Proceedings of the 9th International Multiconference
Zbornik 9. mednarodne multikonference

Information Society
Informacijska družba
IS 2006

9th - 14th October 9. - 14. oktober
Ljubljana, Slovenia

Uredniki:

prof. dr. Marko Bohanec
prof. dr. Matjaž Gams

prof. dr. Vladislav Rajkovič
prof. dr. Tanja Urbančič
Mojca Bernik,

dr. Dunja Mladenić
Marko Grobelnik

prof. dr. Marjan Heričko

dr. Urban Kordeš
prof. dr. Olga Markič

prof. dr. Janek Musek
Mari Osredkar
prof. dr. Igor Kononenko
Barbara Novak Škarja

Založnik: Institut »Jožef Stefan«, Ljubljana
Tisk: Birografika BORI d.o.o.
Priprava zbornika: Mitja Lasič
Oblikovanje naslovnice: dr. Damjan Demšar
Tiskano iz predloga avtorjev
Naklada: 120

Ljubljana, oktober 2006

Konferenco IS 2006 sofinancirata
Ministrstvo za visoko šolstvo, znanost in tehnologijo
Institut »Jožef Stefan«

Informacijska družba
ISSN 1581-9973

```
CIP - Katoložni zapis o publikaciji
Narodna in univerzitetna knjižnica, Ljubljana

659.2:316.42(063)(082)
659.2:004(063)(082)
004.8(063)(082)

MEDNARODNA multi-konferenca Informacijska družba IS (9 ; 2006 ;
Ljubljana)
   Zbornik 9. mednarodne multikonference Informacijska družba IS
2006, 9. do 14. oktober 2006 = Proceedings of the 9th International
Multiconference Information Society IS 2006, 9th-14th October 2006,
Ljubljana, Slovenia / uredili, edited by Marko Bohanec ... [et
al.]. - Ljubljana : Institut "Jožef Stefan", 2006. - (Informacijska
družba, ISSN 1581-9973)


Vsebina na nasl. str.: Inteligentni sistemi = Intelligent systems ;
Vzgoja in izobraževanje v informacijski družbi = Education in
information society ; Izkopavanje znanja in podatkovna skladišča =
Data-mining and data-warehouses ; Sodelovanje in informacijska
družba = Collaboration and information society ; Kognitivne
znanosti = Cognitive sciences ; Mejne kognitivne znanosti =
Borderline cognitive sciences

ISBN-10 961-6303-82-1
ISBN-13 978-961-6303-82-8
1. Informacijska družba 2. Information society 3. Bohanec, Marko
229096448
```

Zbornik 9. mednarodne multikonference
Proceedings of the 9th International Multiconference

INFORMACIJSKA DRUŽBA IS 2006

INFORMATION SOCIETY IS 2006

Inteligentni sistemi
Vzgoja in izobraževanje v informacijski družbi
Izkopavanje znanja in podatkovna skladišča
Sodelovanje in informacijska družba
Kognitivne znanosti
Mejne kognitivne znanosti

Intelligent Systems
Collaboration and Information Society
Data-Mining and Data-Warehouses
Education in Information Society
Borderline Cognitive Sciences
Cognitive Sciences

Uredili / Edited by

Marko Bohanec , Matjaž Gams, Vladislav Rajkovič, Tanja Urbančič, Mojca Bernik,
Dunja Mladenić, Marko Grobelnik, Marjan Heričko, Urban Kordeš, Olga Markič,
Janek Musek, Mari Osredkar, Igor Kononenko, Barbara Novak Škarja

http://is.ijs.si

9. do 14. oktober 2006 / 9th - 14th October 2006
Ljubljana, Slovenia

PREDGOVOR MULTIKONFERENCI INFORMACIJSKA DRUŽBA 2006

V svojem devetem letu ostaja multikonferenca Informacijska družba 2006 (http://is.ijs.si) ena vodilnih srednjeevropskih konferenc, ki združuje znanstvenike z različnih raziskovalnih področij povezanih z informacijsko družbo. V letu 2006 smo v multikonferenco povezali osem neodvisnih konferenc. Informacijska družba postaja vedno bolj zapleten socialni, ekonomski in tehnološki sistem, ki je pritegnil pozornost vrste specializiranih konferenc v Sloveniji in Evropi. Naša multikonferenca izstopa po širini in obsegu tem, ki jih obravnava.

Rdeča nit multikonference ostaja sinergija interdisciplinarnih pristopov, ki obravnavajo različne vidike informacijske družbe ter poglabljajo razumevanje informacijskih in komunikacijskih storitev v najširšem pomenu besede. Na multikonferenci predstavljamo, analiziramo in preverjamo nova odkritja in pripravljamo teren za njihovo praktično uporabo, saj je njen osnovni namen promocija raziskovalnih dosežkov in spodbujanje njihovega prenosa v prakso na različnih področjih informacijske družbe tako v Sloveniji kot tujini.

Na multikonferenci, ki bo trajala šest dni, bo na vzporednih konferencah predstavljenih preko 200 referatov, vključevala pa bo tudi okrogle mize in razprave. Referati so objavljeni v zbornikih multikonference, izbrani prispevki pa bodo izšli tudi v dveh posebnih številkah znanstvenih revij, od katerih je ena Informatica, ki se ponaša s 30-letno tradicijo odlične znanstvene revijei. Multikonferenco Informacijska družba 2006 sestavljajo naslednje samostojne konference:

- BIOMA 2006 – Bioinspired Optimization Methods and their Applications
- Mejne kognitivne znanosti
- Kognitivne znanosti
- Sodelovanje in informacijska družba
- Rudarjenje podatkov in podatkovna skladišča
- Vzgoja v informacijski družbi
- Inteligentni sistemi
- Jezikovne tehnologije.

Soorganizatorji in podporniki konference so različne raziskovalne institucije in združenja, med njimi tudi ACM Slovenija. Zahvaljujemo se tudi Ministrstvu za visoko šolstvo, znanost in tehnologijo za njihovo sodelovanje in podporo. V imenu organizatorjev konference pa se želimo posebej zahvaliti udeležencem za njihove dragocene prispevke in priložnost, da z nami delijo svoje izkušnje o informacijski družbi. Zahvaljujemo se tudi recenzentom za njihovo pomoč pri recenziranju.

V letu 2006 sta se programski in organizacijski odbor odločila, da bosta podelila posebno priznanje Slovencu ali Slovenki za izjemen prispevek k razvoju in promociji informacijske družbe v našem okolju. Z večino glasov je letošnje priznanje pripadlo prof. dr. Cenetu Bavcu. Čestitamo!

Viljan Mahnič, predsednik programskega odbora
Matjaž Gams, predsednik organizacijskega odbora

FOREWORD - INFORMATION SOCIETY 2006

In its 9th year, the Information Society Multiconference (http://is.ijs.si) continues as one of the leading conferences in Central Europe gathering scientific community with a wide range of research interest in information society. In 2006, we organized eight independent conferences forming the multiconference. Information society displays a complex interplay of social, economic, and technological issues that attract attention of many scientific events around Europe. The broad range of topics makes our event unique among similar conferences.

The motto of the Multiconference is synergy of different interdisciplinary approaches dealing with the challenges of information society. The major driving forces of the Multiconference are search and demand for new knowledge related to information, communication, and computer services. We present, analyze, and verify new discoveries in order to prepare the ground for their enrichment and development in practice. The main objective of the Multiconference is presentation and promotion of research results, to encourage their practical application in new ICT products and information services in Slovenia and also broader region.

The Multiconference is running in parallel sessions for six days with over 200 presentations of scientific papers. The papers are published in the conference proceedings, and in two special journal issues. One of them is Informatica with its 30 years of tradition in excellent research publications.

The Information Society 2006 Multi-Conference consists of the following conferences:

- BIOMA 2006 - Bioinspired Optimization Methods and their Applications
- Borderline Cognitive Sciences
- Cognitive Sciences
- Collaboration and Information Society
- Data Mining and Data Warehouses
- Education in Information Society
- Intelligent Systems
- Language Technologies.

The Conference is co-organized and supported by several major research institutions and societies, among them ACM Slovenia, i.e. the Slovenian chapter of ACM. We would like to express our appreciation to the Slovenian Government for cooperation and support, in particular through the Ministry of Higher Education, Science and Technology.

At the end we would like to bring your attention to a special event. In 2006, the Programme and Organizing Committees decided to award one Slovenian for his/her outstanding contribution to development and promotion of information society in our country. With the majority of votes, this honor went to Prof. Dr. Cene Bavec. Congratulations!

On behalf of the conference organizers we would like to thank all participants for their valuable contribution and their interest in this event, and particularly the reviewers for their thorough reviews.

Viljan Mahnič, President of the Programme Committee
Matjaž Gams, President of the Organizing Committee

KONFERENČNI ODBORI
CONFERENCE COMMITTEES

KAZALO / TABLE OF CONTENTS

Zbornik 9. mednarodne multikonference
Proceeding of the 9th International Multiconference

INFORMACIJSKA DRUŽBA IS 2006

INFORMATION SOCIETY IS 2006

Inteligentni sistemi

Intelligent Systems

Uredila / Edited by

Marko Bohanec, Matjaž Gams

http://is.ijs.si

11. do 12. oktober 2006 / 11th - 12th October 2006
Ljubljana, Slovenia

Predgovor

V 2006 smo doživeli izreden porast prispevkov v konferenci *Inteligentni sistemi*, čeprav jo izvajamo vsako leto. Konfrenca je mednarodna, pa tudi vseslovenska. Posebej razveseljivi so tudi prispevki mladih avtorjev, ki opisujejo praktične aplikacije na najrazličnejših področjih. Večina avtorjev ugotavlja, da inteligentni sistemi nudijo pomembne prednosti pri reševanju zahtevnih praktičnih problemov.

V letu 2006 beležimo nove dokaze o pomembnosti in stabilnosti področja inteligentnih sistemov. Strokovnjaki napovedujejo nekaj pomembnih kvalitativnih sprememb: v nekaj letih naj bi programi bistveno bolj uspešno simulirali in opravljali naloge inteligentnih pomočnikov, hkrati pa naj bi postali tudi bistveno bolj komunikativni v smislu govora in mimike. To je tudi ena najpomembnejših predvidenih izboljšav v celotnem računalništvu.

Na letošnji konferenci *Inteligentni sistemi 2006* je predstavljenih preko 30 prispevkov. Vsi prispevki so bili recenzirani s strani dveh anonimnih recenzentov. Oblikovne pripombe sva prispevala tudi predsednika konference.

Matjaž Gams in Marko Bohanec,
predsednika konference

Preface

Even though the conference *Intelligent Systems* is held annually and the quantity of contributions remains stable, in 2006 we noticed a significant increase of contributions. The conference is international and Slovenian at the same time. Especially promising are contributions of young authors who present interesting practical applications of intelligent systems in different fields. Most of the authors confirm that intelligent systems provide important advantages in the solving of difficult real-life problems.

The year 2006 provides further evidence about the importance and stability of the area of Intelligent Systems. Experts predict important qualitative changes: they expect that in a few years time, computer programs will considerably improve their ability to simulate and perform their role of intelligent advisors, and at the same time become much more communicative in the sense of speech and mimics. This is one of the most important advances expected in computer science.

The proceedings of *Intelligent Systems 2006* includes over 30 papers. All submitted papers have been reviewed by two reviewers. Some additional suggestions for improvements were also provided by the chairmen of the conference.

Matjaž Gams and Marko Bohanec,
conference chairs

IZBIRANJE METODE ZA ANALIZO PODATKOV NA PODROČJU SATELITSKIH RAČUNOV ZA TURIZEM

Iztok Bizjak[1], *Marko Bohanec*[2]
[1]Statistični urad RS, Parmova 33, 1000 Ljubljana, e-pošta: iztok.bizjak@gov.si
[2]Institut Jožef Stefan, Jamova 39, 1000 Ljubljana, e-pošta: marko.bohanec@ijs.si

POVZETEK

Za raziskave turističnega trga se danes uporabljajo različne analitične metode, zato se pogosto pojavi vprašanje, katera od njih je najbolj primerna za rešitev določenega problema. V prispevku prikazujemo primer izbora najprimernejše metode za analizo podatkov, zbranih v okviru raziskave *Satelitski računi za turizem*. Izbirali smo izmed šestih metod, s katerimi smo razvili sedem klasifikacijskih modelov. Na podlagi preglednosti modelov in njihove točnosti, ocenjene z šestimi merami, smo izbrali model, ki omogoča najbolj jasno primerjavo turistične dejavnosti držav EU z ostalimi skupinami držav, vključenih v omenjeno raziskavo.

1 UVOD

Vodenje turističnih poslovnih sistemov zahteva predvidevanje razmer na turističnem trgu tako v svetu kot doma. V ta namen so leta 1999 uvedli raziskavo *Satelitski računi za turizem* (ang. Tourism Satellite Accounts-TSA), katere glavni namen je primerjava rezultatov turistične dejavnosti med različnimi državami [1]. V omenjeni raziskavi za predstavitev in primerjavo turistične dejavnosti posameznih držav uporabljajo klasične statistične in tabelarične metode. Te se v sodobnih tržnih raziskavah uspešno nadomeščajo ali dopolnjujejo z metodami za podporo odločanja (ang. Decision Support-DS) [2] in rudarjenja podatkov (ang. Data Mining-DM) [3].

Za potrebe raziskav turističnega trga so bile že uporabljene različne metode DM [4]. Pri tem se je pojavilo vprašanje, katera metoda DM je najbolj primerna za analizo obravnavanih podatkov. V tem prispevku smo odgovore poiskali s kombiniranjem metod DS in DM [5]. Pri tem smo uporabili dve metodi DS, s katerima smo izmed šestih metod DM poiskali tisto, ki je najbolj primerna za obdelavo tistega dela podatkov, zbranih v okviru raziskave TSA, ki se nanašajo na primerjavo med EU in ostalim svetom.

V drugem razdelku predstavimo raziskavo TSA, ki je vir podatkov za naše analize. V tretjem razdelku so opisane metode za podporo odločanja in rudarjenje podatkov, uporabljene v raziskavi. V četrtem razdelku podrobneje opisujemo mere točnosti, s katerimi ocenjujemo metode DM. V petem razdelku opisujemo podatkovno zbirko, na kateri temeljijo analize. V šestem razdelku predstavimo postopek izbora in ocene metod za rudarjenje podatkov, v sedmem pa rezultate tega postopka.

2 SATELITSKI RAČUNI ZA TURIZEM (TSA)

Metodologijo TSA so leta 1999 razvili strokovnjaki Svetovne turistične organizacije (ang. World Tourism Organization-WTO), OECD in Evropske unije. Namenjena je raziskavam in spremljanju ekonomskega obsega in učinkov turizma na nacionalna gospodarstva. Slovenija je omenjeno metodologijo uvedla leta 2000 in tako postala ena izmed prvih držav, ki so pristopile k uvedbi te relativno nove statistične metodologije za vrednotenje turizma. Poleg Slovenije so s procesom uvajanja TSA pričele tudi Avstralija, Avstrija, Danska, Finska, Francija, Mehika, Nova Zelandija, Norveška, Poljska, Španija, Švedska, Švica, Velika Britanija in Združene države Amerike.

Metodologija TSA temelji na desetih tabelah [1]:

- **Tabela 1** prikazuje turistično potrošnjo za mednarodni receptivni turizem, po vrstah turizma in kategorijah proizvodov.
- **Tabela 2** prikazuje turistično potrošnjo za domači turizem, po vrstah turizma in kategorijah proizvodov.
- **Tabela 3** prikazuje turistično potrošnjo za mednarodni emitivni turizem, po vrstah turizma in kategorijah proizvodov.
- **Tabela 4** prikazuje interno oziroma notranjo turistično potrošnjo po proizvodih in vrstah turizma.
- **Tabela 5** je ponudbena tabela in prikazuje račune proizvodnih dejavnosti, ki so značilne za turizem, s turizmom povezanih dejavnosti ter nespecifičnih dejavnosti v določeni državi.
- **Tabela 6** prikazuje domačo ponudbo ter interno oziroma notranjo turistično potrošnjo po proizvodih. Ta tabela je središče TSA.
- **Tabela 7** prikazuje število zaposlenih v turistični dejavnosti po posameznih storitvah.
- **Tabela 8** prikazuje bruto investicije v turistični dejavnosti v osnovna sredstva v turizmu.
- **Tabela 9** prikazuje turistično kolektivno potrošnjo po funkcijah in ravneh.
- **Tabela 10** prikazuje količinske kazalce, ki so pomembni pri ocenjevanju in razlagi nekaterih denarnih informacij, predstavljenih v prejšnjih tabelah.

3 UPORABLJENE METODE

V okviru raziskave smo uporabili kombinacijo metod DS in DM. Z metodami DS smo izbrali metodo DM, ki je najbolj primerna za obdelavo podatkov, zbranih v okviru TSA. Izbirali smo med šestimi metodami DM, s katerimi smo razvili sedem klasifikacijskih modelov. Te smo ocenili na podlagi njihove preglednosti in točnosti. Slednjo smo ocenili z šestimi merami.

3.1 Metode za podporo odločanja

Izmed metod za podporo odločanja smo uporabili analize tipa ROC (ang. Receiver Operating Characteristic) [6] in program za večparametrsko modeliranje DEXi [7].

3.1.1 Analize tipa ROC

Analize tipa ROC spadajo v skupino metod DS, namenjene pa so za grafično ponazoritev občutljivosti in specifičnosti klasifikacijskega modela. Na osi *x* grafikona je ponazorjena specifičnost modela, na osi *y* pa njegova občutljivost. V naši raziskavi smo analize tipa ROC uporabili za oceno klasifikacijskih modelov. Iskali smo predvsem modele, ki imajo visoko občutljivost in majhno specifičnost, pomembno merilo pa je tudi površina, ki jo krivulja ROC oklepa z osjo *x* (ang. Area Under ROC-AUC). Omejitev te metode je, da jo je mogoče uporabiti le v primerih, kjer je problem izražen z dvema razredoma. V okviru naše raziskave smo obravnavali prav takšen klasifikacijski problem: razred pove, ali država je ali ni članica EU [8].

3.1.2 Program DEXi

Pri končnem izboru metod DM smo si pomagali s programom DEXi [7]. Gre za program, katerega namen je pomoč pri odločanju na osnovi večparametrskega modeliranja. Namenjen je za razvoj kvalitativnih odločitvenih modelov. Modeli imajo strukturo drevesa, ki vsebuje atribute (simbolične spremenljivke, pomembne za izbor variant) in funkcije koristnosti (pravila združevanja podrednih atributov v nadredne). Uporaba modelov poteka v treh korakih: (1) opis variant z vrednostmi osnovnih atributov; (2) izračun izpeljanih atributov in končne ocene; ter (3) analiza rezultatov vrednotenja, kjer izbiramo želene atribute in variante ter jih med sabo primerjamo.

3.2 Metode za rudarjenje podatkov

Pri izboru metod DM smo upoštevali tri kriterije: (1) metode ponazarjajo informacije s pomočjo odločitvenih pravil ali dreves; (2) metode omogočajo klasifikacijo razredov, izraženih z nominalnimi vrednostmi; (3) vse uporabljene metode so realizirane v programskem paketu Weka [9].

Konjunkcijska pravila (ang. Conjunctive Rule): Metoda, ki oblikuje preprosta pravila, ki temeljijo na konjunkciji. Če bi ta pravila prikazali v obliki binarnega drevesa, bi to drevo imelo le dva nivoja [10].
OneR: Posebnost te metode je, da ponudi le eno pravilo, s katerim pokrije največje možno število primerov. Prednost te metode je, da je odporna na prazna mesta v zbirki podatkov in da nikoli ne pride do prevelike prilagoditve modela podatkom (ang. overfitting) [9].
ZeroR: Gre za dokaj preprosto metodo, ki podobno kot metoda OneR ponudi le eno odločitveno pravilo. Če razred vsebuje numerične vrednosti, je končen rezultat mediana razreda, sicer pa vrednost, ki se v njem največkrat pojavi [10].
J48: Metoda za razvoj odločitvenih dreves uporablja algoritem C4.5, ki so ga razvili iz algoritma ID3. Izboljšave se kažejo predvsem v metodah za obdelavo atributov z numeričnimi, manjkajočimi in šumnimi podatki [9].
NBTree: Metoda omogoča predstavitev informacij, pridobljenih z algoritmom »naivni Bayesov klasifikator«, s pomočjo odločitvenega drevesa, potem pa poda apriorno verjetnost za nastop posameznega primera, ki je predmet raziskave [10].
Random Tree: Posebnost te metode je, da pri kreiranju posameznega vozlišča izbere naključno število. To število predstavlja zaporedno številko atributa, ki ga metoda uporabi za nadaljnjo širitev drevesa [9].

4 MERE TOČNOSTI METOD DM

Točnost klasifikacijskega modela ima močan vpliv na njegovo kakovost. Na področju strojnega učenja in rudarjenja podatkov obstaja veliko mer za oceno tega parametra. V tem prispevku uporabljamo mere, ki jih je mogoče izračunati iz klasifikacijske matrike (tabela 1) [6]. Gre za števce, ki nam povedo [8]:

- TP (ang. True Positive): število pravilno razvrščenih pozitivnih primerov;
- FN (False Negative): število napačno razvrščenih pozitivnih primerov;
- FP (False Positive): število napačno razvrščenih negativnih primerov, in
- TN (True Negative): število pravilno razvrščenih negativnih primerov.

		Klasifikacija	
		Pozitivni	Negativni
Dejansko stanje	Pozitivni	TP	FN
	Negativni	FP	TN

Tabela 1: *Klasifikacijska matrika [6].*

Od teh vrednosti je odvisna *občutljivost* klasifikacijskega modela (ang. True Positive Rate-*tpr*), ki se izračuna kot razmerje med številom pravilno razvrščenih pozitivnih primerov in številom vseh pozitivnih primerov ter *specifičnost* (ang. False Positive Rate-*fpr*), ki se izračuna kot razmerje med številom napačno razvrščenih negativnih primerov in številom vseh negativnih primerov [8]. Iz teh razmerij je mogoče izračunati še ostale mere, ki so kriterij za ugotavljanje točnosti klasifikacijskega modela. Te mere so razvidne iz tabele 2. Izraz *c* pomeni razmerje med številom pozitivnih in negativnih primerov v učni zbirki podatkov [6].

Klasifikacijska točnost nam pove, kakšno je razmerje med pravilno razvrščenimi primeri in vsemi primeri v zbirki podatkov. *F-mera* je kombinacija dveh kazalcev in sicer preciznosti in pokritosti. *Preciznost* nam pove, kakšen je delež med številom pravilno razvrščenih pozitivnih primerov in številom vseh primerov, ki so pozitivno razvrščeni. *Pokritost* se izračuna kot razmerje med številom pravilno razvrščenih pozitivnih primerov ter vsoto vseh pozitivnih primerov v zbirki podatkov. Modeli, ki so dosegli visoko vrednost F-mere, so običajno bolj točni od tistih z nižjo vrednostjo [6]. Mera točnosti klasifikacijskih modelov *WRAcc* (ang. Weighted Relative Accuracy) je sicer najbolj primerna za oceno odstopanj ločenih skupin primerov v bazi podatkov. Omogoča merjenje pomembnosti pravil. Z večanjem vrednosti mere WRAcc narašča tudi pomembnost pravil in s tem kakovost klasifikacijskega modela [8].

Mera	**Izraz**
Klasifikacijska točnost	$\frac{tpr + c(1 - fpr)}{1 + c}$
Preciznost	$\frac{tpr}{tpr + c \cdot fpr}$
F-mera	$\frac{2tpr}{tpr + c \cdot fpr + 1}$
WRAcc	$\frac{4c}{(1+c)^2}(tpr - fpr)$

Tabela 2.: *Mere točnosti klasifikacijskih modelov [8].*

5 PODATKOVNA ZBIRKA

Pri analizi smo uporabili podatke o turistični dejavnosti držav, ki so bile leta 2005 vključene v raziskavo TSA. Gre za podatke, združene iz različnih tabel, na katerih temelji ta raziskava. Vsako državo opisuje en zapis. Zbirka vsebuje 172 zapisov. opisanih z naslednjimi devetimi atributi:

- SKUPINE: Ta atribut pove, kateri skupini pripada posamezna država. Države so razporejene v 13 skupin.
- POTR_OS: Osebna potrošnja turistov v določeni državi.
- POTR_POSL: Potrošnja poslovnih turistov v določeni državi .
- POTR_TUJ: Potrošnja tujih turistov v določeni državi.
- POTR_SK: Celotna potrošnja turistov v določeni državi
- INVESTICIJE: Javne in privatne, finančne investicije v turistično dejavnost .
- POVPR_SK: Celotno turistično povpraševanje.
- BDP: Bruto družbeni proizvod, turističnega gospodarstva.
- ZAPOSL: Število zaposlenih v turističnem gospodarstvu.

Vse denarne vrednosti v zbirki so podane v ameriških dolarjih.

6 OCENA IN IZBOR MODELOV

Namen raziskave je bil razviti in preizkusiti metodo, ki izbira najboljše klasifikacijske modele, razvite z metodami DM. Izbira poteka z večparametrskim modelom DEXi, ki ovrednoti dosežene rezultate modelov DM, pri čemer upošteva predvsem njihovo preglednost in točnost. Metodo izbire smo preizkusili na problemu klasifikacije držav v dve skupini (EU in ostale države) iz podatkov TSA. Zapise, ki opisujejo države Evropske Unije, smo označili kot pozitivne, ostale pa kot negativne. Pozitivnih zapisov je 25, negativnih pa 147. Apriorna točnost znaša 24%.

6.1 Primerjalna analiza

Za razvoj klasifikacijskih modelov smo uporabili 6 metod DM, s katerimi smo razvili 7 modelov. Da bi dosegli največjo možno točnost modelov, smo pri njihovem razvoju uporabili metodo desetkratnega prečnega preverjanja [9]. Pri metodi J48 smo točnost modelov izboljšali tudi z večanjem parametra *M*, ki predstavlja minimalno število primerov, pokritih s posameznim listom. Točnost modelov smo ugotovili na podlagi mer, predstavljenih v razdelkih 3.1.1 in 4. Rezultate analiz prikazuje tabela 3. Iz tabele je razvidno, da ima model J48 (M10) največjo klasifikacijsko točnost, najmanjšo pa model, razvit z metodo ZeroR. Najbolj občutljiv je model, razvit z metodo Conjunctive Rule, najmanj pa model, razvit z metodo ZeroR, ki sploh ni občutljiv. To je posledica tega, da ni pravilno razvrščenih pozitivnih primerov, saj model nobenega zapisa ne razvrsti med države EU. Prav zato tudi ni napačno razvrščenih negativnih primerov, zato je tudi specifičnost enaka nič. Najbolj specifičen je model, razvit z metodo Conjunctive Rule. Glede na F-mero je najbolje ocenjen model J48 (M10), najslabše pa model, razvit z metodo ZeroR. Največjo površino pod krivuljo ROC ima model J48 (M10), najmanjšo pa model ZeroR. Glede na mero WRAcc je najbolj ocenjen model J48 (M10), najslabše pa model ZeroR

Klasifikator	Klasif. t.	Občutlj.	Specif.	Preciz.	Pokritost	F-mera	AUC	WRAcc
Conjunctive Rule	0,33	0,88	0,45	0,25	0,88	0,39	0,71	0,21
OneR	0,30	0,68	0,25	0,32	0,68	0,43	0,71	0,21
ZeroR	0,24	0,00	0,00	0,00	0,00	0,00	0,44	0,00
J48 (M2)	0,30	0,40	0,17	0,29	0,40	0,33	0,62	0,11
J48 (M10)	0,40	0,76	0,25	0,34	0,76	0,47	0,80	0,25
NBTree	0,33	0,76	0,34	0,28	0,76	0,40	0,76	0,21
Random Tree	0,23	0,28	0,15	0,24	0,28	0,26	0,57	0,06

Tabela 3.: *Ocene klasifikacijskih modelov.*

6.2 Izbor klasifikacijskega modela

Pri izboru klasifikacijskega modela smo upoštevali njihovo točnost in preglednost. Preglednost oziroma nepreglednost modela se nanaša predvsem na njegovo kompleksnost. Modeli, ki imajo večje število listov ozirom pravil, so bolj kompleksni in zato manj pregledni od manj kompleksnih modelov. Točnost modela smo ocenili na podlagi šestih mer, razvidnih iz tabele 3. Izbor smo opravili s programom DEXi. V ta namen smo numerične vrednosti mer (Tabela 3), razvrstili v razrede: »dobro«, »srednje« in »slabo«. Na enak način smo ocenili tudi preglednost modelov. Pri izboru je bil večji poudarek na točnosti klasifikacijskega modela in sicer v razmerju 30%:70%. Rezultate vrednotenja modelov prikazuje slika 1. Najbolje je ocenjen model, razvit z metodo J48, pri katerem smo parameter *M* nastavili na vrednost 10 in s tem dosegli boljšo preglednost in točnost. Sledi mu model, razvit z metodo Conjunctive Rule, ki je nekoliko bolj točen od prvega, vendar zaostaja zaradi njegove slabše preglednosti.

Attribute	J48M10	NBTree	J48M2	RanTree	OneR	ConRule	ZeroR
METODA	dobro	srednje	srednje	slabo	srednje	srednje	slabo
├Preglednost	dobro	srednje	srednje	slabo	srednje	srednje	slabo
└Tocnst	srednje	dobro	srednje	srednje	dobro	dobro	srednje
├ROC	srednje	dobro	srednje	srednje	dobro	dobro	srednje
│├Specificnost	slabo	srednje	slabo	dobro	dobro	srednje	dobro
│└Obcutljivost	dobro	dobro	srednje	slabo	dobro	dobro	slabo
├KlasifikacijskaTocnost	srednje	srednje	srednje	slabo	srednje	srednje	slabo
├FMera	srednje	srednje	dobro	slabo	srednje	srednje	slabo
├WRAcc	dobro	dobro	srednje	slabo	dobro	dobro	slabo
└AUC	dobro	dobro	srednje	srednje	dobro	dobro	srednje

Slika 1.: *Ocena klasifikacijskih modelov s programom DEXi.*

7 SKLEP

V članku smo prikazali metodologijo izbora analitične metode, ki je najbolj primerna za primerjavo turistične dejavnosti držav EU z ostalimi skupinami držav, vključenih v raziskavo TSA. Izbirali smo med tremi metodami za razvoj odločitvenih pravil in tremi metodami za razvoj odločitvenih dreves. Pri izboru smo uporabili dva glavna kriterija in sicer preglednost in točnost klasifikacijskega modela. Točnost smo ocenili z šestimi merami, ki so podrobneje opisane v četrtem poglavju. Izmed metod za razvoj odločitvenih pravil se je kot najboljša izkazala metoda Conjunctive Rule, izmed odločitvenih dreves pa metoda J48. Menimo, da so izmed teh odločitvena drevesa zaradi svojega načina predstavitve informacij bolj primerna za primerjavo turistične dejavnosti držav EU z ostalimi skupinami držav, vključenimi v raziskavo TSA.

Viri

[1] Ministrstvo za gospodarstvo (2006): Satelitski računi za turizem v Sloveniji, http://www.mg-rs.si/datoteke/turizem/satelitski_racuni.pdf.

[2] Turban, E., Aronson, J., Liang, T. (2004): Decision Support Systems and Intelligent Systems (7th Edition), Prentice Hall, New Jersy.

[3] Berry, M., Linoff, G. (2004): Data mining techniques, Wiley Computer Publishing, New York.

[4] Bizjak, I., Bohanec, M. (2004): Rudarjenje podatkov za potrebe turistične dejavnosti, Dnevi slovenske informatike 2004, Portorož.

[5] Lavrač, N., Bohanec, M.(2003): Integration of data mining and decision support.: Mladenić, D., Lavrač, N., Bohanec, M., Moyle, S.: Data mining and decision support : integration and collaboration, Boston (2003) 37-62.

[6] Flach P. (2003): The geometry of ROC space: understanding machine learning metrics through ROC isometrics, International Conference on Machine Learning.

[7] Jereb, E., Bohanec, M., Rajkovič, V. (2003): DEXi: Računalniški program za večparametrsko odločanje, Moderna organizacija, Kranj.

[8] Caruana, R., Niculescu, A. (2004): Data mining in metric space: an empirical analysis of supervised learning performance criteria, 10. KDD 2004, Seattle.

[9] Witten, I., Frank, E. (2005): Data Mining: Practical Machine Learning Tools and Techniques, Second Edition, University of Waikato, Hamilton.

[10] Witten, I., Frank, E., Trigg, L., Hall, M., Holmes, G., Cunningham, S. (1999): Weka: Practical Machine Learning Tools and Techniques with Java Implementations, University of Waikato, Hamilton.

SMAC Advisor: A Decision-Support Tool on Coexistence of Genetically-Modified and Conventional Maize

Marko Bohanec[1], *Antoine Messéan*[2], *Frédérique Angevin*[2], *Martin Žnidaršič*[1]

[1] Jožef Stefan Institute, Department of Knowledge Technologies, Jamova 39, SI-1000 Ljubljana, Slovenia
Tel: (+386) 1 477 3309, Fax: (+386) 1 477 3315, e-mail: marko.bohanec@ijs.si
[2] Institut National de la Recherche Agronomique (INRA), Eco-Innov Unit, Grignon, France

ABSTRACT

This paper presents SMAC Advisor, a decision-support tool for the assessment of coexistence between genetically modified and conventional maize. The assessment is based on a qualitative multi-attribute DEXi model. This model was developed from two sources: (1) extensive simulations of gene flow due to cross-pollination, obtained by a simulator called MAPOD®, and (2) rules provided by experts in agronomy. SMAC Advisor provides a friendly "wizard" interface for its users: farmers, administrative workers and policy makers in agronomy.

1 INTRODUCTION

Modern agronomy is highly innovative. In order to meet the demands for food, ensuring food quality and safety, contributing to sustainable development, and making profit, new innovative production systems are designed. One such recent innovation is the introduction of *genetically modified* (GM) crops. On one hand, GM crops have genetical charateristics, such as resistance to pests and tolerance to herbicides, which make them very convenient for agricultural production. On the other hand, the use of GM crops raises many concerns about their potential ecological and economic impacts. Decision-making about GM crops turns out to be extremely difficult as it involves many factors that are difficult to assess and control, but may have significant long-term or irreversible consequences to the environment and food production.

One of important GM issues is the question of *coexistence*: is it possible, under which conditions and to which extent, to grow both GM and non-GM (conventional) crops simultaneously or in close proximity without affecting each other "too much". In other words, coexistence refers to the ability of farmers to freely choose between conventional, organic or GM-based crop production (Recommendation 2003/556/EC). Currently, coexistence is being studied in two major European research projects: SIGMEA (2004) and Co-Extra (2005).

In this paper, we present a decision-support tool called *SMAC Advisor*. SMAC stands for *SIGMEA MAize Coexistence*, denoting that this software was developed in SIGMEA and specifically addresses the coexistence of *maize*. The aim of this software is to provide advice to farmers and other decision-makers (administrative workers, policy makers) who want to assess the achievable level of coexistence between GM and non-GM maize on a given field and in a given agricultural environment. This assessment is based on a qualitative multi-attribute model, which was constructed from two sources: (1) results of simulation and (2) expert-provided rules.

In what follows, we first define the decision problem addressed by SMAC Advisor. Then, we describe the architecture of this software, which consists of three layers: (1) user interface, (2) multi-attribute model, and (3) simulation results. In sections 4 to 6, these layers are presented in more detail.

2 DECISION PROBLEM

According to the European Commission Recommendation 2003/556/EC, the farmers who introduce a new production type in a region should bear responsibility for implementing the farm management measures necessary to limit gene flow. Accordingly, we have formulated the decision problem as follows:

Suppose a farmer wants to start growing GM maize on some field F. In the neighbourhood, there may be some other fileds, say E_1, E_2, …, E_n, on which this or other farmers grow (or want to grow) non-GM maize. Then, the question is: to which extent will the plants grown on F genetically interfere with the plants on E's? Will this interference be small enough to allow coexistence?

The "interference" between plants is usually expressed and measured in terms of *adventitious presence* (AP). AP refers to the unintentional and incidental commingling of trace amounts of one type of seed, grain or food product with another (BIO, 2006). AP is an unavoidable reality of plant biology, seed production and the distribution of commodity crops. EU regulations have introduced a 0.9 % labelling threshold for the AP of GM material in non-GM products (Regulation 2003/1830/EC). Thus, in order to approve the coexistence between GM and non-GM crops, we usually require that the achieved AP is 0.9 % or less.

There are a number of factors that contribute to AP: pollen flow, volunteers, feral plants, mixing during harvesting, transport, storage and processing, human error, and accidents (BIO, 2006). These factors are complex. Pollen flow, for example, depends on the distance between fields, their sizes and shapes, climate (especially wind characteristics), flowering characteristics of crops, etc. Determining the achievable level of AP and assessing the level of coexistence taking into account all these factors is a difficult problem even for experts.

3 SMAC ADVISOR

SMAC Advisor is aimed at providing assistance in solving the above problem. Basically, the program requires information from the user about the:

- emitting field F,
- neighbouring fields $E_1, E_2, \ldots, E_n$,
- relation between F and each E_i (in terms of distance, relative size, prevalent wind direction, etc.),
- type and characteristics of used seeds,
- environmental characteristics (e.g., background GM pollen pressure),
- use of machinery (e.g., sharing with other farmers).

On this basis, SMAC Advisor determines the *achievable AP*, that is, the expected level of GM impurities in harvests of the neighbouring fields. This achievable AP is compared with the required *target AP* (provided by the user). In principle, when the achievable AP is lower than or equal to the required AP, coexistence is considered to be achieved and, consequently, GM farming on F can be allowed.

Actually, this inference is more complex and takes into account some additional indicators, such as the structure of GM and non-GM production in the neighbourhood. In any case, SMAC Advisor completes the analysis giving one of the following "color-coded" *recommendations*:

- "Green": GM farming allowed (no need to address coexistence at all, e.g., due to existing GM production in the neighbourhood).
- "Red": GM farming dissallowed (e.g. due to an organic farm in close vicinity).
- "Yellow": assess risks (coexistence is possibly achievable, so the farming might be allowed; continue with further analyses not covered in SMAC Advisor).
- "Orange": assess additional measures (target AP is currently not achievable, meaning that the farming is disallowed, but might have been achievable by some small changes, e.g., making an additional agreement with a neighbouring farmer).

Schematically, SMAC Advisor consists of three software layers (Figure 1). On the highest layer, there is a *user interface*. It communicates with the user, guides him or her through the coexistence assessment process and, when necessary, engages the second layer. The second layer performs all the inference (reasoning, evaluation and aggregation) necessary to map the inputs into recommendations. This is done using a *qualitative multi-attribute model*. The essential part of this model has been developed according to pollen-flow simulations provided by a system called MAPOD®; its *simulation results* compose the third layer of SMAC Advisor. In the following sections, these layers are described in more detail in the bottom-up order.

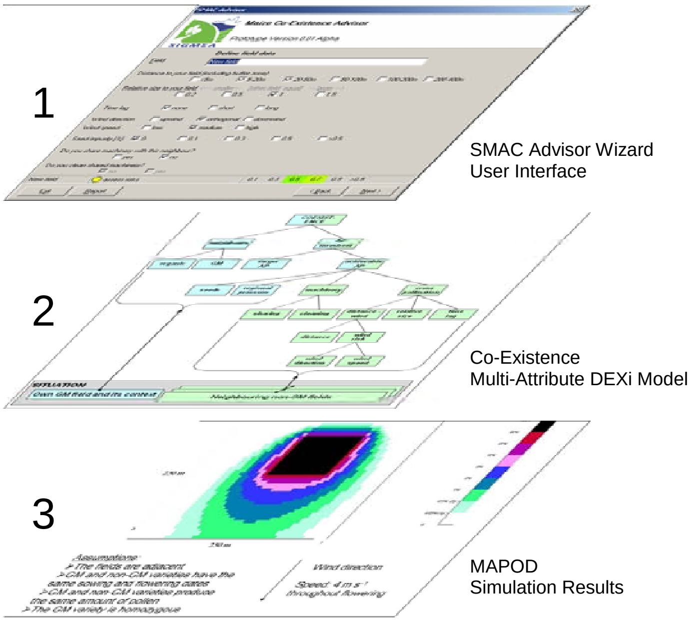


Figure 1: Three layers of SMAC Advisor.

4 MAPOD® SIMULATOR

MAPOD® is an advanced simulator that estimates the rate of varietal impurities due to cross-pollination in maize as well as changes in these rates due to changes in cropping techniques (Angevin et al., 2001). The input variables include certain traits of the varieties and certain agricultural practices for each maize field as well as climatic factors for the given region (Table 1). The output is an estimated amout of pollination in the considered area.

Table 1: MAPOD® input data.

Input data	Description
Field plan	Form and size of fields, location of GM and non-GM maize plants
Climate (per day)	Temperature; rain; wind: speed and direction
Cropping systems	Sowing dates and densities, drought stress before flowering, drought stress during flowering
Variety	Quantity of pollen per plant, pollen sensitivity to high temperature, temperature needs between sowing and female flowering, genotype of GM: homozygous or heterozygous; Tassel height of each variety, ear height of non-GM variety

The overall structure of the simulation model is shown in Figure 2 (Angevin et al., 2002). The first module determines the flowering date for female flowers, expressed in degree-days, as a function of climate and sowing date. The analysis takes into account protandry (male flowering beginning several days before female flowering) and the factors (drought stress and sowing density) that affect it. Then this module simulates the dynamics of male and female flowering, giving an estimate of the amounts of pollen produced by GM and non-GM varieties. The second module simulates pollen dispersal as a function of distance from the emitter, direction and mean speed of the wind, and the difference in height between the panicle from which the pollen is emitted and the receptive silks. The composition of the pollen cloud at a given site in a non-GM field is determined by the pollen dispersal curves for all the plants in the neighbourhood. For each day, the frequency of GM seeds is calculated. These daily results are pooled to provide the total frequency of GM seeds in the harvest.

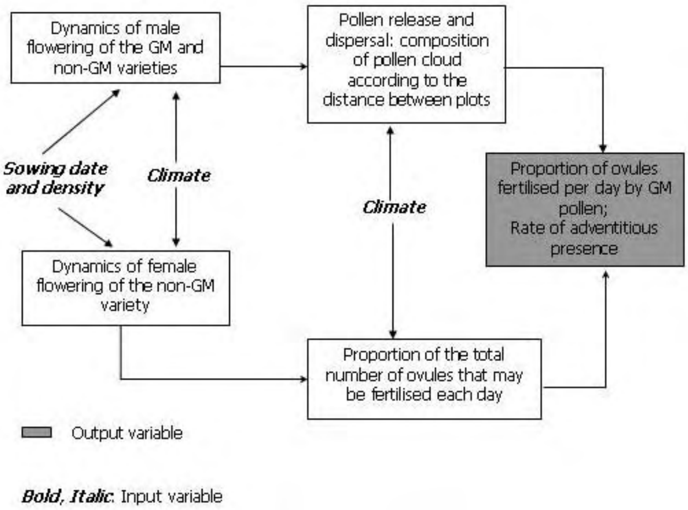


Figure 2: Structure of the MAPOD® model.

This model has been used to carry out several coexistence studies (Angevin et al., 2002; Messéan et al., 2006). In the latter, simulations with MAPOD® were carried out for maize production in Poitou-Charentes (South West of France). Using typical climatic conditions and field patterns, this study aimed at evaluating the impact of current practices as well as the feasibility of alternative practices reducing adventitious presence in non-GM harvests. Different strategies were tested, considering spatial isolation, time isolation, characteristics of GM and non-GM fields, and different buffer zones. In total, 8960 simulations were run to test one or several strategies in combination. Results were synthesised in a database and in decision tables (Messéan et al., 2006). These results were also used to design a part of the DEXi model used at the second layer of SMAC Advisor.

5 MULTI-ATTRIBUTE DEXi MODEL

The second layer of SMAC Advisor contains a qualitative multi-attribute model that was developed according to DEX methodology (Bohanec, 2003), using the software DEXi (Bohanec, 2006). The role of this model is to take the inputs, provided by the user, that describe the decision situation, and to use them to make a final recommendation. This is done according to a hierarchical structure of attributes (Figure 3): inputs are entered at the bottom of the hierarchy and are gradually aggregated in a bottom-up way through a series of internal attributes, until the final recommendation is eventually obtained at the root attribute (COEXISTENCE). The reasoning at each attribute is performed according to 'if-then' rules. The rules that occur in the attribute "cross pollination" and below, were obtained from the results of MAPOD® simulations. All the remaining rules in the model were provided by the experts.

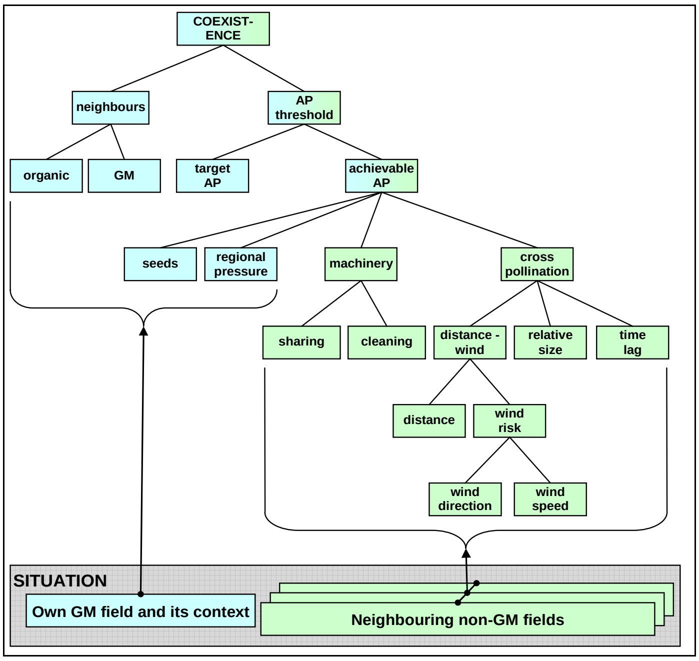


Figure 3: Hierarchical strucure of the DEXi model.

This DEXi model consists of two essential parts. The left-hand part in Figure 3 assesses the characteristics related to the field *F* itself and its environment: % of seed impurity, existing regional GM-pollen pressure, existing farms in the neighbourhood, target AP to be achieved. The right-hand part, which consists of the subtrees "machinery" and "cross pollination", assesses the relation between the field *F* and each of its neighbouring fields E_i. For each such pair, the model determines the achievable AP. The total achievable AP is then the maximum of the AP's achievable pairwise.

6 USER INTERFACE

SMAC Advisor has a user-friendly wizard-type user interface, implemented in Borland Delphi. The interface contains a series of dialogs that guide the user through logical steps of the decision-making process:

1. obtaining data related to the field *F*;
2. for each E_i: obtaining data related to E_i (Figure 4);
3. making and presenting the recommendation (Figure 5).

If necessary, these steps are repeated until the decision situation has been sufficiently analysed.

Figure 4 shows one of the SMAC Advisor's windows, which is used for obtaining data about E_i fields. The data items in this window directly correspond to the right-hand input attributes of the DEXi model (Figure 3). Notice that they are qualitative: they have descriptive values (such as 'low', 'medium', 'high'), or they are divided into numerical intervals (see the attributes "Distance", "Relative size" and "Seed impurity"). It is also worth noticing that the attributes may be assigned more than just a single qualitative value. In Figure 4, the attribute "Seed impurity" has two values (0.1 and 0.3). These two values cause a dual assessment of achievable AP: 0.5 and 0.7 (Figure 5).

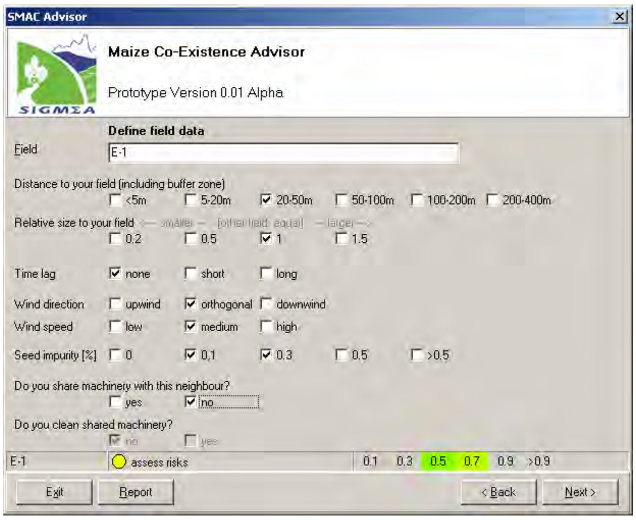


Figure 4: SMAC Advisor: A data-entry window.

SMAC Advisor's assessment is dynamic: at all times, the program shows the current recommendation (as shown in the status line in Figure 4). Whenever the user makes a change, SMAC Advisor re-evaluates the situation and displays the new assessment. This feature turns out to be very useful for "what-if" analysis of the situation.

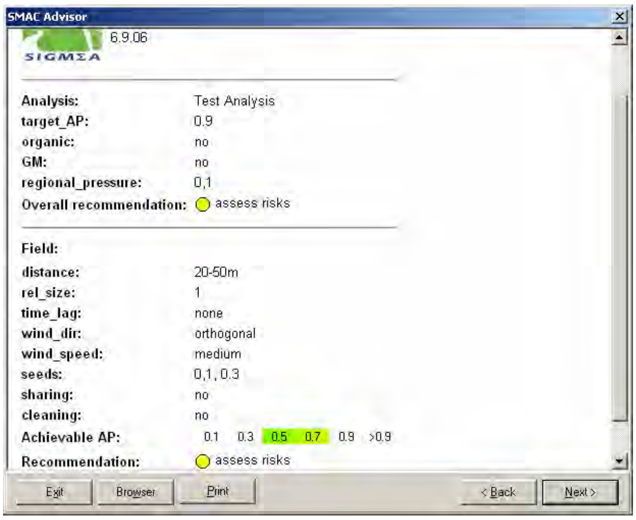


Figure 5: SMAC Advisor: Final report.

6 CONCLUSION

SMAC Advisor is a simple software tool aimed at making advice in a difficult real-life decision problem in agronomy: is it possible to grow genetically modified maize in a given field, achieving coexistence with other fields in a given environment? SMAC Advisor gives recommendations using a knowledge base, which is composed of two parts. The central part is a "shallow" qualitative multi-attribute model, developed according to DEX methodology. It contains rules that aggregate inputs, provided by the user, into final recommendations following a hierarchical structure of attributes. The essential part of this shallow model, which determines the achievable adventitious presence, is however based on a "deep" MAPOD® model, which simulates the biological behavior of maize plants.

Currently, SMAC Advisor has a status of evolving prototype software, which was so far used only on test cases. Within the SIGMEA project, we wish to develop it further towards a useful decision-support tool for farmers, administrative workers and policy makers in the EU.

REFERENCES

Angevin, F., Klein, E. K., Choimet, C., Meynard, J. M., de Rouw, A., Sohbi, Y. (2001). Modélisation des effets des systèmes de culture et du climat sur les pollinisations croisées chez le maïs. In *Pertinence économique et faisabilité d'une filière sans utilisation d'OGM*. Rapport du groupe 3, INRA – FNSEA, pp 21-36.

Angevin, F., Colbach N., Meynard, J. M., Roturier, C. (2002): Analysis of necessary adjustements of farming practices. In: A.-K. Bock, Lheureux, K., Libeau-Dulos, M., Nilsagard H., Rodriguez-Cerezo, E. *Scenarios for coexistence of genetically modified, conventional and organic crops in European agriculture*. Technical Report Series of the Joint Research Center of the European Commission.

BIO (2006): Biotechnology information, advocacy and business support: Adventitious presence. http://www.bio.org/foodag/background/adventitious.asp

Bohanec, M. (2003): Decision support. In: Mladenić, D., Lavrač, N., Bohanec, M., Moyle, S. (eds.): *Data mining and decision support: Integration and collaboration*. Kluwer Academic Publishers, 23–35.

Bohanec, M. (2006): DEXi: A Program for Multi-Attribute Decision Making. http://www-ai.ijs.si/MarkoBohanec/dexi.html

Co-Extra (2005): GM and non-GM supply chains: their CO-EXistence and TRAceability. Integrated Project, funded by the Sixth European Community Framework Programme: Food Quality and Safety Priority. http://www.coextra.org/

Messéan, A., Angevin F, Gómez-Barbero, M., Menrad, K., Rodríguez-Cerezo, E. (2006): *New case studies on the coexistence of GM and non-GM crops in European agriculture*. European Commission , Technical Report EUR 22102 EN.

SIGMEA (2004): SIGMEA*: Sustainable introduction of genetically modified crops into European agricu-ture*. Specific targeted research project, funded by the Sixth European Community Framework Programme: Policy Oriented Research. http://sigmea.dyndns.org/

A PARALLEL IMPLEMENTATION OF SIMULATED ANNEALING WITH A BOLTZMANN SYNCHRONIZATION FUNCTION AND ITS APPLICATION TO SOLVE THE TRAVELING SALESMAN PROBLEM

Ivan Chorbev, Ivica Dimitrovski, Suzana Loskovska, Dragan Mihajlov
Faculty of Electrotechnics and Information Technologies, Ss. Cyril and Methodius University, Skopje, R.of Macedonia
Ruger Boskovic, Karpos 3, 1000 Skopje, R. of Macedonia
Tel: +389 70 758539; fax: +389 2 3064262
e-mail: ivan@etf.ukim.edu.mk

ABSTRACT

Simulated Annealing (SA) has been considered a good tool for complex nonlinear optimization problems. However, a major disadvantage of the technique is its slow solving speed. One way to achieve speedup is parallelization of the otherwise sequential algorithm. We propose a parallelization approach for the SA algorithm. We directed most of our research toward designing the parallel architecture and finding the optimal number of parallel processors. We experimented with the best frequency of communication among parallel processes and especially with the decision making function for accepting processes solutions. The Traveling Salesman problem serves as a benchmark of our parallel SA implementation.

1 INTRODUCTION

Real-world optimization problems require high computational effort. In practice, there is a demand to solve problems of growing size in decreasing time limits. One way to achieve better solving times is to develop sophisticated solving techniques. Another possibility to reduce solving time is the use of parallel systems. Parallelization of existing sequential algorithms is a problem of its own. Different approaches for parallelization have been proposed, with different advantages and benefits [4], [13], [6], [3].

We present our approach of parallelization of the Simulated Annealing algorithm. Our implementation is coded in C++, using the message passing interface (MPI). For some of the experiments, a single personal computer with an installed MPI simulation software was used [2]. For experiments concerning the communication overhead of parallelization, a local area network of 20 identical PCs was used, in order to obtain realistic parallel testing. The Traveling Salesman Problem (TSP) serves as a benchmark for our implementation, since a large library of solved instances is available [1]. The problem is simple enough to implement, so the effort was directed toward optimizing the parallelization of Simulated Annealing itself, rather than finding the best way to solve a certain more complex problem.

In section 2 the sequential SA algorithm is explained. Section 3 describes different methods for parallelization the SA algorithm. Our parallelization of SA is given in Section 4. The TSP is explained in Section 5 while Section 6 gives experimental results. Section 7 contains conclusions.

2 SIMULATED ANNEALING TECHNIQUE

Simulated Annealing (SA) is a heuristic algorithm for solving combinatorial optimization problems. SA is based on a local search procedure, and can be viewed as a control strategy for the underlying heuristic search. The algorithm was first introduced by Metropolis et al. in 1953. Since it was first used for optimization by Kirkpatrik et al. [9], SA has been shown to be a powerful stochastic search method that can be applied to a wide range of problems [8].

Starting with an initial proposed solution, SA repeatedly generates succeeding solutions using the local search procedure. Every solution defines its value of the objective function, also known as cost or energy. Some of the proposed solutions are accepted and some will be rejected, according to a predefined acceptance rule. In the beginning of the optimization process, the main control parameter - the temperature - is high. Proposed solutions that deteriorate the objective function are accepted more often when the temperature is higher. Later in the process when the temperature decreases, only proposals that reduce the cost are accepted. Starting with an arbitrary solution, every improvement is accepted. Proposed solutions that deteriorate the objective function are accepted according to the Boltzmann probability [9]. In our case we implemented the Metropolis distribution probability function:

$$P_T(1 \rightarrow 2) = \begin{cases} 1, (E_2 - E_1) \le 0 \\ e^{-\frac{(E_2 - E_1)}{kT}}, else \end{cases}$$

where $e^{-\frac{(E_2 - E_1)}{kT}}$ is the Boltzman distribution.

An outline of the basic sequential SA algorithm is:

```
INITIALIZE;
M = 0;
repeat
    repeat
        PERTUB(config s(i) -> config s(j), Δcost_ij);
        if Δcost_ij <= 0 then accept
        else if ex(-Δcost_ij/TM) > random[0; 1) then accept;
        if accept then UPDATE(config s(j));
    until equilibrium is approached sufficiently;
    TM+1 = f(M); (Generate new smaller temperature)
    M = M + 1;  (Temperature iteration counter)
until stop criterion = true (system is frozen);
```

3 STRATEGIES OF PARALLELIZING THE SA ALGORITHM

Parallelism in SA can be broadly classified into two approaches, single and multiple path parallelism. In a single path algorithm, only a single path in the search space is carried out. In a multiple path approach, several different trials are evaluated simultaneously. In single-path algorithms, only one step is carried out (single-step parallelism), or a sequence starting at the current solution (multiple-step parallelism) after evaluating a part of the current solution's neighborhood. In multiple path algorithms the parallel-path can be independent or may interact according to a communication pattern [10]. Another taxonomy divides parallel annealing into three major classes: serial-like algorithms, altered generated algorithms and asynchronous algorithms [13].

An approach where a master processor sends and receives data from slave processors, and makes decisions by sending commands to the slave processors is proposed [6]. In this approach the master processor turned out to be a bottleneck, forcing implementation of as much independence to the slaves as possible. Czech et al. propose a parallelization approach where every m-th process consults the best solution of previous (m-1) processes [5].

4 PARALLEL SA WITH A BOLTZMANN SYNCRONISATION FUNCTION

The cooperation of more processors can be used either to speed up the sequential annealing algorithm or to achieve a higher accuracy of solutions to a problem. In this work we considered both goals. The accuracy of a solution is meant as its proximity to the global optimum solution.

We designed a system with r available processors and each of them is capable of generating its own annealing process. The architecture includes a master computer and given number of slave computers, interconnected in a Local Area Network. The starting - master computer P1 imports the initialization data, generates the first proposed solution and passes data to r-1 remaining computers. All remaining computers – processors start independent annealing process after receiving the initial data. All processors communicate by exchanging current best solutions during annealing processes, at a chosen rate. The scheme of communication is given in the figure 1.

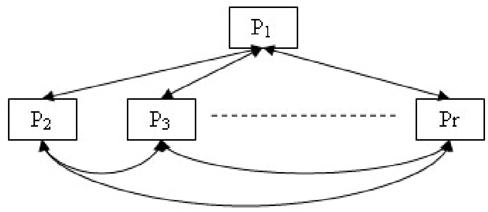


Figure 1: *Processor communication*

The communication model used is synchronized point-to-point. Before the temperature is decreased, every process sends its best found solution to the remaining r-2 processes, and waits the best found solutions from all other processes, too. Once all data is received, each process calls its acceptance function to decide weather to accept the best solution from all other processes or continue with the one found by the process itself. With this architecture, the master computer only starts the solving process and eventually, collects best solutions from slave computers. It serves no purpose during solving iterations and information exchange; therefore its functions could be performed by some of the slaves. Keeping master's functions limited excludes it being a bottleneck in the architecture.

We analyzed a possible problem of certain faster convergating processes to wait for slower processes to send their best solutions. Truly, this architecture is only as fast as the slowest of the included computers. However, we consider this not to be a setback. All computers used in the network are of same type, design and performance. Also, all computers execute the same annealing algorithm; use the same temperature decrement coefficient, the same number of iterations during each temperature and the same metropolis function. The only difference is the independent random generation of the next proposed solution in every computer. This provides different search paths through the solution space in every parallel process and increase diversity of the search. Therefore, all computers are expected to make at average the same number of acceptance and declination of new proposed solutions (due to the metropolis function). The cumulative result is roughly the same computational effort (time of execution) in each computer. Sometimes some processors might convergate faster toward a local optimum, but the necessary broad search of the domain that this parallel architecture brings is worth waiting.

The acceptance function (the decision in every processor to accept the best solution from others or continue with its own) was also a subject of interest in our research. We tried: always accepting the best solution from all others, randomly accepting any of the given solutions from other processes and eventually accepting solutions using the Boltzmann distribution. We got the best results using the Boltzmann distribution. This probability function is fundamental for SA and it seems natural for it to be part of SA's parallelization.

There are other points among the algorithm steps where parallel processes could communicate, i.e. different rates of communication. Data could be exchanged within the inner annealing iteration at every n-th iteration or after certain number of temperature decreasing iterations. In our parallel SA the processes P_2, P_3,…Pr cooperate among each other at every temperature decreasing iteration.

Implementation of the parallel SA is the following:

Process P0:
INITIALIZE;
Dispatch initial solution to processes Pp, p=2,3,…… r
Wait until final solutions from processes Pp, p=2,3,……r are received
Choose and display the best solution from processes Pp, p=2,3,……r

Process Pp, p=2,3,……r:
INITIALIZE;//receive initially proposed solution
repeat
    repeat
        PERTUB(solution(i) -> solution(j), $\Delta cost_{ij}$);
        if METROPOLIS($\Delta cost_{ij}$) **then** accept
        if accept **then** UPDATE(solution(j));
    until predefined number of iterations;
    Send current solution s(p) to other processes Pq, q=2,3,…r, q≠p
    Receive solutions from all proc. Pq, q=2,3,……r, q≠p
    Choose the best solution s(q) from received solutions
    if exp(-$\Delta cost_{pq}$/TEMP) > random[0; 1) //Boltzmann
    then accept;
    if accept **then** UPDATE (solution s(j));
    $TEMP_{+1}$ = f (TEMP); //Decrease temperature
until stop criterion = true (system is frozen);

5 THE TRAVELING SALESMAN PROBLEM

The traveling salesman problem (TSP) is a problem for finding the minimum distance of a tour of visiting all the finite number of cities and returning to the starting point. The tour distance is expressed as follows:

$$\sum_{i=1}^{N-1} d(\upsilon_\pi(i), \upsilon_\pi(i+1)) + d(\upsilon_\pi(N), \upsilon_\pi(1))$$

where $\upsilon(i)$ is the i-th point (city) in a tour π; $d(\upsilon(i); \upsilon(j))$ is the distance between two points, and $d(\upsilon(i); \upsilon(j)) = d(\upsilon(j); \upsilon(i))$.

The constellation of cities used for evaluating our proposed algorithm is selected arbitrary from TSPLIB [1]. An optimal solution for the selected constellation is already given there, so our results can be compared with TSPLIB optimal solution.

The worst case time complexity of the sequential Simulated Annealing applied to the Traveling Salesman Problem is $cn^2 = O(cn^2)$, where c is the number of cooling stages. [7].

The worst case time complexity of the parallel simulated annealing algorithm that we propose is $c(n^2 + rn) = O(cn^2 + crn)$, where c is the number of cooling iterations and r is the number of parallel processes which communicate. The additional crn component in the parallel SA as opposed to the sequential version is because the necessity for r parallel processes to exchange r messages of O(n) complexity c times. Experiments of communication with different rates are given in the experimental results.

5 EXPERIMENTAL RESULTS

A crucial component when designing a parallel algorithm is finding the best tradeoff between the amount of communication and every processor's independence. Communication of the parallel processes within the inner annealing cycle causes extensive communication slowing the overall performance. On the other hand, delaying the communication for every n-th temperature iteration gave worse solution quality because of lack of sufficient information exchange. The experimental results given in figure 2 show that best results are attained when communicating at every temperature iteration. This graph is generated with 5, 10 and 20 processors.

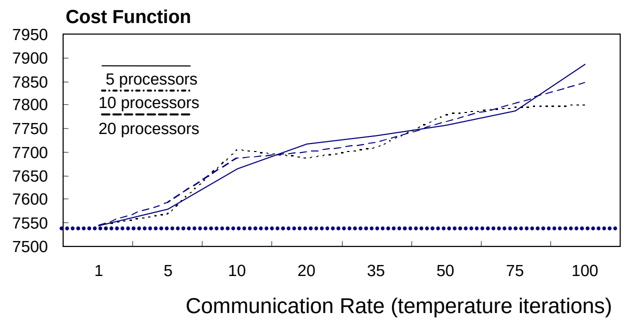


Figure 2: *Course of solution quality versus the rate of communication among processes. The horizontal axis is the number of temperature iterations between the processes communication. The vertical axis is the solution cost. The dashed line is the optimal solution*

Besides increasing solution quality, main reason for parallelization is the expected speedup. Speedup is defined as the ratio of solving time using single processor versus multiple parallel processors solving time. Efficiency is defined as the ratio of speedup versus the number of processors used. Efficiency gives the utilization of the processors. According to experimental results in figure 3, the speedup is obviously increasing when going from one processor toward five or ten. Further increasing of the number of processors brings no advantage since large amount of communication among processes slows the overall performance. According to experimental results, our parallel SA implementation achieves best speedup at 10 - 20 processors. However, if we take the efficiency into consideration, using more than 10 processors is highly inefficient.

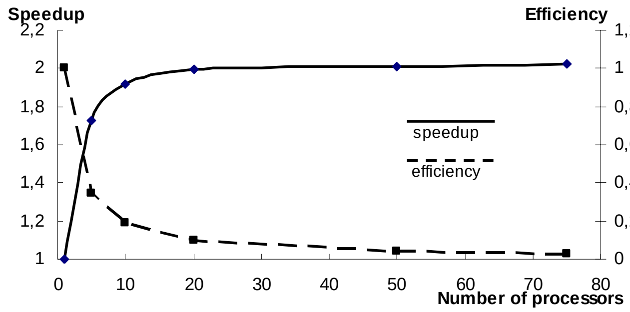


Figure 3: *Course of speedup and efficiency versus the number of processors.*

4 CONCLUSION

Results showed that time needed to get the solution decreases when using parallel, yet synchronized computation. However, increasing the number of processors beyond certain saturation point becomes highly inefficient (Figure 3).

The rate of processors communication also contributes for the quality of the solution. Higher communication rates cause parallel processes to become over-dependent, reducing to the performance of a single processor (Figure 2). The optimal communication rate (at every temperature iteration), combined with the Boltzmann acceptance function gave the best results in the shortest time.

The implemented parallel architecture emphasizes both intensification and diversification of the heuristic search, what in sequential algorithms is only a trade off. While each processor intensifies the search through its path in the domain, they all cumulatively perform a broad diversified search through the entire domain. Hence, growth of the problem size is easily compensated with increasing the number of used processors. Frequent Boltzmann synchronization among the parallel processes adds the proper amount of intensification in the otherwise diversified search.

References

[1] [Tsplib]http://elib.zib.de/pub/Packages/mp-testdata/tsp/tsplib/stsp-sol.html

[2] [MPICH2] http://www-unix.mcs.anl.gov/mpi/mpich2/

[3] [Aarts 1989] E.H.L., and van Laarhoven, P.J.M., Simulated annealing: Theory and application, Wiley, New York, 1987

[4] [Czech 2006] Czech Z, Czarnas P. Parallel simulated annealing for the vehicle routing problem with time windows, Proceedings of the 14th EUROMICRO International conference on Parallel, Distributed and Network–based Processing (EUROMICRO-PDP'06) IEEE

[5] [Czech 2002] Czech Z., Wieczorek B. Solving bicriterion optimization problems by parallel simulated annealing, Proceedings of the 10th Euromicro Workshop on Parallel, Distributed and Network –based Processing (EUROMICRO-PDP'02) IEEE

[6] [Diekmann 1992] Diekmann R., LulingR., Simon J. A General Purpose Distributed Implementation of Simulated Annealing, 4th IEEE Symposium on Parallel and Distributed Processing, SPDP '92

[7] [Johnson 1997] D.S. Johnson, L.A. McGeoch, "The Traveling Salesman Problem: A Case Study in Local Optimization," Local Search in Combinatorial Optimization, E.H.L. Aarts and J.K. Lenstra, eds., pp. 215-310. London: John Wiley and Sons, 1997

[8] [Jolevski 2005] Jolevski I., Loskovska S., Chorbev I., D.Mihajlov. An Overview of a Constraint Solving Engine with Multiple Optimization Algorithms, ITI2005 Cavtat, Croatia, 2005, pages 637-643

[9] [Kirkpatrick 1982] Kirkpatrick S., Gelatt, C. D. Jr., Vecchi M.P., Optimization by Simulated Annealing, in Technical Report Research Report RC 9335, IBM Thomas J. Watson Center, Yorktown Heights, N.Y., 1982

[10] [Kliewer 2000] Kliewer G., Tschöke S., A General Parallel Simulated Annealing Library and its Application in Airline Industry, Proceedings of the 14th International Parallel and Distributed Processing Symposium (IPDPS 2000) IEEE

[11] [Miki 2001] Miki M., Hiroyasu T., Kasai M., Ono K., Temperature Parallel Simulated Annealing with Adaptive Neighborhood: Information Processing Society of Japan, Vol.42, pp745-753 (2001)

[12] [Miki 2003] Miki M., Hiroyasu T., Yoshida T., Fushimi T., Parallel Simulated Annealing with Adaptive Temperature Determined by Genetic Algorithm. IEEE International Conference on Systems, Man & Cybernetics, 2003

[13] [Ram 1996] Ram J.D., Sreenivas H.T., Subramaniam G.K., Parallel Simulated Annealing Algorithms, Journal of Parallel and Distributed Computing 37, 207-212 (1996)

[14] [Santander 2005] Minimal loss reconfiguration based on simulated annealing meta-heuristic, Santander G., Chacra F.A., Opazo H., Lopez E., Proceedings of the 15th International Conference on Electronics, Communications and Computers (CONIELECOMP 2005) IEEE

IMPROVED SHOT BOUNDARY DETECTION ALGORITHM

Ivica Dimitrovski, Suzana Loskovska, Ivan Chorbev, Dragan Mihajlov
Department of Computer Science and Information Technology
Faculty of Electrical Engineering
Karpos 2 b.b., 1000 Skopje, Macedonia
Tel: +389 2 3099159; fax: +389 2 3064262
e-mail: *ivicad@etf.ukim.edu.mk*

ABSTRACT

In this paper, we describe an improved approach for shot boundary detection in digital videos, one of the fundamental steps in digital video analysis. Our approach is divided into two steps: histogram–level extraction and local mean-ratio comparison. The detection method has been tested on video sequences with different object and camera motions. We used TV news, commercial, sports and documentary video sequences to estimate the performance of the proposed algorithm. Test results have shown that this method can produce accurate shot cut detection, even in video materials that contain illumination changes and moving objects.

1 INTRODUCTION

In multimedia information retrieval, shot boundary detection is a very active research topic [1], [2], [3]. Today, a typical end-user of a multimedia system is overwhelmed with video collections. Organizing these collections, so they are easily accessible, is a major problem. Thus, to enable efficient browsing of multimedia materials, it is necessary to design techniques and methods for indexing and retrieving this kind of data. We focus on video data, as it is one of the richest, but also most resource consuming part of multimedia content. Digital video information often consists of series of 25 frames or images per second and an associated and synchronized audio track. To develop any content-based manipulations on digital video information, the video information must first be structured and broken down into components. Digital video can be described with four different levels of details (Figure 1). At the lowest level, the video consists of a set of frames. At the next, higher level, frames are grouped into shots. Consecutive shots are aggregated into scenes based on story-telling coherence. All scenes together compose the entire video sequence.

Shots are basic structural building blocks in video. A shot in video information may be defined as a sequence of continuous images (frames) from a single camera at a time. A shot boundary is the gap between two shots. Naturally, boundaries between shots need to be determined automatically. After the boundaries are found, each shot can be represented with an appropriate key frame. Key frames are used to encapsulate the content of the video sequence, and to apply indexing and browsing.

A shot cut is a shot boundary where one shot abruptly changes to another. In shot cuts there is a sudden transition from one shot to another, i. e. one frame belongs to the first shot, the following frame belongs to the second shot. Other types of shot boundaries include fades, dissolves or wipes [4]. These shot boudaries types include gradual transition between two shots, i. e. there exists a sequence of frames that belongs to both the first and the second shot. "Detecting a cut" means precise positioning of the change of shots. In this paper we focus on detecting shot cuts, since they contribute roughly 90% of all shot boudaries present in video collections, as opposed to 10% presence of gradual transitions.

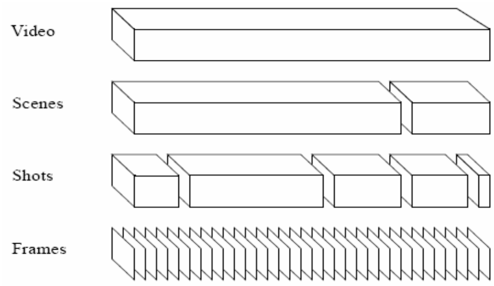


Figure 1: *Video structuring model*

The remainder of the paper is organized as follows. Section 2 gives an overview of existing approaches in shot boundary detection, Section 3 introduces our proposed algorithm, Section 4 describes the algorithm evaluation technique and the data used for testing the proposed method. Section 5 presents the experimental results and Section 6 gives a conclusion of the paper.

2 OVERVIEW OF EXISTING APPROACHES

A variety of techniques have been proposed for shot boundary detection in digital video [5], [6], [7], [8], [12]. These techniques can be categorized in two basic groups: techniques using compressed and techniques using uncompressed video. Most shot boundary detection algorithms use uncompressed video [5]. Each approach typically computes difference in various properties between frames. There is generally little difference between adjacent frames that belong in the same shot.

However, when two adjacent frames span a cut, each is a member of a different shot and there is a sufficient dissimilarity to enable cut detection. There are several methods that can be used to measure the difference between frames. In pixel-by-pixel comparison, the change in values of corresponding pixels of adjacent frames is determined. The main disadvantage of this method is that any kind of shot transition can be easily confused with object motion, which often occurs in video. This method is highly sensitive to camera motion, camera zoom, intensity variation, and noise. Most popular techniques on uncompressed video summarize frame content using histograms. Such approaches represent a frame, or parts of a frame, by the frequency distribution of features such as color. For example, color spaces are often separated into their component dimensions which are then divided into discrete ranges or bins. For each bin, frequency is computed in the frames. The difference between frames is computed using the distance between bin frequencies over each color dimension using an appropriate distance metric. Another method for shot detection is the edge detection segmentation method. This method seeks for entering and exiting edge pixels. All these methods operate on uncompressed video. However, some other techniques utilize the compression features of MPEG for shot boundary detection: color blocks in MPEG stream [9], [10], DCT – based shot boundary detection uses differences in motion encoded in a MPEG stream to find shots [11].

3 SHOT BOUNDARY DETECTION ALGORITHM

The task in any shot boundary detection method in a video sequence is to detect the visual discontinuities along the time domain. During the detection process, it is crucial to extract the visual features that measure the degree of similarity between frames in a given shot. The color histogram-based shot boundary detection is one of the most reliable variants of histogram-based detection algorithms [13]. It considers that color content does not change rapidly within, but across shots. Thus, shot cuts and also gradual transitions, can be detected as single peaks in the time series of the differences between color histograms of continuous frames. Often, digital images are represented in RGB color space. In our work, we used 24 bits/pixel images (8 bits for every color channel). If we compute the overall number of possible colors we rise to a high number of levels (2^{24} bins). Due to the limited response of human visual system, we are not able to distinguish the whole levels of possible colors. A simple solution considers only the most significant bits of each RGB component (Figure 2). This solution reduces computational overhead and increases robustness toward simple camera and object motion.

R_7	R_6	R_5	R_4	R_3	R_2	R_1	R_0
G_7	G_6	G_5	G_4	G_3	G_2	G_1	G_0
B_7	B_6	B_5	B_4	B_3	B_2	B_1	B_0

Figure 2: *Video structuring model*

With this quantization method we have grouped all possible colors into 2^{12} different color levels in RGB space. This corresponds to 4096 colors. We can define the color histogram as an array of 4096 elements after the quantization. If we compare the original image and the image obtained by eliminating the four least significant bits of every component, we can see that pixels have been grouped according to their similarity (Figure 3).

The shot boundary detection method is based on the difference between color histograms of frames belonging to a video sequence. This difference is computed as:

$$HistDif[i] = \sum_{j=1}^{M} \left| h_i(i) - h_{i-1}(j) \right|$$

where h_i is the color histogram with M=4096 bins of frame *i* of the video sequence.

Previous approaches only compare peaks in the histogram difference graph with a previously obtained threshold value. Differences that reach above the threshold value represent detected shot cuts. Figure 4 shows the result of computing the color histogram difference for a given video sequence. In the figure a peak appears when a large discontinuity occurs between histograms. These peaks are usually associated to an abrupt transition. However, from all appearing peaks in figure 4, a real shot cut is represented only with the peak appearing at frame 4090. All other peaks are caused by the intensive object movement in front of the camera. It is evident that selecting the threshold value is a problem of its own. Selecting too high threshold value increases the number of missed shot cuts. Using a lower threshold results in increasing the number of false alarms. A way to eliminate the peaks caused by the camera or object motion, has to be derived.

Figure 4 shows that an abrupt scene transition produces

(a) 

(b) 

Figure 3: *(a)24 bits/pixel image (b)12 bits/pixel image*

only one peak value within a period of time. Therefore, we consider a sliding window of size *2n+1* along the axis that covers frame transitions HistDif[i-n], ..., HistDif[i+n]. Next we compute the local mean-ratio within the sliding window, for each frame:

$$M_i = \frac{\sum_{j=i-n,\, j\neq i}^{j=i+n} HistDif_j}{2n}$$

Then we map the color histogram difference curve into the local mean-ratio space. The histogram difference value at frame *i* is now equal to its original value HistDif[i] divided by the the mean M_i of the appropriate sliding window:

$$HistDif^*[i] = \frac{M_i}{HistDif[i]}$$

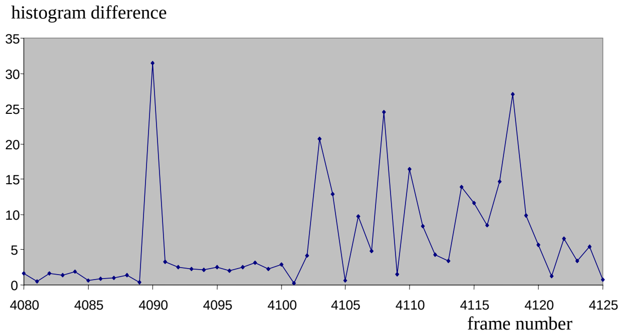


Figure 4: *Color histogram difference*

Figure 5 shows the transformed color histogram difference for a window of size n=5 applied on the same video sequence from the Figure 4.

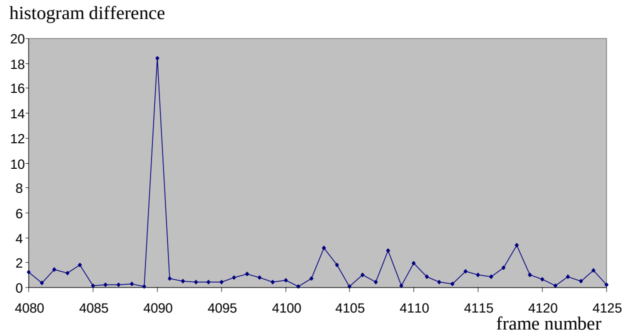


Figure 5: *Transformed color histogram difference*

It is evident that false alarms appearing in the original histogram difference graph are eliminated. The only peak that appears in this curve is the actual shot cut at frame 4090. The chosen value of 5 for the half length of the sliding window n, is empirically derived from various experiments. Choosing a greater value than 5 increases the danger of including two shot cuts in a single sliding window.

3 QUALITY OF DETECTION

When evaluating our shot boundary detection method we compared results with a listing of the actual shot cuts (when and where they occur). In evaluating the results of a shot boundary detection method, there are a number of parameters that should be considered, but the most important are:

- N_i – number of false shot boundaries detected by the method
- N_d – number of shot boundaries not detected by the method
- N_t – number of actual shot boundaries

Having these values, most of the important evaluation measures can be calculated. In our work we use the following:

$$\text{Recall} = \frac{N_t - N_d}{N_t} \qquad \text{Precision} = \frac{N_t - N_d}{(N_t - N_d) + N_i}$$

The recall measure looks at the percentage of actual shot cuts that has been detected by the method, while the precision measure is a percentage showing how accurate the method is at detecting only the actual shot boundary.

Name	Type	Number of Frames	Number of Shots
V1	News	479	4
V2	Music	10406	174
V3	Film	2632	34
V4	Film	1648	7
V5	Film	5132	38
V6	Film	24214	180
V7	Documentary	6297	12

Table 1: *Video data used for experiments*

4 EXPERIMENTAL RESULTS

To conduct a comprehensive test of the implemented algorithm, we selected a variety of video clips as test data. The characteristics of the test sets are presented in Table 1. The locations of the shot boundaries within the test videos were determined by a manual visual analysis.

We conducted numerous experiments with a variety of video contents to evaluate the performance of our boundary detection algorithm. The testing sequences contain usually film features, cuts, camera motions, rapid moving objects, zooms, flickers, and often combinations of these. These videos contain most of the difficult aspects that challenge the scene change detection algorithms. Our results are presented in Table 2. Results show that proposed algorithm has a very high accuracy on abrupt cut detection and there is virtually no false detection. The obtained results were compared with the color histogram difference algorithm [5]. It's evident that our improved approach is highly accurate when the video sequence contains object and camera motion (V2 and V6).

Name	Type	Recall	Precision
our approach			
V1	News	100%	100%
V2	Music	95%	95%
V3	Film	100%	100%
V4	Film	97%	98%
V5	Film	93%	90%
V6	Film	99%	99%
V7	Documentary	100%	100%
histogram color difference			
V1	News	100%	100%
V2	Music	85%	82%
V3	Film	90%	89%
V4	Film	92%	85%
V5	Film	90%	85%
V6	Film	91%	89%
V7	Documentary	100%	100%

Table 2: *Video data used for experiments*

5 CONCLUSION

In this paper we present a novel, robust and efficient method to detect abrupt cuts in video. It has been demonstrated that our method produces highly accurate abrupt cut detection for a wide-range of types of video. Our method is immune to moving objects, camera motion, and other similar effects. Furthermore, our method uses only frame pixel values without any motion estimation processes, so that frugal computational complexity is maintained, which makes it very attractive for real-time video applications.

References

[1] Content-based Video Indexing for the Support of Digital Library Search, M. Petkovic, R. van Zwol, H.E. Blok, W. Jonker, P.M.G. Apers, M. Windhouwer, M. Kersten - Proceedings of the 18th International Conference on Data Engineering (ICDE 2002)

[2] Video Data Mining: Mining Semantic Patterns with temporal constraints from Movies, Kimiaki Shirahama, Koichi Ideno and Kuniaki Uehara - Proceedings of the Seventh IEEE International Symposium on Multimedia (ISM 2005)

[3] Video structuring, indexing and retrieval based on global motion wavelet coefficients, E. Bruno, D. Pellerin, Proc. Int. Conf. of Pattern Recognition (ICPR), Quebec City, Canada, 2002.

[4] Comparison of Automatic Shot Boundary Detection Algorithms, Rainer Lienhart, Proc. SPIE Vol. 3656, p.290-301, Storage and Retrieval for Image and Video Databases VII, Editor(s), 1998

[5] J. S. Boresczky and L. A. Rowe. A Comparison of Video Shot Boundary Detection Techniques. Storage & Retrieval for Image and Video Databases IV, SPIE 2670, pp. 170-179, 1996.

[6] Seungchul Jun, Sunghan Park, "An Automatic Cut Detection Algorithm Using Median Filter and Neural Network", ITC-CSCC 2000, Vol. 2, pp 1049-1052.

[7] A New General Framework for Shot Boundary Detection and Key-Frame Extraction, H. Feng,W. Fang, Sen Liu, Y. Fang, MIR 2005 Singapore

[8] A New Algorithm For Shot Boundary Detection, Y. Abdeljaoued, T. Ebrahimi, C. Christopoulos, I. Mas Ivars, journal: Lecture Notes in Computer Science, vol. 2195:63, 2001

[9] An Evaluation of Motion and MPEG Based Methods for Temporal Segmentation of Video R. Kasturi, S. H. Strayer, U. Gargi, S. Antani Department of Computer Science and Engineering Technical Report CSE-98-014, 1998

[10] Shot Boundary Determination on MPEG Compressed Domain and Story Segmentation Experiments for TRECVID 2003 Masaru Sugano, Keiichiro Hoashi, Kazunori Matsumoto, Fumiaki Sugaya, and Yasuyuki Nakajima

[11] Shot boundary detection via similarity analysis Matthew Cooper, Jonathan Foote, John Adcock, and Sandeep Casi, Proceedings of the TRECVID 2003 Workshop, Gaithersburg, Maryland, USA, pp. 79--84.

[12] Video Cut Detection using Frequency Domain Correlation S. V. Porter and M. Mirmehdi and B. T. Thomas, In Proceedings of the 15th International Conference on Pattern Recognition, pages 413--416, September 2000.

[13] Temporal Segmentation of Video Using Frame and Histogram Space Robert A. Joyce, Bede Liu, IEEE Transactions on multimedia, vol. 8, no. 1, February 2006

FUNCTIONALIZING TRUST IN A MODEL AGENT-BASED E-COMMERCE SYSTEM

Maria Ganzha, Maciej Gawinecki, Paweł Kobzdej, Marcin Paprzycki
Systems Research Institute, Polish Academy of Science
Newelska 6, 01-447 Warsaw, Poland

Costin Badica
Computer Science Department, University of Craiova
Bvd. Decebal 107, Craiova, 200440, Romania

ABSTRACT

This note discusses the way that operations involved in trust management in a model agent-based e-commerce system are functionalized. Specifically, we use UML sequence diagrams to identify when, during an attempted purchase, trust-related information is exchanged between agents in the system. We also illustrate precise form and content of messages exchanged between agents.

1 INTRODUCTION

Currently we are in the process of developing a complete model agent-based e-commerce system. Its description can be found in [1] and in collected there references to our earlier work. In this system there exist a number of places where its behavior is influenced by what can be defined as a "trust relationship" between its components. In our earlier work [2] we have conceptualized, on a very general level: (1) precisely where in our system we have to deal with "trust management," (2) which "events" that take place in the system influence trust relationships, and (3) how do they influence them. The aim of this note is to look into trust management related processes from the functional point of view. Specifically, we are interested in establishing (1) which components of the system are involved in trust management, (2) when, during purchasing process, do these components communicate, and (3) what information is being transferred. Let us start from briefly summarizing the way our system has been designed, with special attention paid to trust management related issues.

2 SYSTEM SUMMARY

Our proposed model agent-based e-commerce system depicts an e-marketplace where *shop agents* and their co-workers, represent *User-Seller*s and attempt at selling products to *buyer agents*, which together with *client agents* represent *User-Client*s. In Figure 1 we present a partial use case diagram of the system, in which we focus our attention on these of its components that are directly involved in trust management (detailed description of the system, as well as it complete use case diagram can be found in [1]).

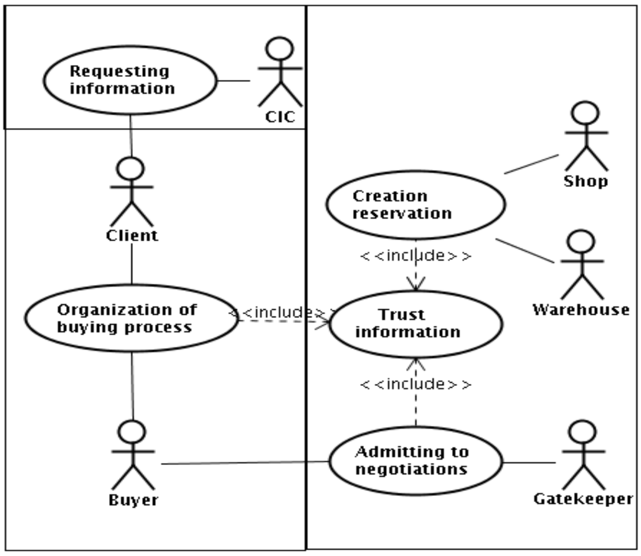


Figure 1: *Partial use case diagram of the system* (*only agents participating in trust relations and their interactions are depicted*)

In Figure 1 we can see three major agents (and three main "areas") of our system: (1) the *CIC* (*Client Information Center*) *agent* which manages white-page and yellow-page data about products sold in the system (this is the central information repository), (2) the *Client agent* (*CA*) which represents *User-Client* (this is the *User-Client* support infrastructure), and (3) *Shop, Warehouse* and *Gatekeeper agent*s, which represent *User-Seller* (this is the *User-Seller* support infrastructure). Let us now briefly describe each one these agents.

CIC agent (*CIC*) is responsible for providing information which e-store in the system sells which products. Information about products and stores is semantically represented – using OWL Lite demarcation – and persisted in a Jena [5] environment (for more details see [4]).

Client agent (*CA*) represents *User-Client* in autonomously making all necessary decisions related to the purchasing process. *Buyer agent*(*s*) (*BA*) help the *CA by* actually taking part in price negotiations.

Shop agent (*SA*) is the central manager of the e-store and autonomously makes all decisions pertinent to selling products offered by the store. The *SA* is helped by (1) the *Gatekeeper agent* (*GA*) that is responsible for admitting (or not) *BA*s to the host, managing the process of preparing negotiation which includes, among others, registration of participants and supplying them with negotiation template and protocol, and releasing *BA*s to price negotiations; (2) the *Warehouse agent* (*WA*) that is responsible for product reservations and inventory management; and, (3) multiple *Seller agents* (*SeA*) that are directly involved in price negotiations with *BA*s.

A typical system operations scenario is as follows (for a detailed description see [4]). Let us assume that system is already initialized and all information about all products sold by all e-stores has been registered with the *CIC*. *User-Client* formulates a request – what product she would like to purchase. The *CA* queries the *CIC* to find out which stores sell the requested product and attempts to “deliver” a *BA* to these stores it deems worthy of its *trust*. Depending on the *trust* that each store has in the *CA*, its *BA*s are allowed (or not) to enter. *BA*s participate in price negotiations and report results to the *CA*. Based on obtained results, the *CA* decides to (1) attempt purchase at one of the stores, (2) try to negotiate a better price, or (3) abandon purchase altogether. Let us note that *trust* that the *CA* has in shops (*SA*s) in which its representatives were winners in price negotiations plays a role in making these decisions.

In our system we utilize an *airline ticket reservation mechanism* to manage the purchasing process. Successful price negotiations result in a reservation being issued to the winner. Within a certain time, specified in the reservation, that winner can make a purchase of the product at the negotiated price. Time of the reservation depends on the *trust* that the *SA* has in a given *CA*. When the reservation expires the reserved product is returned to the pool of available products and the only way for the *BA* to make a purchase is through repeated participation in price negotiations. Note that expired reservation has a direct negative effect on *trust* that the *SA* has in a given *CA*.

In the above description, we have identified these situations which involve trust relationships. Let us now discuss in more detail how these processes actually take place in the system.

3 INTERACTIONS BEFORE NEGOTIATIONS

Let us start from the interactions between agents in the system that take place before price negotiations. Let us assume that for each store that a given *CA* interacted with in the past, it has computed its trust-value. Let us also note that in the actual implementation we have decided to split the *CA* into two agents. The *CA* itself became an orchestrator of the flow of information and a store manager – taking part in interactions with other components of the system. The *CDA* (*Client Decision Agent*), which was originally viewed as an integral part of the *CA*, is where actual decision-making takes place. It has been upgraded to a status of a full-blown agent. Metaphorically, the *CDA* is the brain of the *CA* that, for technical reasons, has been removed from its skull.

After *User-Client*’s request is formulated, the *CA* communicates with the *CIC* and obtains a list of stores that sell a given product. The *CA* analyses that list of stores and updates their trust-values [2]. Then it checks if there are any stores with trust-value below a “threshold of trust.” Such stores are considered untrustworthy and removed from the list. Obviously, when only very few stores remain on the active list, the *CA* may decide to adjust the threshold value vis-à-vis a given (unpopular) product and as a result to increase number of stores that it will try to interact with. One of the reasons for such a decision may be to obtain a broader perspective on current valuation of the requested product within the marketplace. After adjusting the list of shops, the *CA* interacts with *GA*s representing them (each shop (*SA*) is actually represented by its *Gatekeeper agent*, which is the agent that any other agent has to interact with first when attempting to make a purchase).

The *GA* checks the trustworthiness of each of the *CA*s that approach it about entering the shop. Note that, similarly to the case of the *CA* and the *CDA*, we have decided to separate the manager / orchestrator functions of the *SA* from the decision-making functions that were delegated to the *Shop Decision Agent* (*SDA*). Thus, to assess the trust value of incoming *BA*s, the *GA* communicates with the *SDA*. These processes have been depicted in the sequence diagram in Figure 2. Note that all messages presented in this and subsequent figures reference FIPA ACL messages.

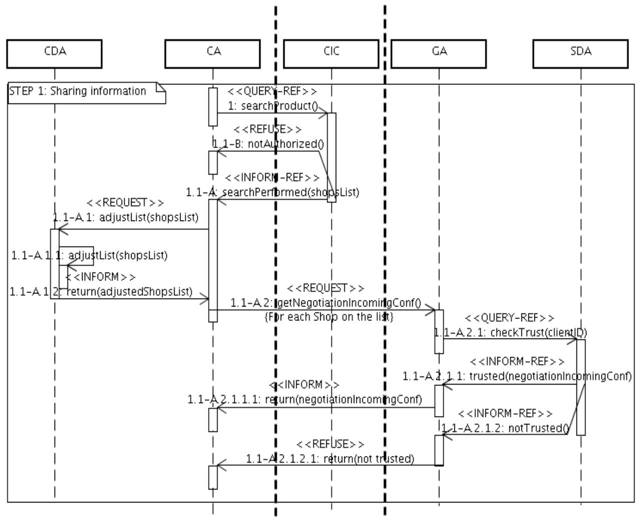


Figure 2: *The sequence diagram of ACL messages exchange between CA and CIC and CDA*

We can see here, first, exchange of messages between the *CA* and the *CIC* (*QUERY-REF* message from the *CA* is either responded to by a *REFUSE* message – when the *CA* is not authorized in the system or by the *INFORM-REF* message containing the requested list of stores). Next, the *CA* communicates with its “brain,” the *CDA*, to adjust the list of shops to interact with (here we can see a simple *REQUEST* – *INFORM* pair of messages). For each store

on the list, the *CA* sends a *REQUEST* message to its *GA*. Such a message requests to be admitted to the store and to specify conditions of admission – the store may admit *BA*s, or create them internally (for more details see [3]).
In the way that our system was set up, where the *CA* and the *GA* are located on two separate servers named *beethoven* and *bach*, when running JADE agent environment, the message that the *CA* sends to the *GA* will have the form:

```
(request
  :sender (agent-identifier
    :name ca@beethoven:7771/JADE
    :addresses (sequence
http://10.1.1.2:7770/acc)
    :X-team-id "client-1")
  :receiver (agent-identifier
    :name ga@bach:7771/JADE
    :addresses (sequence
http://10.1.1.2:7770/acc))
  :content
    (action
      (agent-identifier
        :name ga@bach:7771/JADE
        :addresses (sequence
http://10.1.1.2:7770/acc))
      (get-negotiation-incoming-conf)
    )
)
```

The *GA* communicates with the *SDA* to evaluate the trust value of the incoming *CA* (in Figure 2, a pair of *QUERY-REF – INFORM-REF* messages). Depending on the content of the *INFORM-REF* message that it receives from the *SDA*, the *GA* sends to the *CA* either: (1) an *INFORM* message – in the case it is to be admitted – which will have the following form (note that here the *GA* informs the *CA* not only that it is ready to get involved in interactions, but also informs the *CA* that it can both accept its representative – `can-welcome-buyer true`, and create a buyer agent locally – `can-create-buyer true`):

```
(inform
  :sender (agent-identifier
    :name ga@bach:7771/JADE
    :addresses (sequence
http://10.1.1.2:7770/acc)
    :X-team-id "shop-1")
  :receiver (agent-identifier
    :name ca@beethoven:7771/JADE
    :addresses (sequence
http://10.1.1.2:7770/acc))
  :content
    (result
      (action
        (agent-identifier
          :name ga@bach:7771/JADE
          :addresses (sequence
http://10.1.1.2:7770/acc))
        (get-negotiation-incoming-conf)
      (negotiation-incoming-conf
        :can-create-buyer true
        :can-welcome-buyer true)
    )
)
```

or, otherwise, (2) when the *CA* is not going to be admitted to negotiations, a *REFUSE* message – which will have the form:

```
(refuse
  :sender (agent-identifier
    :name ga@bach:7771/JADE
    :addresses (sequence
http://10.1.1.2:7770/acc)
    :X-team-id "shop-1")
  :receiver (agent-identifier
    :name ca@beethoven:7771/JADE
    :addresses (sequence
http://10.1.1.2:7770/acc))
  :content
    (result
      (action
        (agent-identifier
          :name ga@bach:7771/JADE
          :addresses (sequence
http://10.1.1.2:7770/acc))
        (get-negotiation-incoming-conf)
      (reason not-trusted)
     )
)
```

Interestingly, the fact that at this stage the *GA* sends back a positive response does not mean automatically that the representative of the *CA* will be admitted to negotiations. Specifically, if the shop *creates BA*s locally, then the *BA* will be created for the *CA*. Situation changes when the shop receives incoming *BA*s. In this case it is possible that between moment of the first request about trust which is presented on the Figure 2 and the moment when *BA* arrives in the shop, trust relationship between *SA* and *CA* could change. To explain this we have to recall that the trust value depends, for instance on the fact that the *CA* has won price negotiations but did not make a purchase, or that it confirmed purchasing a product, but did not make a payment. Now, we have to consider the fact that a given *CA* can be involved in multiple interactions with a given shop (*SA*). Therefore, between the time that the *CA* receives a positive answer from the *GA* and prepares the *BA*; and the time that *BA* arrives at the shop, trust value could have changed because of actions of other *BA*s representing the *CA*.

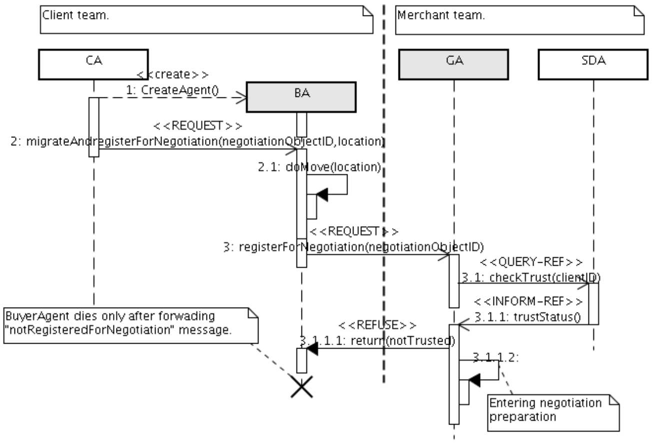


Figure 3: *The sequence diagram of ACL message exchange between arriving BA and GA.*

Therefore, when the *BA* arrives at the Shop and informs the GA: "I am here" the *GA* has to re-check the trust status of the *CA* that the *BA* represents. This process has been depicted in Figure 3. There we can see first the *CA* creating the *BA* and sending it a *REQUEST* message to migrate to a given *GA* and register for price negotiations. Upon receiving this *REQUEST* message, the *BA* moves to the specified location and sends a *REQUEST* to register to the local *GA*. The *GA* sends a *QUERY-REF* message to the *SDA* to (re)check if the *CA* is (still) trusted. In the case of a trusted *CA*, the *GA* initiates the process of preparing negotiations. If the *CA* is not to be trusted, then the *GA* sends a *REFUSE* message to the *BA*. In this case the *BA* sends a *REFUSE* message back to the *CA* (to inform it about the situation) and kills itself.

4 INTERACTIONS AFTER NEGOTIATIONS

The last moment in which trust is taken into account is when a given *BA* is a winner of price negotiations. As stated above, in our system we use an airline ticket reservation model. In this model, winning price negotiations means that a limited-time reservation will be issued for the winning *BA*. Furthermore, the time of reservation will depend on the level of trust (the more trusted the given *CA* is, the longer the reservation time is going to be (longer reservation time is a reward for being a good client). In this situation the *SA* asks the *SDA* about reservation time for the given *BA*. *SDA* establishes its duration based on the trust level [2]. After receiving an answer the *SA* asks the *WA* to reserve the product for a specific time. Finally, the *SA* informs the *BA* about the reservation time. This process (combined with the *CA* decision making that also involves trust considerations – we may not want to buy cheap products from stores that have a low trust value and rather buy more expensive products from trusted sources) is represented in Figure 4.

5 CONCLUDING REMARKS

In this note we have discussed functional aspects of trust management in a model agent-based e-commerce system. We have used UML sequence diagrams to formally represent all situations when agents exchange messages related to trust management. We have also presented form and content of trust-related messages exchanged between agents in the system.

Currently our system is being implemented and the above presented sequence diagrams are used as aid in this process.

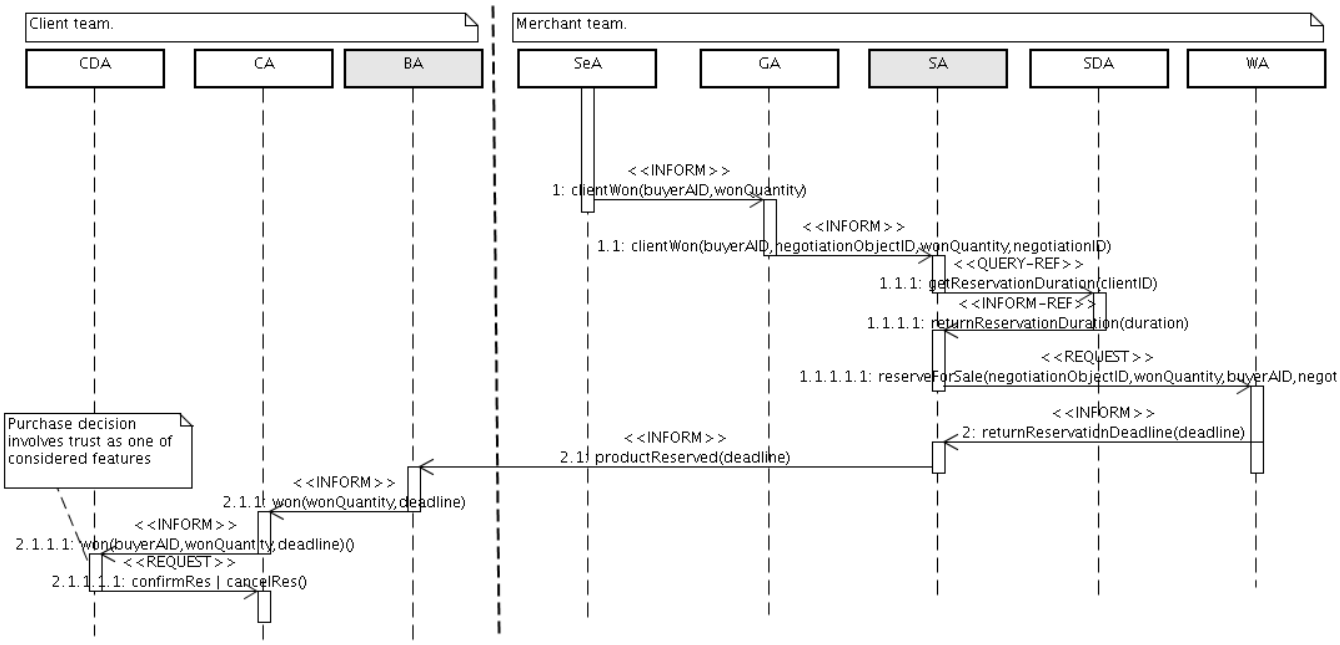


Figure 3: *The sequence diagram of ACL message exchange when negotiations are completed and there was a winner*

References

[1] C. Badica, M. Ganzha, M. Paprzycki, *Developing a Model Agent-based E-commerce System*, in: Jie Lu et. al. (eds.) E-Service Intelligence - Methodologies, Technologies and Applications, Springer, 2006, to appear

[2] C. Badica, M. Ganzha, M. Gawinecki, P. Kobzdej, M. Paprzycki, *Towards trust management in an agent-based e-commerce system – initial considerations*, Proceedings of the MISSI 2006 Conference, to appear

[3] C. Badica, M. Ganzha, M. Paprzycki, *Two Approaches to Code Mobility in an Agent-based E-commerce System*, in: C. Ardil (ed.), *Enformatika*, Volume 7, 2005, 101-107

[4] M. Gawinecki, M. Ganzha, P. Kobzdej, M. Paprzycki, C. Badica, M. Scafes, G. Popa, *Managing Information and Time Flow in an Agent-based E-commerce System*, in: Proceedings of the ISPDC'2006 Conference, to appear

[5] Jena, http://jena.sourceforge.net/

The Adaptive Tabu Search and Its Application to the Quadratic Assignment Problem

Elena Ikonomovska, Ivan Chorbev, Dejan Gjorgjevik, Dragan Mihajlov

Faculty of Electrical Engineering Skopje,
Karpos II bb, 1000 Skopje, Republic of Macedonia
{ Elena.Ikonomova, ivan, dejan, dragan,}@etf.ukim.edu.mk

ABSTRACT

This article presents a new algorithm for combinatorial optimization based on the basic Tabu Search scheme named Adaptive Tabu Search (A-TS). The A-TS introduces a new, complex function for evaluation of moves. The new evaluation function incorporates both the aspiration criteria and the long-term memory. A-TS also introduces a new decision making mechanism, providing means for avoiding possible infinite loops. The performance of A-TS was measured by applying it to the Quadratic Assignment Problem. The experimental results are compared to published results from other authors. The data shows that A-TS performs favorably against other established techniques.

1 INTRODUCTION

Heuristic search algorithms have proven to be very useful in solving difficult combinatorial optimization problems. Due to their ability to escape local optima, most successful heuristic local search techniques are Simulated Annealing, Genetic Algorithms, and Tabu Search with its variations. Tabu Search has been very successful in achieving near-optimal (and sometimes optimal) solutions to a variety of hard problems.

This paper introduces the Adaptive Tabu Search (A-TS), an improved tabu search algorithm for combinatorial optimization. Adaptive Tabu Search introduces a new evaluation function to the basic scheme of Tabu Search. Our Tabu scheme also proposes a new mechanism for selecting the best move. The selection process uses the evaluation function which incorporates both long-term memory and aspiration criteria.

The performance of our A-TS is evaluated by using instances of the Quadratic Assignment Problem (QAP), chosen from the QAP Library (QAPLIB) [3]. By solving the same problem instances of QAP used by other cited researchers [2][4][5][14], we aimed to derive objective conclusions of the advantages of our Adaptive Tabu Search.

Section 2 presents a formal definition of the QAP. Section 3 provides a brief overview of the basic Tabu Search algorithm and its popular variations. In section 4 we describe the main improvements that we propose to the basic TS algorithm, resulting in our Adaptive Tabu Search (A-TS) algorithm. The environment used to test A-TS is described in section 5. Section 6 presents the experimental results. Our conclusions and areas of further research are given in section 7.

2 THE QUADRATIC ASSIGNMENT PROBLEM

The Quadratic Assignment Problem (QAP) is NP-hard combinatorial optimization problem [13]. Its many practical instances come from areas such as design and resource allocation, microprocessor design and scheduling. Due to the complexity of QAP, in some ways, it has become a benchmark by which new techniques are validated.

For the first time, QAP is stated by Koopmans and Beckman in 1957 [11]. It can be described as follows: Given two $n \times n$ matrices $\mathbf{A}=(a_{ij})$ and $\mathbf{B}=(b_{ij})$, find a permutation $\boldsymbol{\pi}^*$ minimizing

$$\min_{\pi\in\Pi(n)} f(\pi) = \sum_{i=1}^{n} \sum_{j=1}^{n} a_{ij} \cdot b_{\pi(i)\pi(j)}$$

where $\Pi(n)$ is the set of permutations of n elements. In other words, it deals with identifying optimal assignments of facilities to locations such that the cost of the resulting system is minimized. Shani and Gonzalez [13] have shown that the problem is *NP*-hard and that there is no *e*-approximation algorithm for the QAP unless $P = NP$.

In practice, a large number of real world problems lead to QAP instances of considerable size, that cannot be solved exactly. For example, an application in image processing requires solving more than 100 QAP problems of size $n = 256$ [15]. Even with today's fastest computers, relatively small problems require prohibitive amounts of time to solve to provable optimality [1]. The use of heuristic methods for solving large QAP instances is currently the only practicable solution.

3 TABU SEARCH OVERVIEW

Glover introduced Tabu Search (TS) in the late 80's [6]. The basic idea behind TS is that, adding short-term memory to local search, improves its ability to locate optimal solutions. Revisiting previously or recently visited solutions is discouraged, and operations that would do so are labeled as being "tabu" or "taboo". Glover proposed the use of both statically and dynamically sized memory structures for tracking tabu operations. In 1991 Taillard created the Robust Tabu Search (RO-TS) [14], which introduced a dynamic randomly-sized short-term memory design. Battiti and Tecchiolli developed the RE-TS [2] in 1994. They introduced a dynamically sized short-term memory, dependent on the runtime characteristics of the algorithm. Also, they utilized a form of long-term memory that helped prevent searches from stagnating.

Many other TS variations have been developed that incorporate various forms of dynamically-sized short-term memory and long-term memory [9][10]. Still, the RO-TS and RE-TS remain among the most successful and popular. The following concepts are common to most (if not all) Tabu Search techniques, but their specific implementations are somewhat flexible.

A move *m* is an operation by which one solution is transformed into a new, neighboring solution. The neighborhood of the solution, $N(i,k)$, is the set of all solutions that can be derived from the given solution *i*, at iteration *k*, by applying a valid move. For the QAP, a common move strategy consists of swapping facilities assigned to two locations.

The Tabu List implements the short-term memory. It is the most influential piece of any TS design. The basic purpose of the list is to maintain a record of moves that are tabu (discouraged) during a number of following iterations. Usually, a move added to the Tabu List is the reciprocal of the move last accepted and applied to the current solution. The reciprocal is recorded in order to prevent the search from "undoing" recent moves.

During a TS run, it is possible that a single solution will be visited multiple times. To some degree, this behavior is desirable - it supports the concepts of exploitation and exploration. On repeated visits of a solution, the Tabu List will most likely contain a different set of tabu moves, and the search may travel a new path. However, the problem arises when the algorithm continuously revisits the same set of solutions repeatedly (infinite loop), leaving large areas of the search space unexplored. Increasing the length of the list, decreases the probability of entering an infinite loop. On the other hand, longer lists limit the exploration of the search space. The so called long-term memory has a great deal in solving this problem.

When selecting the next move to perform, TS evaluates the neighborhood of the current solution and attempts to find the best non-tabu move; "best" being determined as the objective value of the resulting solution, should the move be applied. Sometimes, however, it may be desirable to allow a tabu move to be chosen. The conditions under which a tabu move would be allowed are known as the aspiration criteria. The most common aspiration criteria is to test whether the implementation of the tabu move would result in the best-fit solution yet found, for the current run. The above criteria is used by Battiti and Tecchiolli in the RE-TS. Figure 1 shows the basic elements of TS.

Step 1. Create an initial solution *i* at random. Set $i^*=i$ and $k=0$.
Step 2. Set $k=k+1$ and generate a subset V^* of solutions in $N(i,k)$ such that either one of the tabu conditions $tr(i,m)\in \mathrm{Tr}$ is violated ($r=1,...,t$) or at least one of the aspiration conditions $ar(i,m)\in Ar(i,m)$ holds ($r=1,...,a$).
Step 3. Choose a best $j=i\oplus m$ in V^* (with respect to objective function f) and set $i=j$.
Step 4. If $f(i) < f(i^*)$ then set $i^*=i$.
Step 5. Update tabu and aspiration conditions.
Step 6. If a stopping condition is met then stop. Else go to Step 2.

Figure 1: Tabu Search pseudo code.

4 THE ADAPTIVE TABU SEARCH

The Adaptive Tabu Search, that we propose, explores the meaning of finding the "best" move. The search for the best move is a very computation demanding operation. Therefore, it plays a major part in the speed and accuracy of the solving process. The local search in TS consists of evaluating all moves applicable to the current solution, and choosing the best one. In the A-TS approach, the non-tabu move that generates the greatest improvement of the objective function is chosen and applied. In this case, no aspiration criteria are being utilized. However, in some instances, none of the evaluated non-tabu moves provides any improvement. The proposed evaluation function is triggered only when all evaluated moves are tabu or non-improving, non-tabu. The move for which the evaluation function returns the lowest value is accepted and performed.

Any implementation of TS must provide a balance between exploring and exploiting the search space. The risk of visiting certain solutions infinite number of times must be avoided. On the other hand, the potential benefit from revisiting a single solution has to be encouraged. The aim of A-TS is to achieve this balance and maintain it throughout the whole search.

The evaluation function makes its decisions considering the long-term memory and the remaining time (iterations) for the move as tabu (*tabu_time_left*). The long-term memory is implemented as a list of counters, remembering the application of each possible move during the search. In the evaluation function, the number of occurrences of the move (*frequency*) is multiplied with an adaptive coefficient (k_1). The value of k_1 is proportional to the value of the move itself, the frequency of the application of the move and the current iteration. The main objective of the adaptive coefficient is to prevent the search from getting caught in an infinite loop.

On the other hand, the function includes an aspiration criterion. It allows a tabu move to be performed, if it seems promising and not risky in terms of loops or local stagnation. The criterion is implemented using another adaptive coefficient (k_2), whose value also changes and is proportional to the value of the move. The adaptive nature of our Tabu Search scheme is based on these two adaptive coefficients. The final form of the evaluation function is:

evaluation_ func (*move_value, frequency, tabu_time_left*)= *move_value* + k_1 * *frequency* + k_2 * *tabu_time_left*

where:

$$k_1 = \begin{cases} c_1 \cdot iter \cdot abs(\max(move\_value,1)), \text{ if } freq > avgfreq \\ c_2 \cdot abs(move\_value), \text{ if } freq \le avgfreq \end{cases}$$

$$k_2 = \begin{cases} 0, \text{ if } move\ is\ tabu \\ c_3 \cdot abs(move\_value), \text{ if } move\ is\ not\ tabu \end{cases}$$

The coefficients k_1 and k_2 control the influence of the move frequency and the remaining time of the move in the tabu list. The coefficients c_1, c_2 and c_3 are tuned up experimentally, according to the specific problem being solved. Their influence upon the accuracy of the obtained solutions is considerable. However, they have no significant influence on the number of iteration required to reach the optimal solution. The values for c_1, c_2 and c_3 used here are 10, 0.01 and 0.01 respectively.

5 BENCHMARK INSTANCES

The problem instances used in the development and testing of A-TS were obtained from the QAPLIB, a public library of QAP problems and their best-known solutions [3]. The number in the problem's name corresponds to the size of the problem. QAPLIB currently contains over 100 instances that have been used in earlier researches. Some of them originate from real life applications, like hospital layout (kra30*, els19), typewriter design (bur26*), etc.

As shown by Taillard [15], the quality of solutions produced by heuristic methods strongly depends on the problem type. For problems taken from the real world, many heuristic methods perform rather poorly. They are not able to find solutions within 10% of the value of the best solutions known, even if excessive computing time is allowed. Conversely, the same methods may perform very well on randomly generated problems. For such problems, almost all heuristic methods are able to find high quality solutions (i.e., solutions approximately one percent worse than the best solution known). Therefore, it is reasonable to analyze the performance of A-TS by splitting the problem instances into two categories: (i) real world, irregular and structured problems, and (ii) randomly generated, regular and unstructured problems.

6 EXPERIMENTAL RESULTS

A-TS is compared with a set of the best heuristic methods available for the QAP, such as the genetic hybrid method of Fleurent and Ferland [5] (GH), the reactive tabu search of Battiti and Tecchiolli [2] (RE-TS), the tabu search of Taillard [14] (RO-TS) and a simulated annealing from Connolly [4] (SA). In the comparison, a large subset of well known problem instances is considered, with sizes between n = 12 and n = 35, contained in the QAPLIB.

The complexity of one iteration, for each algorithm considered, varies: SA has the lower complexity with $O(n)$ per iteration. RO-TS and RE-TS have a complexity of $O(n^2)$ per iteration, GH has a complexity of $O(n^3)$, while A-TS has a complexity of $O(n(n-1)/2) \approx O(n^2)$.

In order to make fair comparisons between these algorithms, the same computational time was given to each test problem trial, by performing a number of iterations equal to $nI_{max}(62.5n – 5)$ for A-TS, to $10nI_{max}$ [12] for RE-TS and RO-TS, $125n^2I_{max}$ [12] for SA and $2.5I_{max}$ [12] for GH.

Tests are performed with I_{max}=10. The experiments evaluate their ability in producing relatively good solutions under strong time constraints.

Problem name	Best known value	RO-TS	RE-TS	SA	GH	A-TS
Els19	17212548	21.261	6.714	16.028	**0.515**	10.0914
Tai20b	122455319	**0**	—	6.7298	**0**	1.4522
Tai25b	344355646	0.0072	—	1.1215	**0**	0.0559
Tai30b	637117113	0.0547	—	4.4075	**0.0003**	1.7026
Tai35b	283315445	0.1777	—	3.1746	**0.1067**	1.1849
Kra30a	88900	0.4702	2.0079	1.4657	0.1338	**0.0267**
Kra30b	91420	0.0591	0.7121	0.1947	0.0536	**0**
Chr25a	3796	6.9652	9.8894	12.4973	2.6923	**0**

Table 1: *Quality of various heuristic methods for irregular problems, measured in percent above the best solution value known. Best results are in boldface.*

Table 1 compares all mentioned methods on real life, irregular and structured problems opposed to A-TS. In particular, the average quality of the solutions produced by these methods is shown, measured in percent above the best solution value known. The RE-TS, S-TS, and RO-TS data contained in table 1 and 2, was gathered from L. M. Gambardella, É. D. Taillard and M. Dorigo [12]. The results of the mentioned authors are averaged over 10 runs, while the results of A-TS are averaged over 100 runs.

Table 1 shows that methods like RE-TS or SA are not well adapted for irregular problems. Sometimes, they produce solutions over 10% worse than the best solutions known. Other heuristic methods are able to exhibit solutions at less than 1% of the optimum value, with the same computing effort. For problem types tai*b, GH seems to be the best method overall. Our approach produces solutions with average deviation smaller than 1% in most of the cases.

Table 2 provides the same type of comparisons as those of table 1, only for unstructured problems. Table 2 shows that our technique outperforms all of the other techniques, for all of the listed problems. In half of the cases, our results achieve the exact best solutions in all 100 trials, whereas in the rest, the average gap (deviation from the optimal) is below 1%.

Problem name	Best known value	RO-TS	RE-TS	SA	GH	A-TS
Nug20	2570	0.101	0.911	0.327	0.047	**0**
Nug30	6124	0.271	0.872	0.500	0.249	**0**
Tai20a	703482	0.769	0.705	1.209	0.732	**0.046**
Tai25a	1167256	1.128	0.892	1.766	1.371	**0.736**
Tai30a	1818146	0.871	1.044	1.434	1.160	**0**
Tai35a	2422002	1.356	1.192	1.886	1.455	**0.014**

Table 2: *Quality of various heuristic methods for regular problems measured in percent above the best solution value known. Best results are in boldface.*

Additional comparison of the algorithms, based on the number of iterations needed to achieve the optimal solution, was performed. A series of runs performed with the A-TS were compared with published results of the metaheuristic search techniques RE-TS and RO-TS. Table 3 shows comparisons over some of the problems from the Taillard set, ranging in sizes from 12 to 35. 100 runs were performed on each problem by A-TS, opposed to 30 runs performed by the authors of the other approaches. The RE-TS, and RO-TS data contained in this table was gathered from Battiti and Tecchiolli [2]. The best result in each row is bolded.

Problem	Max.Iter A-TS/Others	RE-TS	RO-TS	A-TS Avg. Iter.
Tai12a	10K/100K	282.3	210.7	**165.7**
Tai15a	10K/100K	**1780.3**	2168.0	2145.5
Tai17a	100K/100K	**4133.9**	5020.4	4363.9
Tai20a	100K/500K	37593.2	34279	**31650.8**
Tai25a	400K/1M	38989.7	80280.4	**19945**
Tai30a	560K/2M	**68178.2**	146315.7	104084.2
Tai35a	760K/4M	**281334.0**	448514.5	290458.1

Table 3: *Comparison of average iterations before convergence to best solution for RE-TS, RO-TS, and A-TS.*

7 CONCLUSION

This paper describes a novel approach to the Tabu search scheme. We propose a new decision making mechanism with a new evaluation function to integrate within the standard TS. The resulting Adaptive Tabu Search (A-TS) augments the exploration and exploitation of the search space, through the incorporation of long-term memory, aspiration criteria and the value of the move in a single evaluation function. By using search history, the adaptive coeficients within the combined evaluation function provide useful feedback to the process.

Instances of the Quadratic Assignment problem were used for quantitative evaluation of the algorithm. Experimental results show that A-TS performs favorably. In some cases, the optimal result was found in less iteration than other techniques. For most of the problems, especially regular problem instances, A-TS seems to be the best choice.

Based on the encouraging results, further research of A-TS will be performed. Its implementation to more complex, real life problems, will provide more details of the algorithm quality and advantages.

References

[1] Anstreicher, K.M. Recent advances in the solution of quadratic assignment problems. *Mathematical Programming, Series B* 97:27-42, 2003.

[2] Battiti, R. and Tecchiolli, G. The reactive tabu search. *ORSA Journal on Computing, 6, 2,* 126-140, 1994.

[3] R. E.Burkard, S. E. Karisch and F. Rendl. QAPLIB—a quadratic assignment problem library. *Journal of Global Optimization*, 10, 391–403, 1997.

[4] Connolly D T (1990). An improved annealing scheme for the QAP. *Eur J Op Res* 46: 93–100.

[5] Fleurent C and Ferland J (1994). Genetic hybrids for the quadratic assignment problem. *DIMACS Series in Mathematics and Theoretical Computer Science* 16: 190–206.

[6] Glover, F. Future Paths for Integer Programming and Link to Artificial Intelligence. *Computers and Operations Research*, 12:533-549, 1986.

[7] Glover, F., Laguna, M. *Tabu Search*. Kluwer Academic Publishers, 1997.

[8] Glover, F. Laguna, M. Tabu Search. *Modern Heuristic Techniques for Combinatorial Problems*. Colin Reeves, ed. Blackwell Scientific Publishing, 71-140, 1993.

[9] Koopmans T C and Beckmann M J (1957). Assignment problems and the location of economics activities. *Econometrica* **25**: 53–76.

[10] L. M. Gambardella, É. D. Taillard and M. Dorigo. Ant colonies fot the quadratic assignment problem.IDSIA-1997.

[11] Sahni, S. and Gonzalez, T. P-complete approximation problems. *J. ACM 23*, 555-565, 1976.

[12] Taillard, E. D. Robust tabu search for the quadratic assingnment problem. *Parallel Computing*, 17:443-455, 1991.

[13] Taillard, E. Comparison of iterative searches for the quadratic assignment problem. *Location Science*, 3:87-103, 1995.

METODA UMETNEGA NEVRONSKEGA OMREŽJA ZA KRATKOROČNO NAPOVED VREMENSKIH POGOJEV V OKOLICI NADZEMNEGA ELEKTROENERGETSKEGA VODA.

Ruslan Kadyrov, Jure Lodrant, **Krešimir Bakič*
ARTES
Efenkova 61, Velenje
ruslan.kadyrov@artes.si
*ELES
Hajdrihova 2, Ljubljana
kresimir.bakic@eles.si

1 Povzetek

Referat obravnava metodo umetna nevronska omrežja za kratkoročno prognoziranje vremenskih pogojev v okolici daljnovoda. Prognoze lahko služijo pri izračunih termične zmogljivosti daljnovoda nekaj ur v naprej. Iz informacijskega sistema DAMOS, ki je vgrajen v slovensko prenosno omrežje, je možno izbrati različne vzorce potrebnih vremenskih podatkov. Na vzorcu meritev petminutnih povprečij za štiri vremenske parametre: skalarna hitrost vetra, smer vetra, temperatura okolice in sončno sevanje, v obdobju 30 mesecev, je bil izdelan model za izračun predikcije za 4 ure vnaprej za parametre, ki vplivajo na določitev termične zmogljivosti nadzemnega voda. Rezultati so pokazali, da metoda nevronskih omrežij daje dobre rezultate.

2 Uvod

S kratkoročnimi predikcijami vremenskih parametrov od 1 do 24 ur je možno določati dinamične zmogljivosti daljnovodov v realnem času, za razliko od večine danes uporabljenih metod statičnih določitev zmogljivosti, ki slone na konzervativnem ročnem izboru teh parametrov. S pomočjo kakovostnih predikcij bi bilo mogoče v primeru zamašitev omrežja na določenih trasah, napovedati dinamične zmogljivosti in jih v primeru zadostnih rezerv tržiti.

Pri uporabi metode umetnih nevronskih omrežij za reševanje problema časovnih vrst je potrebno izbrati ustrezni algoritem in arhitekturo nevronskega omrežja. Algoritmi se med seboj razlikujejo po zgradbi, vrsti učenja (nadzorovano ali nenadzorovano) in vrsti signala. Najbolj razširjena je večnivojska usmerjena nevronska mreža z učenjem vzvratnega razširjanja napake (Backpropagation of error). Na osnovi podatkovne baze (30 mesecev, 5-minutna povprečja) se želi izdelati model za predikcijo in sicer za 4 ure v naprej. Aplikacija nevronske mreže za reševanje problema časovnih nizov izvaja razpoznavanje vzorca. Vhodne vrednosti za izračun napovedanih vrednosti za določen časovni interval se določajo iz tekočih merjenih vrednosti izbranih parametrov.

V referatu je prikazan pristop k izračunu kratkoročnih predikcij vremenskih pogojev (veter, smer vetra, zunanja temperatura in sočni prispevek) s pomočjo umetnega nevronskega omrežja.

3 Postavitev nevronskega omrežja

V našem modelu je bil uporabljen večnivojski prediktor, ki je primeren za daljše časovne predikcije hitrosti vetra. Za vsak parameter in vsako lokacijo je bilo potrebno določiti primerno strukturo nevronskega omrežja. Postopek dela je bil razdeljen na tri faze:

1. Priprava vhodnih podatkov, konverzija podatkov in generiranje vzorca.
2. Določitev števila nevronov.
3. Izgradnja nevronskega omrežja.

Natančnejši opis posamezne faze je prikazan spodaj.

Priprava vhodnih podatkov.

Nevronsko omrežje se mora zasnovati tako, da lahko ocenjuje različne vhodne podatke. Magnitude vhodnih vrednosti ne reflektirajo njihove relativne pomembnosti pri določanju zahtevanih izhodnih informacij. Zato se morajo vhodni podatki normalizirati, da izboljšajo karakteristike nevronskega omrežja. Srednje vrednosti nestandardne deviacije vhodnih podatkov so namenjene skaliranju vhodnih in izhodnih podatkov. Normalizacija je izvedena kot sledi:

$$n_{i,k} = \frac{y_{i,k} - m_k}{SD_k}$$

... $n_{i,k}$ je normaliziran vhodni podatek, k (ciljni podatek) pri $i = 1,2\ldots,N$ (indeks podatka) $y_{i,k}$ je originalni podatek

... m_k in SD_k sta srednja vrednost in standardna deviacija vhodnega podatka k (ali ciljnega podatka)

Vhodne podatke smo razdelili na dva slučajno izbrana vzorca: za učenje in validacijo, v izbranem razmerju. Vzorec za učenje smo uporabili v fazi učenja, vzorec za validacijo pa za verifikacijo izdelanega modela nevronskega omrežja po fazi učenja.

Določitev števila nevronov

Izračun avtokorelacijskih koeficientov je merilo korelacije med sosednjimi podatki, ki so opazovani v časovnih vrstah meritev. To informacijo je uporabljena za določitev števila vhodnih signalov in števila nevronov v skritem nivoju. Koeficienti so izračunani po naslednji formuli:

$$r_k = \frac{1}{N}\frac{\sum(y_i - \tilde{m})(y_{i+k} - \tilde{m})}{\partial^2}$$

Avtokorelacija niza k je definirana kot pričakovano odstopanje spremenljivke od srednje vrednosti, normalizirane z varianco. Število vhodnih signalov in število nevronov v skritem nivoju je pomembno pri aplikaciji nevronskega omrežja za predikcijo meritev.

Na osnovi vzorca in števila vhodnih signalov ter števila nevronov v skritem nivoju lahko zgradimo prediktor nevronskega omrežja.

Uporabili smo večnivojsko usmerjeno nevronsko mrežo. Nevronsko omrežje ima lahko enega ali več skritih nivojev. Parametri nevronskega omrežja so odvisni od vrednosti meritev in dolžine napovedovanega intervala. Na Sliki 1 in Sliki 2 je prikazana shema avtokorelacijske analize za hitrost vetra.

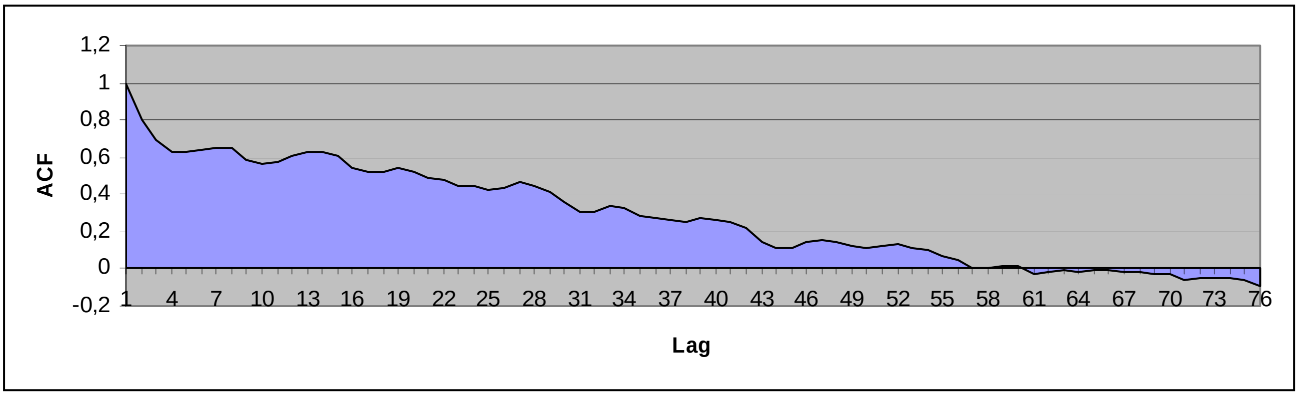
Na osnovi statistične analize in različnih eksperimentov smo izbrali naslednji model za napoved hitrosti vetra za 4 ure na lokaciji postaje RTP Beričevo: usmerjena tronivojska nevronska mreža s 45 vhodnimi nevroni, 10 v skritem nivoju in enim izhodnim nevronom. Na lokaciji postaje RTP Podlog so bili rezultati drugačni: mreža z 52 vhodnimi nevroni, 20 v skritem sloju in enim izhodnim nevronom. Za učenje smo uporabili posplošeno pravilo delta (backpropagation of error). Za funkcijo aktivacije smo izbrali hiperbolični tangens (thc, hyperbolic tangent).

Podobne analize so bile narejene tudi za ostale meritve in postaje. Za vsako postajo in meritev je bilo potrebno zasnovati ustrezno strukturo nevronskega omrežja.

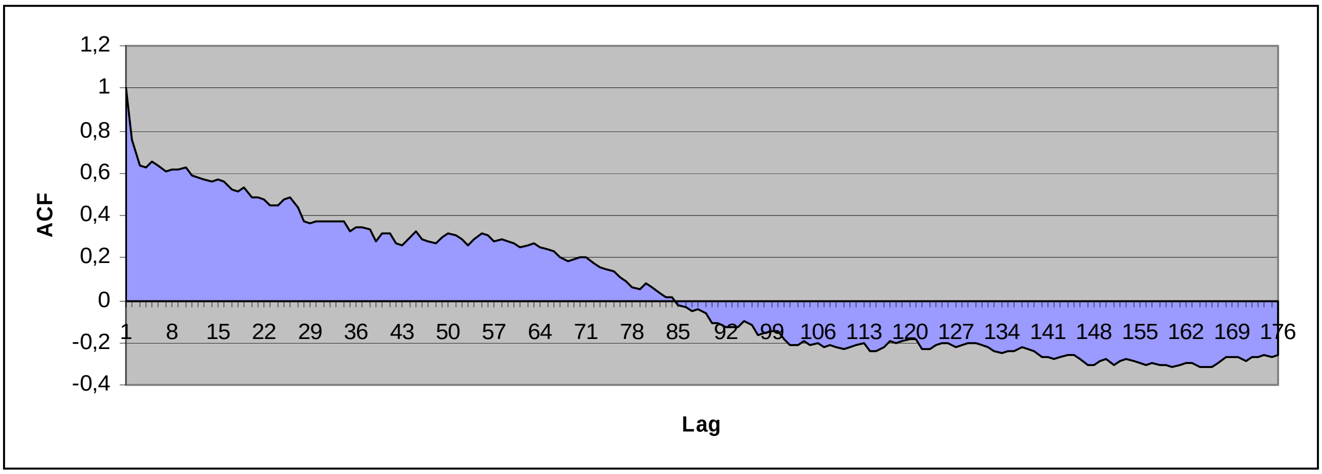
Pri testiranju modela za štiri urno napoved hitrosti vetra je bilo izbrano obdobje od 22.01.2006 00:00 do 28.01.06 23:55. Iz Slike 3 in Slike 4 je razvidno, da se predikcije vetra zelo malo razlikujejo od dejanskih, kar je dovolj za načrtovano uporabo.

3 Zaključek

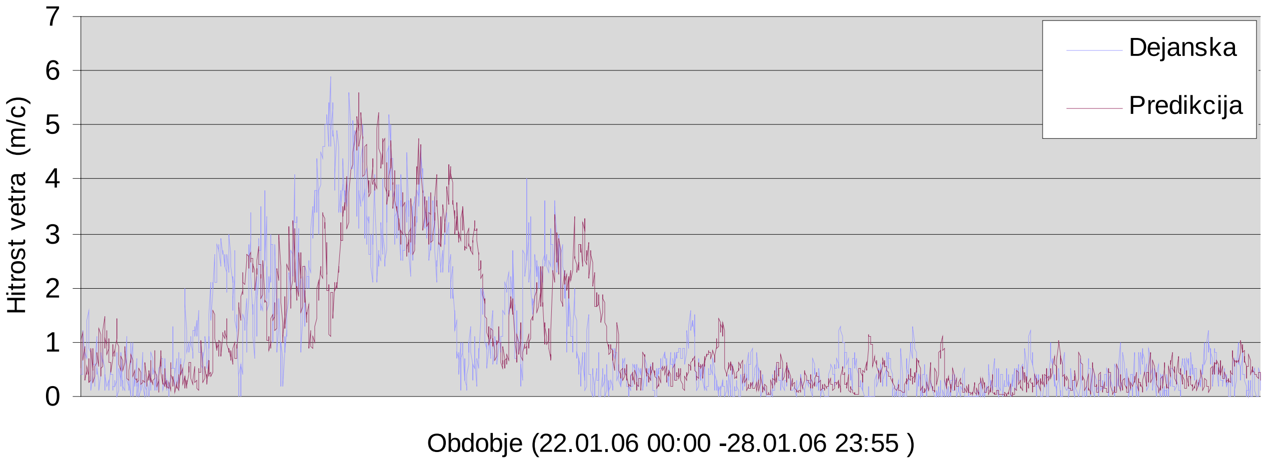
Na osnovi baze podatkov za 30 mesecev (od 1.7.2003 do 31.12.2005) je izdelan model tronivojske nevronske mreže za vsako postajo in merjeni parameter. Model je uporabljen za 4-urno napoved v obdobju od 22.1.2006 do 28.1.2006. V našem primeru analiza pokaže, da je uporaba te metode za predikcijo atmosferskih podatkov za potrebe monitoringa termičnih obremenitev nadzemnih vodov primerna metoda. S časom bo potrebno izvajati ponovno učenje sistema na osnovi večje količine izmerjenih podatkov, kar bo omogočilo se boljše rezultate napovedi.



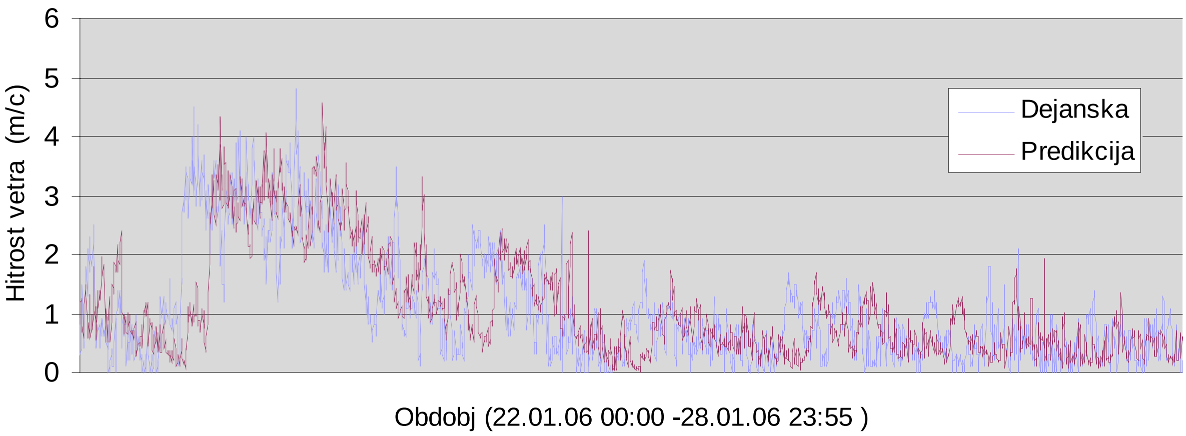
Slika 1: Avtokorelacijska funkcija za predikcijo hitrosti vetra na lokaciji RTP Beričevo.



Slika 2: Avtokorelacijska funkcija za predikcijo hitrosti vetra na lokaciji RTP Podlog.



Slika 3: Predikcija jakosti vetra v postaji RTP Beričevo za 4 ure po metodi ANN



Slika 4: Predikcija jakosti vetra v postaji RTPPodlog za 4 ure po metodi ANN

Viri

[1] K. Bakič, R.Kadyrov. Primerjava metod kratkoročne napovedi vremenskih pogojev v okolici nadzemnega elektroenergetskega voda, **15** mednarodno posvetovanje Komunalna energetika, 9.-11. maj 2006, Maribor, Slovenija.

[2] Guide for selection of weather parameters for bare overhead conductor ratings, CIGRE, Paris, Study Commette B2, Working Group 12, Task Force6, February 2006 (To be published in Electra in 2006).

[3] The use of weather predictions for transmission line thermal ratings, CIGRE, Paris, Study Committee 22 Working Group 12, Task Force, Published in ELECTRA, no 186,1999.

[4] R.Kadyrov, K.Bakič: Izbor metode predikcije atmosferskih podatkov za potrebe monitoringa termičnih obremenitev nadzemnih vodov, Interna študija ARTES-ELES, februar, 2006.

[5] K. Bakič, J Lodrant, R Kadyrov, I Jarm, I Čuhalev: Povečanje učenkovitosti prenosnega omrežja s pomočjo monitoringa obremenitev nadzemnih vodov, 3 DEL (Damos 3.0), ELES-ARTES, Ljubljana-Velenje, 2004.

[6] G Giebel, L. Landberg, G Kariniotakis, R. Brownsword: State-of-the-Art on Methods and Software Tools for Short-Term Prediction of Wind Energy Production, European Wind Energy Confernece, EWEC, Madrid, 2003.

[7] C.Perez-Lera, M.C.Fernandez-Baizan, J.L.Feito, del Valle “"Local Short-term Prediction of wind speed: A nurual network Analyses”.

[8] K. Bakič, R Kadyrov: Reactive sources planning in transmission system aided ba evolutionary programming, 7th Slovenian Power Conferences, Paper C1-13, Velenje, 2005.

Napovedovanje požarne ogroženosti naravnega okolja v geografskem informacijskem sistemu

Andrej Kobler, Gozdarski inštitut Slovenije, andrej.kobler@gozdis.si
Sašo Džeroski, Inštitut Jožef Stefan, saso.dzeroski@ijs.si
Dušan Fajfar, IGEA d.o.o., dusan.fajfar@igea.si

Povzetek

S strojnim učenjem smo iz podatkov o preteklih požarih izdelali dva logistična modela, ki napovedujeta verjetnost izbruha požara v naravnem okolju na podlagi prostorsko in časovno opredeljenih podatkov o vremenu, požarnih gorivih, rabi tal, prometni infrastrukturi in reliefu. Modela delujeta na ravni kvadrantov velikosti 1 km x 1 km in sta sta prostorsko komplementarna, eden pokriva Primorski del Slovenije, drugi pa preostalo Slovenijo. Modela delujeta na ravni kvadrantov velikosti 1 km x 1 km. Prostorska in časovna povezava med lokacijami požarov ter pojasnjevalnimi spremenljivkami je bila vzpostavljena v okolju GIS. Zaradi šuma v vhodnih podatkih in zaradi nepopolnosti modelov modelne vrednosti iz ravni kilometrskih kvadrantov statistično agregiramo na ravni občin. Zvezne vrednosti napovedi na ravni občin nato diskretiziramo v predpisano 5-stopenjsko lestvico. Modela sta prototipno implementirana v informacijskem sistemu Uprave RS za zaščito in reševanje (eGIS UJME).

1 Uvod

Ocena požarnega tveganja je ključna tako za preprečevanje požarov v naravnem okolju kot tudi za organizacijo preventivnih ukrepov in optimalno razporejanje gasilskih resursov. Pomembno orodje za napovedovanje požarnega tveganja je modeliranje povezav med požarno ogroženostjo in vplivnimi faktorji. Ker okoliščine za izbruh požarov večinoma določajo prostorsko izraženi faktorji, tovrstne modele razvijamo v okolju geografskih informacijskih sistemov (GIS). Namen pričujoče raziskave, ki je potekala v okviru raziskovalnega projekta »Napovedovalni GIS model požarne ogroženosti naravnega okolja« (CRP MIR 2004 – 2010, pog. št. 3311-04-828032; MO in MŠZŠ), je bil razširiti veljavnost že obstoječega modela za ocenjevanje požarne ogroženosti (Kobler 2001a, 2001b) iz zgolj gozda na celotno naravno okolje, med pojasnjevalne spremenljivke vključiti tudi podatke o vremenu in požarnih gorivih ter izvesti prototipno implementacijo modela v okviru informacijskega sistema eGIS UJME na Upravi RS za zaščito in reševanje.

2 Vhodni podatki in kalibracija modelov

Izdelali smo dva prostorsko komplementarna empirična modela verjetnosti izbruha požara v naravnem okolju, enega za Primorski del Slovenije in drugega za preostalo Slovenijo. Modela delujeta na ravni kvadrantov velikosti 1 km x 1 km. Vrednosti obeh modelov združujemo v enotni model s pomočjo geografskega ponderja, ki v vmesnem območju med Primorsko in celinsko Slovenijo upošteva oba delna modela. Enotni model napoveduje verjetnost izbruha požara v naravnem okolju, ne pa tudi hitrosti in načina njegovega razvoja ali njegovega končnega obsega. Delna modela temeljita na statistični povezavi med pojavi požarov, zabeleženimi v 5-letnem obdobju 2000 – 2004 in vplivnimi faktorji (vreme, požarna goriva, infrastruktura, raba tal, relief ipd). Prostorska in časovna povezava med lokacijami požarov ter pojasnjevalnimi spremenljivkami je bila vzpostavljena v okolju GIS. Zaradi napak v vhodnih podatkih in zaradi neizogibne nepopolnosti modelov so izračunane vrednosti obremenjene z negotovostjo, ki smo jo zmanjšali s statistično agregacijo modelnih vrednosti iz ravni kvadrantov na raven občin.

Vhodne podatke ločimo v tri sklope:

- Odvisne samo od prostora (GIS podatki).
- Odvisne od prostora ter dneva v letu (povprečja za več let – multitemporalni satelitski podatki

MODIS, ki implicitno podajajo informacijo o odzivnosti vegetacije na sušo in s tem o vrsti požarnih goriv).

- Odvisne od prostora ter časa (meteorološki podatki modela Aladin)

GIS podatki so časovno neodvisni, vsi so podani na ravni na kilometrskih kvadrantov, vključujejo pa podatke o nadmorski višini, naklonu in ekspoziciji reliefa, oddaljenosti kvadranta od najbližljih cest, naselij in železnic ter deleže glavnih tipov rabe tal.

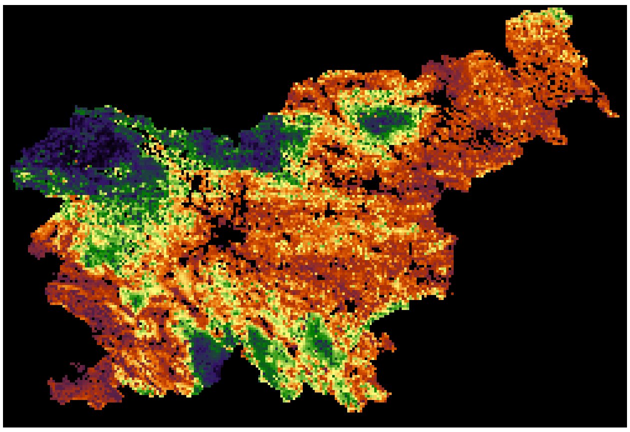
Multitemporalni satelitski podatki MODIS (King in sod. 2003), ki implicitno podajajo informacijo o odzivnosti vegetacije na sušo in s tem o vrsti požarnih goriv, so časovno odvisni od dneva v letu. Ti podatki odražajo izmerjene temperature (T) zemeljskega površja in neto primarno produkcijo (NPP) rastlinstva za obdobje 2000 – 2004 s prostorsko resolucijo približno 1 km in časovno resolucijo 8 dni. Za vsak kvadrant smo dobili maksimalno 5 vrednosti za vsako 8-dnevno obdobje skozi 5 let ter izračunali 5-letno povprečje. Če za določen kvadrant v vseh petih letih ni bilo dobrega podatka, smo iz sosednjih 8 kvadrantov izračunali povprečje. Iz tako očiščenih in združenih podatkov smo izpeljali različne pojasnjevalne spremenljivke za model: razna povprečja, vsote ter razmerja med T in NPP v zadnjih nekaj tednih.

Vremenske vplive v požarnem modelu predstavljajo podatki meteorološkega modela Aladin (ARSO 2006), ki jih dnevno izdaja Agencija RS za okolje (ARSO). ARSO je zagotovila tudi arhivske podatke Aladin za obdobje 2000 – 2004 za kalibracijo požarnega modela. Aladin podatki vsebujejo triurne dnevne napovedi (od 00:00 do 21:00 UTC) desetih vremenskih parametrov – padavine, energija sončnega sevanja, hitrost, smer ter sunki vetra, evapotranspiracija, transpiracija, evaporacija, relativna vlažnost ter temperatura na 2 metrih od tal. Vseh teh deset parametrov smo sešteli oziroma povprečili za zadnjih 24, 48, 96 ur ter 14 dni. Prostorska ločljivost za arhivske Aladin podatke je dobrih enajst kilometrov, za tekoče približno devet kilometrov, v prihodnosti pa je pričakovati prostorsko še podrobnejše napovedi.

Za napovedovanje verjetnosti izbruha požara na ravni kilometrskih kvadrantov smo uporabili logistične modele (Slika 1). Modele smo kalibrirali s strojnim učenjem na izbranih trenažnih podatkih s pomočjo programa Weka. Za kalibracijo logističnega modela potrebujemo pozitivne in negativne primere. Pozitivne primere predstavljajo lokacije, kjer je bil v preteklosti zabeležen izbruh požara, skupaj s časom izbruha požara (URSZR 2005, ZGS 2005). Negativne primere predstavljajo lokacije (skupaj s časovno znamko), kjer se požar v preteklosti ni zgodil oziroma je bila verjetnost izbruha majhna. Po čiščenju podvojenih podatkov, izločanju požarov znotraj naselij ter požarov brez časovne znamke nam je za obdobje 2000 – 2004 preostalo 4267 požarov. Enako število negativnih primerov smo generirali naključno po algoritmu, ki daje prednost območjem, kjer je bila v določenem obdobju verjetnost izbruha požara manjša.

Algoritem za izbor negativnih primerov je naslednji:

1. Izberi naključni trenutek t znotraj obdobja 2000 – 2004.
2. Poišči vse pozitivne primere znotraj obdobja $t \pm 3$ dni.
3. Za vse pozitivne primere iz (2) tvori 15-kilometrsko okolico.
4. Zunaj okolice iz (3) in zunaj naselij naključno lociraj negativni primer.
5. Ponavljaj (1) do (4), dokler število negativnih primerov ni enako številu pozitivnih.



Nizka verjet. Visoka verjet.

Slika 1: Primer vizualizacije rezultatov modelnega izračuna verjetnosti izbruha požara na ravni kilometrskih kvadrantov za 8. april 2003.

3 Prikazovanje napovedi modelov

Zaradi napak v vhodnih podatkih in zaradi neizogibne nepopolnosti modelov so vrednosti izračunane na ravni kvadrantov obremenjene s šumom, ki ga deloma zadušimo s statistično agregacijo modelnih vrednosti iz ravni kvadrantov na raven občin. Agregiramo le veljavne kvadrante, torej kvadrante znotraj naravnega okolja, kjer površinski delež naselij ne presega 15 % in kjer je delež površinskih voda pod 50 %. Kjer je število veljavnih kvadrantov v občini manjše od 30, to občino pred agregacijo pridružimo požarno najsorodnejši sosednji občini. Uporabili smo dva načina agregacije:

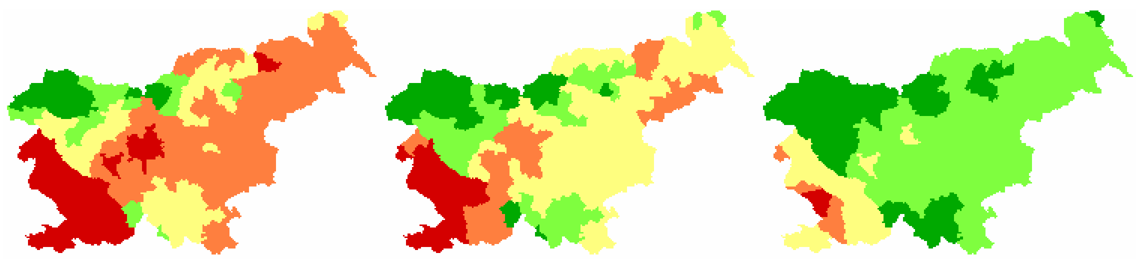
- Srednja vrednost na ravni občin, ki je enaka povprečju veljavnih kvadrantov v občini. Rezultati dobljeni s tovrstno agregacijo povedo nekaj o povprečnih požarnih razmerah v občini, nič pa ne povedo o ekstremnih primerih znotraj občine.
- Zgornja vrednost na ravni občine, ki je enaka 80. percentilu vseh modelnih vrednosti vseh veljavnih kvadrantov v občini. Rezultati dobljeni s tovrstno agregacijo dajo oceno najvišje zaznane verjetnosti izbruha požara znotraj občine.

Rezultat modelov na ravni občin so zvezne vrednosti (srednje, zgornje) na intervalu od 0 do 1. Po Uredbi o varstvu pred požari v naravnem okolju pa se uporablja 5-stopenjska lestvica z diskretnimi razredi požarne ogroženosti. Potrebna je torej diskretizacija zveznih vrednosti in sicer na podlagi vnaprej zahtevanih frekvenc pojavljanja posameznega razreda ter izmerjene dolgoletne frekvenčne porazdelitve modelnih vrednosti. Uporabili smo 3 različne lestvice pragov za diskretizacijo, ki jih imenujemo linearna delitev (razred "Zelo visoka" ima frekvenco 1k, razred "Visoka" 2k, razred "Srednja" 3k, ...), geometrična delitev (1k, 2k, 4k, ...) in kvadratno geometrična delitev (1k, 4k, 16k, ...). Vpliv različnih načinov diskretizacije ilustrira Slika 2 – s prehodom iz linearne proti kvadratno-geometrični delitvi delež občin uvrščenih v najvišjo stopnjo verjetnosti izbruha požara drastično pada.

Poleg ocene verjetnosti izbruha požara v naravnem okolju, smo predlagali še oceno požarne ogroženosti, ki jo dobimo tako, da verjetnost izbruha požara ponderiramo z nevarnostjo širjenja požara, v primeru da bi požar v resnici izbruhni. Mera za to nevarnost, je standardiziran faktor, odvisen od hitrosti sunkov vetra, za katero dobimo napoved iz meteorološkega modela ALADIN.

Napoved ogroženosti se računa na ravni kvadranta kot:

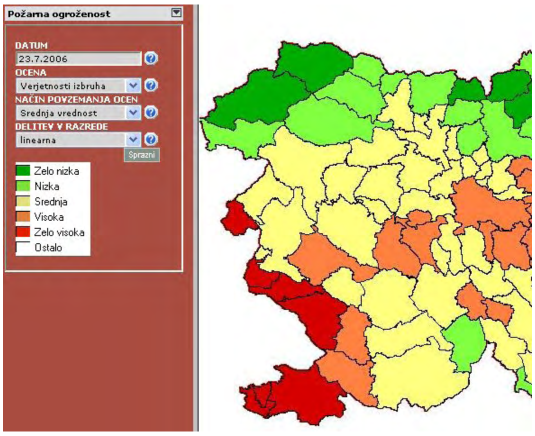
Požarna ogroženost = Standardiziran_faktor * Verjetnost izbruha požara



Linearna lestvica Geometrična lestvica Kvadratna geometrična lestvica

Zelo nizka verjetnost izbruha požara
Nizka verjetnost izbruha požara
Srednja verjetnost izbruha požara
Visoka verjetnost izbruha požara
Zelo visoka verjetnost izbruha požara

Slika 2: Vpliv različnih lestvic mejnih vrednosti se kaže v različnih deležih občin, uvrščenih v najvišje oziroma najnižje stopnje verjetnosti izbruha požara. Na primeru karte zgornje verjetnosti izbruha za 8. april 2003 vidimo, da ima linearna lestvica (leva karta) največji delež občin uvrščenih v najvišjo stopnjo verjetnosti, kvadratno geometrična (desna karta) pa najmanjšega.



Slika 3: Prikaz modela verjetnosti izbruha požara v eGIS UJME za 23. julij 2006

4 Požarna ogroženost v sistemu eGIS UJME

Informacijski sistem eGIS UJME je bil razvit za Republiko Slovenijo - Ministrstvo za obrambo in sicer za Upravo RS za zaščito in reševanje (URSZR). Je geografski informacijski sistem, namenjen podpori ukrepanju ob naravnih in drugih nesrečah. Aplikacijo eGIS_UJME uporabljajo v operativnih službah centrov za obveščanje in načrtovalci zaščite pred naravnimi in drugimi nesrečami.

Sistem vsebuje osnovne karte kot tudi posamezne dodatne karte o različnih vrstah ogroženosti okolja. Slednje vključujejo poplavna ogroženost, ogroženost pred nesrečami z nevarnimi snovmi, ogroženost pred zemeljskimi in snežnimi plazovi, potresna ogroženost... Omogočeno je dodajanje poljubnega števila tematskih kart. V okviru pričujočih raziskav smo dodali oz. izboljšali podatke o ogroženosti pred požari v naravi.

Model za napovedovanje verjetnosti izbruha požara, kot tudi model za požarno ogroženost, sta bila prototipno implementirana v okviru spletnega prostorskega informacijskega sistema eGIS UJME na Upravi RS za zaščito in reševanje. Ustrezno sta bila dodana dva nova podatkovna sloja, ki ustrezata napovedim obeh modelov. Sistem eGIS ujme omogoča enostavno pregledovanje podatkov, izbor pogledov in znotraj njih preko legende interaktivno izbiro slojev za pregledovanje. Prikaz pregledovanja napovedi modela verjetnosti izbruha požara v eGIS UJME za 23. julij 2006 je prikazan na Sliki 3.

5 Zaključki

Razvili smo modele požarne ogroženosti naravnega okolja z veljavnostjo za celotno Slovenijo in posebej za Kras. Razvili smo prototipno implementacijo teh modelov z navezavo na obstoječi GIS sistem v Upravi RS za zaščito in reševanje (GIS-UJME) in z online povezavo na meteorološke podatke ALADIN (ARSO). Izboljšali smo prostorsko podrobnost vhodnih meteoroloških podatkov (uporabljeni so rezultati modela Aladin, ARSO – HMZ) ter razširili njihov tematski obseg v primerjavi z obstoječimi modeli, s čimer smo tudi izboljšali točnost modela.

6 Viri

Agencija RS za okolje (ARSO), 2006. Produkti modela Aladin. http://www.arso.gov.si/podro~cja/vreme_in_podnebje/napovedi_in_podatki/aladin/aladin.htm

King, M.D., Closs, J., Spangler, S., and Greenstone, R., (eds), 2003. EOS Data Products Handbook. National Aeronautics and Space Administration, Washington D.C., NP-2003-4-544-GSFC.

Kobler, A., 2001. Končno poročilo o rezultatih podprojekta "Prostorski model požarne ogroženosti gozdov" : (dopolnjena izdaja). Ljubljana: Gozdarski inštitut Slovenije: Biotehniška fakulteta, Oddelek za gozdarstvo in obnovljive gozdne vire, 2001. 112 str., graf. prikazi, zvd.

Kobler, A., 2001. Prostorski model požarne ogroženosti gozdov = Spatial model of forest fire danger. Zb. gozd. lesar., 2001, št. 66, str. 65-93.

Uprava RS za zasščito in reševanje (URSZR), 2005. Podatki o požarih v naravnem okolju v Sloveniji v obdobju 2000 – 2004.

Zavod za gozdove RS (ZGS), 2005. Podatki o gozdnih požarih v Sloveniji v obdobju 2000 – 2004.

Napovedovanje uporabe UMTS storitev s pomočjo orodja Weka

Aleksander Kucler
Študent Ekonomske fakultete, Ljubljana
Sandi.Kucler@mobitel.si

Povzetek

Čedalje ostrejše razmere na trgu silijo podjetja v uporabo novih tehnik pridobivanja kupcev. Na ta način si poizkušajo zagotoviti prednost pred konkurenco ali pa zmanjšati stroške promoviranja novih storitev. Ena izmed teh tehnik je tudi podatkovno rudarjenje, katerega glavna značilnost je odkrivanje nepoznanih zakonitosti v podatkih.

To delo prikazuje uporabo podatkovnega rudarjenja pri napovedovanju bodočih uporabnikov UMTS storitev. Zato sem v nadaljevanju poizkušal iz zgodovinskih podatkov dobiti odgovor na to vprašanje. Pri tem mi je pomagal programski paket Weka. Rezultati šestih algoritmov, s katerimi je bilo opravljeno testiranje, so se med seboj močno razlikovali. Kot najboljši se je izkazal SimpleKMeans – to je predstavnik skupine algoritmov, ki delujejo na principu razvrščanja v skupine. Algoritem je z 79,8 % natančnostjo pravilno napovedal novega UMTS uporabnika.

1. UVOD

Mobilna telefonija je v zadnjem desetletju dosegla velik razvoj tako, da že skoraj vsakdo uporablja mobilni telefon. Večina uporabnikov uporablja storitve kot so telefonija, SMS in MMS sporočanje ter prenos podatkov. Zadnji dve storitvi temeljita na paketnem prenosu podatkov GPRS (General Packet Radio Service), ki omogoča hitrosti prenosa do 54 kbps. Pred nekaj leti pa se je v svetu pričelo uveljavljanje tretje generacije v mobilni telefoniji, ki jo na kratko opisuje kratica UMTS (Universal Mobile Telecommunications System). UMTS je povsem nov pristop, čeprav se iz uporabniškega stališča vidi kot nadgradnja GPRS omrežja. Ponuja povečanje hitrosti paketnega prenosa podatkov, ki tu znaša zaenkrat do 384 kbps.
Cilj mobilnih operaterjev je, da bi uporabniki čim bolj uporabljali nove tehnologije, saj bi na ta način zagotovili njihovo amortiziranje. Problem pa se pojavi pri lociranju posameznih ključnih skupin. Klasični poslovni uporabniki so navadno podvrženi posebni obravnavi s strani svetovalcev, ki jih sproti obveščajo o novih storitvah. Večji problem pa se pojavi pri fizičnih uporabnikih. Ti predstavljajo heterogeno okolje, ki se ga lahko opiše z množico spremenljivk. Nekaj izmed teh spremenljivk lahko odloča kdo je oziroma kdo ni kandidat za uporabo novih storitev. Kako prepoznati te uporabnike?

Čeprav je človek inteligentnejši od obstoječih računalnikov (Gams, 2001), lahko računalniki z različnimi metodami olajšajo delo pri takšnih problemih. Te metode, ki temeljijo na strojnem učenju in podatkovnem rudarjenju omogočajo, da na podlagi vhodnih podatkov z določeno verjetnostjo napovejo končni rezultat oz. v našem primeru ali bo določen uporabnik v bodočnosti uporabljal nove storitve.

2. PRIPRAVA PODATKOV

Podatki za analizo so bili pridobljeni iz treh virov. Prvi vir je vseboval podatke o naročniških razmerjih:

- ZAVEZANEC davčni zavezanec (da, ne)
- TIP tip stranke
- POŠTA pošta prebivališča
- DRŽAVA država prebivališča
- RAZRED naročniki so klasificirani v razrede,ki opisujejo njihov profil (neznan, srednji uporabnik, veliki uporabnik, vip)

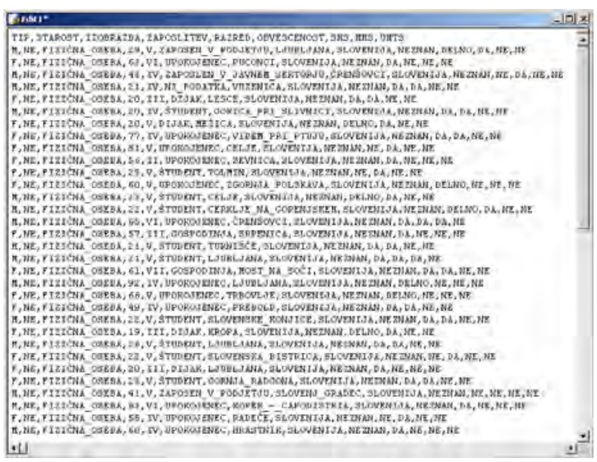
Drugi vir podatkov je izhajal iz prejetih anket:

- SPOL
- STAROST
- IZOBRAZBA stopnja izobrazbe (II-VIII)
- OBVEŠČENOST opisuje zanimanje za nove tehnologije (ne, delno, da)
- ZAPOSLITEV opisuje zaposlitev naročnika (osnovnošolec, dijak, študent, drugo, ni podatka, gospodinja, samozaposlen, zaposlen v podjetju, javni sektor, upokojenec)

Tretji vir pa je prestavljal uporabo storitev v preteklem mesecu:

- SMS uporabljal SMS (da, ne)
- MMS uporabljal MMS (da, ne)
- UMTS uporabljal UMTS (da, ne)

Fizično so se vsi trije viri nahajali v podatkovnem skladišču podjetja. Pri izvozu v CSV datoteko so bili viri združeni z internim ključem. S tem se je že na začetku zagotovila anonimizacija podatkov. Končni izbor je tako obsegal 5.000 zapisov, katere je sestavljalo 13 atributov.

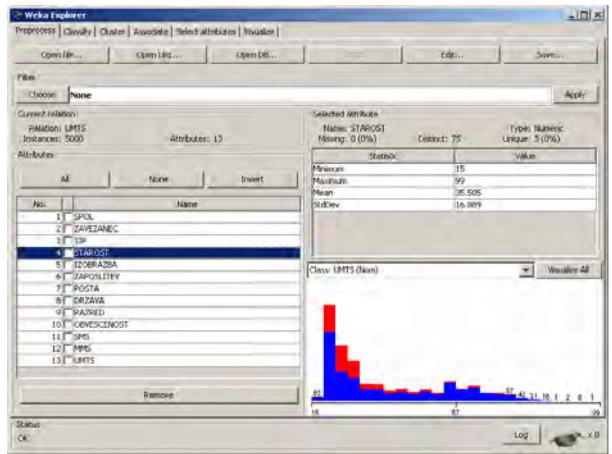


Slika 1: Priprava vhodnih podatkov CSV formatu

3. PODATKOVNO RUDARJENJE

Prej pripravljena datoteka v CSV formatu je predstavljala vhodne podatke za program. WEKA je prepoznala, da je atribut STAROST tipa NUMERIC, vsi ostali atributi pa tipa NOMINAL.

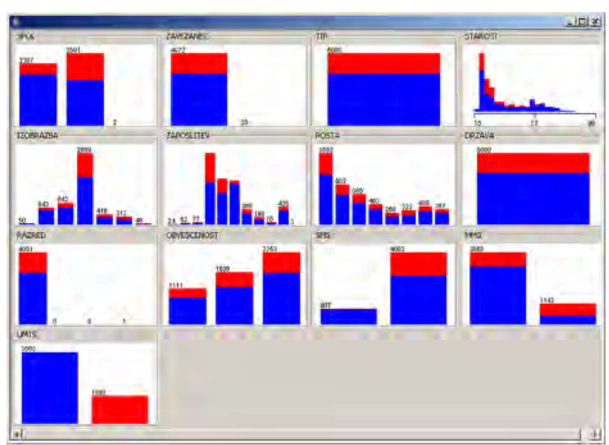
Zapisi so bili razporejeni neenakomerno. Od 5.000 naročnikov jih 3.608 ni uporabljalo UMTS storitve. Zaradi narave podatkov – ciljni atribut UMTS je tipa NOMINAL, priporoča teorija (Taft, 2003; Goonatilake, 1995) klasifikacijske metode podatkovnega rudarjenja. Klasifikacija se uporablja v primerih, ko se želi napovedati nominalni razred za vrednost ciljnega atributa (Gams, 2006).



Slika 2: Podatki naloženi v programu WEKA

3.1. Analiza podatkov

Analiza kvalitete podatkov je eden izmed najpomembnejših korakov za zagotovitev uspešnosti podatkovnega rudarjenja (Edelstein, 1999; Goonatilake, 1995). Srečujemo se lahko z napakami (manjkajoče vrednosti, vrednosti izven območja, nelogične vrednosti,...) kot tudi s prevelikim številom atributov.



Slika 3: Grafični prikaz distribucije začetnega nabora atributov

Opravljena so bila tri pred testiranja na podatkih:

- <u>Izločanje atributov</u>: Prvi test je iskal atribute, ki na prvi pogled nimajo nobenega vpliva na odločitev.

Iz seznama atributov so bili tako izločeni ZAVEZANEC, TIP, DRZAVA in RAZRED.

- BestFirst: Sledilo je testiranje pomembnosti preostalih atributov. 10-kratno prečno preverjanje v Weki je pokazalo, da je imajo največjo težo atributi SPOL, STAROST, SMS, MMS.

- Ranker: Metoda ranker je se je izkazala za boljšo od prejšnje v tem, ker je atribute uredila po pomembnosti in obenem našla atribut ZAPOSLITEV, ki ga metoda BestFirst ni našla. Kot najpomembnejšega je izbral MMS, ostali po pomembnosti pa so STAROST, ZAPOSLITEV, SMS, SPOL, IZOBRAZBA, POSTA in OBVESCENOST.

Podatki do bili sedaj pripravljeni na naslednjo fazo – modeliranje.

3.2. Modeliranje

Modeliranje je bilo opravljeno s štirimi algoritmi strojnega učenja:

- klasifikacija z drevesom odločanja
- klasifikacija z najbližjimi sosedi
- naivni Bayesov klasifikator
- razvrščanje v skupine

Za klasifikacijo z odločitvenimi drevesi je bil vzet klasifikacijski algoritem poimenovan J48.
Prvi test s tem algoritmom je bil opravljen s privzetimi parametri. Test je vrnil odločitveno drevo z 71 listi in 92 pravili.
Zaradi nepreglednosti drevesa je bilo potrebno to drevo porezati. V ta namen se je parameter minNumObj, ki definira minimalno število pripadnikov v listu drevesa, iz vrednosti 2 spremenil v 20. S tem se je zagotovila večja preglednost odločitvenega drevesa in univerzalnost algoritma. Odločitveno drevo je se je zmanjšalo na 66 pravil in 54 listov, vendar pa je bilo zaradi obilice podatkov še vedno slabo pregledno.

Drugi algoritem je uporabljal klasifikacijo z najbližjimi sosedi. Pri klasifikaciji z najbližjimi sosedi poteka klasifikacija novega primera tako, da algoritem gleda kako so klasificirani njegovi sosedi. V veki je ta postopek implementiran z algoritmom IBk

Prvi test je bil opravljen z vrednostjo parametra k=1. V tem primeru se predpostavlja, da je učna množica brez napak. Algoritem gleda samo najbližjega soseda in tako določi razred novega primera.
Drugi test je predpostavljal napake v učni množici. Parameter k je bil nastavljen na vrednost 10. Algoritem je tako primerjal razrede desetih najbližjih sosedov in tako določil razred novega primera.

Tretji algoritem je temeljil na Bayesovi formuli za pogojno verjetnost, pri tem pa predpostavlja neodvisnost atributov glede na razred. V programu Weka je predstavljen z metodo NaiveBayes.

Za zadnji uporabljeni algoritem – razvrščanje v skupine je značilno, da se primerom ne določa razreda, ampak se jih razvršča glede na podobnost. Uporabljen je bil algoritem Simple k-Means, ki je s privzetim parametrom zgradil skupine okoli k=2 centrov.

4. PRIMERJAVA TOČNOSTI PREUČEVANIH METOD

Točnost preučevanih metod je temeljila na rezultatih klasifikacijske točnosti in vrednost parametra TP Rate za razred »DA«.

Klasifikacijska točnost je definirana kot razmerje med številom pravilno klasificiranih primerov in številom vseh primerov.

Parameter TP Rate pa definira razmerje med številom pravilno klasificiranih primerov v nekem razredu in številom vseh primerov v tem razredu.

Pri delu je bila uporabljena metodologija, ki jo predlaga standard CRISP (Chapman, 1999), primerjava pa se je izvedla nad istim naborom podatkov.

Vsi testi so bili opravljeni z 10-kratnim prečnim preverjanjem. To poteka pri Weki avtomatsko in sicer tako, da se podatke razdeli na učno (90 %) in testno (10 %) množico. Potem se na vseh 10 razdelitvah izračuna model iz učnih primerov in se ga oceni na testnih primerih. Orodje na koncu iz desetih ocen izračuna povprečen rezultat.

Naslednja tabela prikazuje vrednosti obravnavanih parametrov:

Algoritem		Klasifikacij-ska točnost	TP Rate za razred DA
J48	minNumObj=2	77,28 %	0,485
	minNumObj=20	77,88 %	0,478
IBk	k=1	70,48 %	0,466
	k=10	76,88 %	0,430
Naive Bayes		75,40 %	0,657
SimpleKMeans	K=2	54,23 %	0,798

Tabela 1: Rezultati testiranj z različnimi algoritmi

Klasifikacijska točnost je bila najvišja pri algoritmu J48 s parametrom minNumObj=20, kjer je znašala 77,88 %. V splošnem primeru, bi ta algoritem veljal za najustreznejšega. Poslovni primer, ki ga delo analizira pa želi s podatkovnim rudarjenjem čim bolj natančno poiskati primere, ki ustrezajo razredu »DA«. V tem primeru pa se izkaže, da zgoraj omenjeno drevo odločanja ni najboljša izbira. To nam pove vrednost parametra TP Rate. TP Rate se je kot najvišji izkazal pri zadnjem primeru - razvrščanju v skupine z algoritmom Simple K-Means. Vrednost parametra je 0,798, kar pomeni, da algoritem v slabih 80 % pravilno določi razred »DA«.

5. ZAKLJUČEK

Podatkovno rudarjenje omogoča podjetjem, da odkrijejo skrite vzorce v njihovih podatkih, ki jim lahko služijo kot osnova za napovedovanje obnašanja kupcev, izdelkov in procesov. Kakorkoli že, pa velja, da morajo biti postopki podatkovnega rudarjenja vodeni s strani ljudi, ki poznajo posel, podatke in osnove uporabljenih analitičnih metod. Realistično je pričakovati, da pravilna uporaba orodij za podatkovno rudarjenje izboljša stanje na različnih finančnih področjih od povečanja prihodkov do zmanjšanja stroškov.

Izdelava modela predstavlja samo en korak pri odkrivanju znanj. Glavnega pomena je pravilna priprava podatkov in testiranje modelov v realnem svetu. Najboljši model se navadno pojavi po izdelavi več modelov različnih tipov.

Pomembna je tudi pravilna izbira orodja za podatkovno rudarjenje. Weka kot odprtokodno orodje vsekakor spada v skupino dobrih orodij, saj njeno akademsko ozadje omogoča stalno izpopolnjevanje in nadgrajevanje algoritmov.

Literatura in viri

1. Chapman Pete et al.: *The CRISP-DM Process Model*, CRISP-DM Consortium, 1999. 99 str.
2. Edelstein Herb: *Introduction to Data Mining and Knowledge Discovery*, Two Crows Corporation, 1999. 40 str.
3. Gams Matjaž: *Weak Intelligence: Through the Principle and Paradox of Multiple Knowledge*, Nova Science Publishers, 2001. 245 str.
4. Gams Matjaž, Lectures and exams for students [http://ai.ijs.si/Mezi/pedagosko/examse.html], 10.04.2006
5. Goonatilake Suran: *Intelligent System for Finance and Business*, Wiley, 1995. 335 str.
6. Taft Margaret et al.: *Oracle Data Mining Concepts*, Oracle Corporation, 2003. 118 str.
7. Weka 3: Data Mining Software in Java, [http://www.cs.waikato.ac.nz/~ml/weka], 10.04.2006
8. Weka, [http://weka.sourceforge.net/wekadoc/index.php], 10.04.2006

INTELLIGENT AGENT AIDED USE OF UNSTRUCTURED INFORMATION IN DECISION SUPPORT

Dejan Lavbič, Viljan Mahnič
University of Ljubljana
Faculty of Computer and Information Science
Tržaška 25, 1000 Ljubljana, Slovenia
Tel: +386 1 476 83 67; fax: +386 1 476 87 04
e-mail: Dejan.Lavbic@fri.uni-lj.si

ABSTRACT

There is more than 90% of unstructured information in organizations, but still majority of information engineers mainly deal with structured data. The answer may simply be that we know this best and basically all information systems are based on structured repositories like relational databases. Decision support systems often prove as inefficient due to the lack of intuitive support and active involvement of business user which drives to limited view of the decision problem. Data warehouses are often used for this purpose, but like many other tools for decision support they are also based on structured data. This article deals with integration of data warehouse and unstructured information with the use of ontologies and intelligent agents. The purpose of this synergy is to support associative thinking of business user and facilitate systems support.

1 INTRODUCTION

Majority of business intelligence (BI) systems are based on structured data, ie. data with predefined format (number, character, date etc.) and known location within electronic record. It is still a very demanding task to build systems like this due to increasing emphasis on searching while the quantity of data is rising uncontrollably.

Unstructured data from various sources, like forms, e-mails or documents, contains a lot of information that can be applicable in existing information systems. It is a very important fact that data don't contribute added value if they are not employed in the process of decision making.

The problem of using unstructured data was already addressed by Bill Inmon [1] who argues that accessing unstructured data is only the first step in filtering of usefull information. When unstructured data are read it has to be edited and sorted by priority. Problem in unstructured data is exactly that – it is unstructured. Because structure and format are undefined it is hard to determine important parts of unstructured data.

In data warehouse we work mainly with structured data. They alone are not sufficient for optimal decision making because majority of usefull information is still located in documents and not relational databases. This article therefore presents integration of both types of information into unified system. The purpose of this system is to efficiently aid business user in decision making process.

The article is organized as follows. Section 2 briefly presents background on data warehouses and section 3 on intelligent agents and Multi-Agent Systems. The main part is presented in section 4 with presentation of architecture of solution, conceptual plan and short evaluation. Finally section 6 concludes this contribution.

2 DATA WAREHOUSES

Organisations within their day-to-day operations collect immense quantity of data. These data are usually kept in transactional systems with primary task of maintaining consistency, effective updating, safe simultaneous access, effective execution of numerous small transactions and securing the data in case of failures. Transaction system also provide quick response time especially when using SQL queries [2].

Organisation of transactional oriented databases is not suitable to be directly used in business applications. Business users and analysts require aggregated and summarized information, comparisons by time and space dimensions, synthesis by numerous records, trends in data and other complex analyses that support their tactical and strategical decision support process.

Transactional systems were not designed for decision support, therefore new type of systems to support decision support has evolved. They are usually named analytical systems or BI systems. Data warehouse (DW), optimized for complex analyses and query execution for more than thousand records, plays the main role in these systems [3, 4]. The most widely used BI solutions are OLAP (On-Line Analytical Processing) systems and introduce functionality of interactive exploring of data warehouse.

Data warehouse combines data from heterogeneous data sources to provide united source of information that user can query. Data in DW is organized in a way that enables direct support to management functions.

Relational data model is not appropriate for DW, because all tables are treated symmetrical and users have difficulties comprehending it and nevertheless is also less effective in execution of analyses that require several conditions. Therefore dimentional data model is used for OLAP analyses with fact table and related dimensional tables. Every record in fact table contains measurable fact according to combination of values from multiple dimensions.

Data warehouses present an important foundation for decision support systems. They form the platform for development of analytical application and are based under assumption that underlying data is at desired quality and cleanse in preceding ETL (Extract-Transform-Load) process.

3 INTELLIGENT AGENTS AND MULTI-AGENT SYSTEMS

Multi-Agent Systems (MAS) are gradually becoming a new paradigm in development distributed business information systems. With agent oriented technology more complex information systems can be developed with the help of natural decomposition of problems, abstraction and flexibility of management of organizational changes [5].

Interest in research of intelligent agents and MAS has been increasing in the last two decades. The mainstream of research is focused mainly on business information systems [6, 7, 8], confirming that MAS is very appropriate for decision support information system development. Resemblance between agents from MAS paradigm and human actor in business organizations can be seen in characteristics and coordination styles. This leads to a modeling approach where intelligent agent in MAS plays a role of actor in business organizations. While the popularity and the quantity of applications with agent technology have gone up in recent years, the recent developments in this area include innovative approaches and architectures for management of integration between different systems.

Many definitions of an agent exists nowadays so it is hard to point one out. They all agree that an agent is a computer system, located in its environment and is capable of autonomous actions in this environment with a purpose of achieving predefined goals. Intelligent agent also share the properties like autonomy, reactivity, proactivness and social behaviour. Agents are also often modeled using abstract concepts like knowledge, belief, desire and intention, while objects on the other side simply encapsulate their inner structure with methods and attributes. Level of autonomy differs from agents to objects – object don’t have control over their execution and are initiated by other entity, while agents can, after receiving a request, decide whether to execute requested action or not.

In the following section 4 the use of intelligent agents in the domain of data warehouse will be shown with the emphasis on organizational view of MAS and roles of agents in integration and acquiring of information.

4 THE USE OF INTELLIGENT AGENTS IN DATA WAREHOUSES FOR INTEGRATION WITH UNSTRUCTURED INFORMATION

4.1 Introduction

The most important part of the decision support system is the business user who makes all decision. Business user is usually not a specialist in modern technologies in knowledge management but is rather an expert in a problem domain where he works. This section therefore presents framework for implementation of data warehouse and unstructured information integration. The purpose of this approach is to facilitate decision support process where business analyst has overall view of the data, required for making decisions.

4.2 Architecture

Figure 1 presents organizational structure of intelligent agents supporting data warehouse. There are several roles of agents: **OLAP Agent** (OA), **Information Retrieval Agent** (IRA) and **Knowledge Discovery Agent** (KDA).

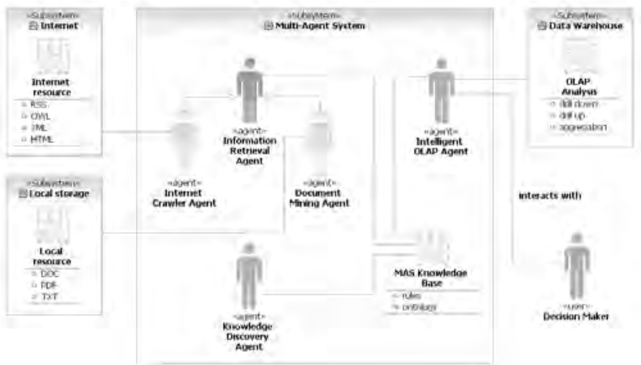


Figure 1: *Use case of MAS for decision support.*

IRA is responsible for acquisition of information from various sources and is furthermore specialized in **Internet Crawler Agent** (ICA) and **Document Mining Agent** (DMA). The role of ICA is to autonomously search for information available on the Internet, related to the OLAP analyses. As depicted in metamodel in figure 2 ICA acquires different information (news, forum opinions, stock reports etc.) about the selected problem domain. Resources being searched are also identified automatically to achieve highest level of autonomy as possible. DMA is on the other hand oriented towards finding usefull data from local document repository, including specifications, contracts etc. in different formats (DOC, PDF, TXT etc.). Role of KDA is employing methods of artificial intelligence and analytical methods for identification of important facts and patterns in existing data. The derived knowledge is therefore directly used to aid business users in their decision making.

The central element of Multi-Agent System is MAS knowledge baze (MAS-KB) with its data vocabulary, used for standardization of used concepts. As depicted in figure 1 all collaborating agents use MAS-KB either for storing found information or deriving new knowledge. With advent of Semantic Web the availability of tools for implementation of this kind of mechanisms is increasing.

4.3 Integration of unstructured information with DW

Before proceeding with the use of unstructured information in DW let us identify some possible approaches of integration that are available on the market [9, 10]. There are approaches using ETL tools for unstructured information examination and extracting usefull information and transforming to structured form. Another approaches emphasize semantic handling. Hybrid approach that we introduce is based on several concepts from basic taxonomy (hierarchical structure of classification) and ontology (rules and different view on taxonomies) to describing data for enabling context and associative thinking [11].
The idea of integration is depicted in figure 2 where all important elements are presented. Metamodel includes elements of data warehouse and unstructured information from various sources.

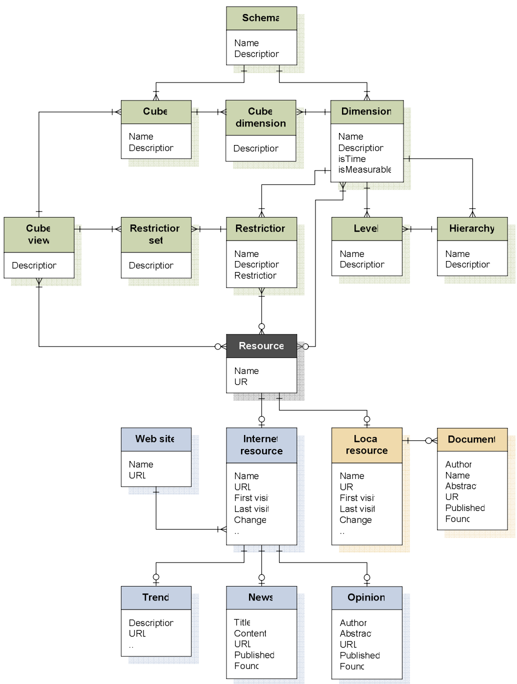


Figure 2: *Metamodel of using unstructured information in OLAP analyses.*

Elements relating to DW are as follows – schema, cube, dimension, cube dimension, cube view, level, hierarchy, restriction and restriction set. Element related to unstructured information is depicted as resource and further specialized into internet resource and local resource.
The most important part of the integration is linking element between unstructured information and process of OLAP analysis. To benefit from overall view on the information space we introduce the use of topic maps [12, 13] that contain metadata needed for navigation between data. Problem with OLAP analyses nowadays lies in preprepared and static reports. These reports have been prepared by users with technical background and will be used by business users who generally don't posses that kind of technical expertise. Let us consider for example a business user from a trading company that makes a decision about a supplier of chocolate bars. Decision maker is primarily interested in movement of sales of several chocolate products in the nearby history, which branch was the most successful, what is the most appropriate stock quantity etc. All these analyses can be accomplished by using OLAP tool on structured data found in DW, but generally this is not sufficient to make an optimal business decision.

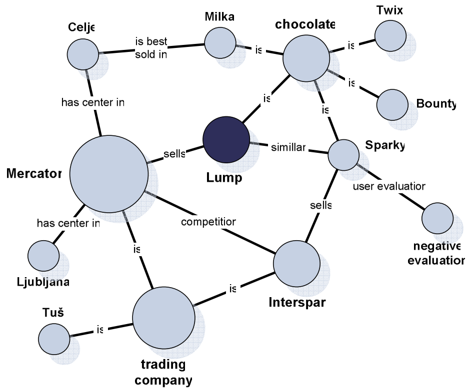


Figure 3: *Ontology in a form of Topic Map for traversing through information space.*

It can be very important how selected supplier is presented in the media or are there any associated scandals, open contracts, what is their financal report and nevertheless what is the general opinion of potential buyers that would trading company include in its sell program. All of these can be achieved with Topic Maps as a mechanism for management of metadata within data warehouse. It is all based on associative thinking paradigm where focus is in selected moment concentrated on specific concept and its context. If someone is interested in Lumpi chocolate bar (see figure 3) then this element becomes the observed concept with all related properties – who currently sells this product, what is the general opinion on forums, which products are in the same scope etc.

4.4 Implementation and evaluation

Implementation of presented approach is progressing in a form of prototype in Java programming language. Tools, used for implementation, are as following:

- **Mondrian** – OLAP server that enables interactive analyses on various datasources.
- **JPivot** – OLAP client used by business analyst used for standard OLAP functions – slice, dice, drill down, drill up etc.
- **Ontopia Omnigator** – supporting tool for building Topic Maps with emphasis on navigational aspects.
- **JADE** – platform for developing agents.

Concept of user interface used by business user is depicted in figure 4. When viewing and dynamically generating reports business user has ability to use related information from the internet and local document repository and therefore aiding decision making process.

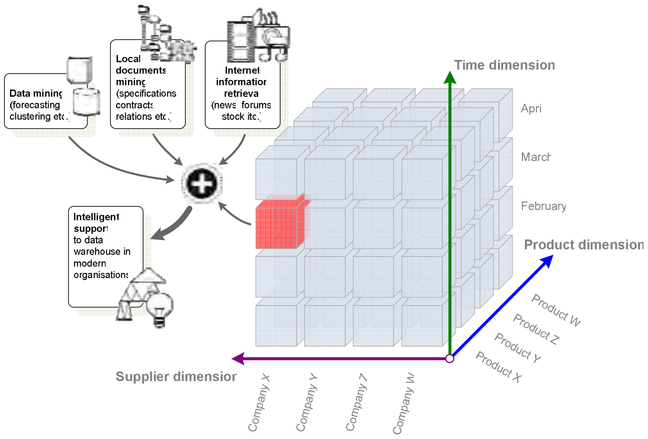


Figure 4: *Dynamic support to decision support process in data warehouses.*

In comparison to existing OLAP tools our approach present several advantages:

- When viewing information from selected problem domain our approach enables connections to other sources within observed context. Existence of navigation on information space where user can freely traverse based on mutual dependencies.
- When viewing report, it is feasible to view all related documents (news on the internet, documents from local repository, financal reports etc.)
- When making decisions all opinions are welcomed (internet forums).

6 CONCLUSION

In decision making information plays the most important role and that remained unchanged. The only thing that changed are types of decisions. In transition from industry oriented to knowledge oriented economy more information is needed to endorse decision support process. Dynamics currently present in business environment demands less information that can be classified into structured information model. It is kind of a paradox that information specialists label themselves as experts for information technology but they still constantly ignore more than 90% of relevant information. This is related to ratio between unstructured and structured information which reaches 9:1, while majority of information specialists mainly deals with minor part of unstructured information. Nevertheless unstructured information are still priceless source for decision support process. Business processes were always dependant on unstructured information and the quantity of unstructured information is only rising not vice versa. A good example is gaining importance of World Wide Web, e-mails, forums etc.

This article presented concept of linking unstructured information with data warehouse as one of the most important systems for decision support. Solution is presented by using agent oriented approach with emphasis on cooperation with business user while searching for information and exploiting navigational support. Problem was addressed with the use of ontologies as a metalevel above data warehouse and contains all required information about associations between data and metadata needed for navigation through information space. Solutions tries to support the process of associative thinking at decision making and enable business user access to required information as entirely as possible.

References

[1] B. Inmon. Information Management: The Noise is Terrific, *DM Review Magazine*. December 2004. http://www.dmreview.com/article_sub.cfm?articleID=1014519.

[2] C. J. Date. *An Introduction to Database Systems, 8th edition*, Addison-Wesley, 2003.

[3] W. H. Inmon. *Building the Data Warehouse, 3rd edition*. Wiley Publishing. 2002.

[4] R. Kimball. *The Data Warehouse toolkit – The Complete guide to dimensional modeling, 2nd edition*. John Wiley & Sons. 2002.

[5] R. Kishore, H. Zhang, R. Ramesh. Enterprise integration using the agent paradigm: foundations of multi-agent-based integrative business information systems. *Decision Support Systems*. Elsevier. 2003.

[6] N. Kang, S. Han. Agent based e-marketplace system for more fair and efficient transaction. *Decision Support Systems, Volume 34*. Elsevier. pp. 157-165. 2003.

[7] G. Tewari, J. Youll, P. Maes. Personalized location-based brokering using an agent-based intermediary architecture. *Decision Support Systems, Volume 34*. Elsevier. pp. 127-137. 2003.

[8] S. T. Yuan. A personalized and integrative comparison – shopping engine and its applications. *Decision Support Systems, Volume 34*. Elsevier. pp. 139-156. 2003.

[9] W. N. McCrosky. The Integration of Unstructured Data into a Business Intelligence System. *DM Review Magazine*. December 2004. http://www.dmreview.com/editorial/dmreview/print_action.cfm?articleId=1015671

[10] J. Ladley. Beyond the Data Warehouse: Primer for Unstructured Data and Semantics. *DM Review Magazine*. October 2005. http://www.dmreview.com/editorial/dmreview/print_action.cfm?articleId=1039846

[11] I. Lajovic. Panoramski pogled na baze podatkov. *Proceedings of Dnevi Slovenske Informatike 2005*. Slovenian society Informatika. Portorož. 2005.

[12] K. Olseviceva. Development of Topic Maps E-Learning Portal. *Electronic Journal of e-Learning, Volume 4, Issue 1*. March 2006.

[13] S. Pepper, G. Moore. XML Topic Maps (XTM) 1.0. *TopicMaps.org Specification*. http://www.topicmaps.org/xtm/1.0. 2001

AGENT BASED PRESENTATION OF AFFECTIVE USER PROFILES

Cveta Martinovska
Department of Computer Science
European University - R. Macedonia
Anton Popov bb, 1000 Skopje, Macedonia
Tel: +389 2 2580234 Fax: +389 2 2580400
e-mail: cveta.martinovska@eurm.edu.mk

ABSTRACT

This paper presents an agent based framework for delivering information about affective user profiles. The agent model is based on fuzzy decision-making techniques with the utility function defined over the affective profile attributes, personality traits and the social context. Subject-agent and psychiatrist-agent forms of interaction are covered by varying the utility function.

1 INTRODUCTION

The interest in emotions as elements of agent architectures has grown dramatically in the past 10 years. The initiators of this interest are several works that explicitly emphasize the importance of emotions [1, 2]. The conferences organized by Cañamero, the simulation of adaptive behavior conference SAB'98 [3] and AAAI'98 conference [4] have significant influence on recognizing the potential of emotions for creating intelligent systems.

Nowadays, animated agents that recognize and express emotions, provided with a personality and a social competence, and with verbal and nonverbal abilities represent a new approach to creating natural and efficient interfaces. Several projects describe embodied conversational agents, like REA [5], DFKI Persona [6] and pedagogical agents of Lester and his colleagues [7, 8].

Important aspect to enhance the believability of animated agents is a social role awareness that determines the behavioral reactions according to the social context. For example, when interacting with the patient the agent psychiatrist has to behave according to the norms and standards appropriate for the situation. The behavior is different when presenting a diagnosis to a psychiatrist or psychologist. In a particular social setting the social distance between the participants and the power that an agent role has over other roles determine the appropriate behavioral and communicative conventions.

Several agent architectures are based on the decision theory [9, 10]. Since the description of user affective state involves imprecision in this work a fuzzy decision-making paradigm is proposed to deal with this uncertainty.

This work describes the design of an intelligent agent whose behavior is determined with the utility function defined over the affective profile attributes, personality traits and the social context.. The main task of the agent is to interpret the affective profiles created with the user-modeling component. Agent presentations are formulated as informative paragraphs and are taken from the predefined knowledge base.

Next section describes the user-modeling component. Then the conceptual model of the agent for delivering information about the profiles is presented. This approach is illustrated by an example that shows the principles of fuzzy decision-making paradigm used to formalize the agent behavior. The paper ends with a brief discussion and conclusions.

2 CREATING AFFECTIVE USER PROFILE

The affective profile is built according to the standard test in psychiatry and clinical psychology Emotions Profile Index. This instrument uses the idea that personality traits are mixtures of two or more primary emotions [11]. For example, personality trait cautious includes expectancy and fear as two main emotional components, and affectionate includes acceptance and joy. EPI assesses the user affective state based on a partial ordering scheme of personality traits: adventurous, affectionate, brooding, cautious, gloomy, impulsive, obedient, quarrelsome, resentful, self-conscious, shy, and sociable.

The emotional dispositions, such as fear, anger, joy, sadness, acceptance, disgust, expectancy and surprise, represent the user affective state. One type of a user profile is shown in Figure 1.

2.1 Rule-Based Refinement of the User Profile

EPI is used for initialization of the user affective profile. The user model might be modified using fuzzy rules [12].

Emotional state is described with linguistic labels for the fuzzy variables <R,I,N,S,D,O,E,A> denoting emotional categories reproduction, incorporation, orientation, protection, deprivation, rejection, exploration and destruction, respectively.

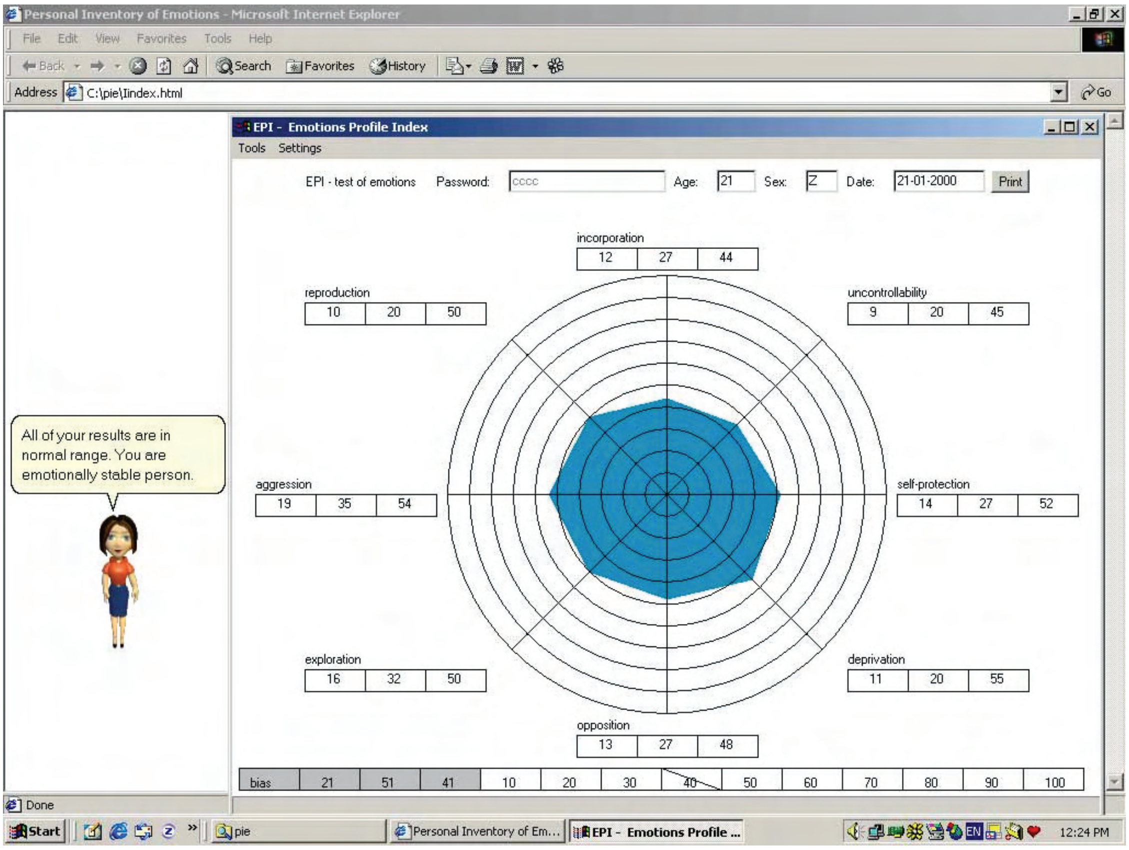


Figure 1: *Representation of affective user profile*

Fuzzy rules with the following general pattern are used for updating of the profile:

if x_1 is A_1 and ... and x_n is A_n or ... then y is B,

where A_i and B are linguistic variables from the universes of discourse U and V respectively, x_i is an instance in the universe U corresponding to membership value $\mu_{Ai}(x_i)$, y is an instance in V with membership value $\mu_B(y)$.

Condition part of the rule might, for example, include events from the application where EPI is used for the assessment of the user emotional state. Action part might specify new values for the attributes in the user model or might activate other rules.

The process of fuzzy inference is formalized with fuzzy automaton:

$$FA=(I,S,O,f,\lambda),$$

where I is a set of input linguistic variables, S is a set of automaton internal states and O is a set of output linguistic variables.

Transition function f is defined as f: SxIxS $\rightarrow$ {0,1} and output function λ as λ: SxIxO $\rightarrow$ {0,1}, where $f(s_i,i_p,s_j)=1$ if there is link from state s_i to s_j, and $f(s_i,i_p,s_j)=0$ in other cases, and $\lambda(s_i,i_p,o_p)=1$ if o_p is the output at state s_i when input is i_p and $\lambda(s_i,i_p,o_p)=0$ otherwise.

The fuzzy automaton has to be deterministic. That is, for a given input and current state there is only one next state and output. So, some constraints are imposed: function f has value 1 for exactly one next state s_j being in state s_i when the input is i_p and λ has value 1 for only one output o_k being in state s_i when the input is i_p.

To obtain next states the automaton computes max-min operations from the current state and inputs.

Let current input x has membership values

$$I=[\mu_{i1}(x),\dots,\mu_{ip}(x)],$$

for every input linguistic variable i_k and S is the current state of the automaton distributed over several states, where the degree of activation of the states is defined with value in the interval [0,1].

The next state S' is computed as fuzzy composition

$$S'=S\circ\max[\min(\mu_{i1}(x),f(s_i,i_1,s_j)),..,\min(\mu_{ip}(x),f(s_i,i_p,s_j)).$$

User affective profile might be modified to include evidence from psychiatrists. The experts might add a rule that is inconsistent with the rest of the rules. Analyzing the process of fuzzy inference using fuzzy automaton may help in detecting undesirable and ambiguous situations.

3 FORMAL MODEL OF THE AGENT

In what follows the formal model of the agent fuzzy decision-making process is represented together with the transformations of the decision-making situation under the influence of the social roles and agent personality traits. The role of the agent is associated with certain goals and behaviors to model social competence.

Let the set of feasible alternatives or actions that the agent is able to perform in state $X_i \in X$ is $S = \{S_1, ..., S_n\}$.

The state X_i is the decision context. Agent actions in this model are actually conversational acts.

In general case S represents the subset of the space R^p, or with other words an alternative might be defined with p attributes.

The agent goals and motives are formalized as decision criteria. The motives determine priority of the goals. The set of agent goals and motives is

$$C = \{C_1, ..., C_k\}.$$

The criteria are defined as functions

$$C_j : R^p \to R,$$

where j=1,...,k.

The image of S in R^k is the set of feasible solutions for the multi-criteria problem of selecting an alternative

$$B_S = \{B_i \in R^k \mid b_{ij} = C_j(S_i), j = 1,..,k,\ S_i \in S,\ i = 1,..,n\}.$$

Actually $B_i = \{b_{i1}, ..., b_{ik}\}$ are evaluations of the alternative S_i, i=1,...,n versus all the criteria.

Ordering the set of motives and goals is realized with the function that assigns weights to the criteria in different decision-making situations

$$W : X \to [0,1]^k$$

where $W(X_i) = (w_1, ..., w_k),\ \ X_i \in X,\ \ i = 1, ..., n$ denotes the importance of the motive or the goal j=1,...,k for the agent in a particular situation.

Using the defined terms the agent utility function for the alternative $S_i = \{s_{i1}, ..., s_{ik}\}$ is given with the following formula

$$U(S_i) = f(g(w_1, s_{i1}), ..., g(w_k, s_{ik})),\ \ i = 1, ..., n$$

where $g : R\ X\ R \to R$ is a function that transforms the evaluations of the alternatives with the criteria weights, and $f : R^k \to R$ is an aggregation operator that gives the unit score of appropriateness of the alternative versus all the criteria. For example, f might be the minimum operator and g maximum t-conorm

$$g(w_j, s_{ij}) = \max\{1 - w_j, s_{ij}\},\ \ i = 1, ..., n,\ \ j = 1, ..., k.$$

In the cases where the type of aggregation is neither pure "anding" denoting complete lack of compensation nor pure "oring" denoting complete submission to any good satisfaction, OWA operators [13] might be used. OWA aggregation operators act like quantifiers, providing ways to represent aggregation where "many", "most", "few", etc. criteria are satisfied by the alternative.

The agent selects actions that maximize its performance measure and in that sense performs utility-directed action selection

$$U(S^*) = \max_i (U(S_i)),\ \ i = 1, ..., n.$$

Agent actions feasible in situation X_i are subset of the set Δ^* that we call the set of behavior conventions $S \subseteq \Delta^*$, where Δ is the set of all elementary actions in any situation of X, Δ^* is a set of all sequences that can be formed from the elementary actions of set Δ.

The decision-making situation is represented with the following quadruple

$$V=(X_i, S, C, U)$$

where X_i is the state or decision context, S is the set of actions feasible in particular situation or appropriate conversational acts, C are agent goals and motives that serve as decision criteria and U is the utility function.

Under the influence of the social roles the decision-making situation is transformed in

$$(X_i, S, C, U').$$

The impact of the social roles is implemented through the change of the criteria weights. The transformed utility function is

$$U'(S_i) = f(g(w_1', s_{i1}), ..., g(w_k', s_{ik})),\ \ i = 1, ..., n.$$

Agent personality traits, as relatively stable characteristics are included in the set of decision criteria. In that sense personality traits influence the selection of the alternative and determine the linguistic style for expressing information.

4 AN EXAMPLE

To exhibit social competence, an agent ought to possess the ability to select adequate behaviors. The process of selection depends on the evaluation of the situation and on the desirability of the possible outcomes.

Two characters are defined to cover the subject-agent and psychiatrist-agent forms of interaction. First agent will assign higher importance to expressions of empathy and giving advice to subjects and the second will value more the actions offering detailed explanations of the results about the mental health of the user.

Let the affective profile under consideration belongs to a person with certain pathological manifestations and let the following alternatives from the knowledge base are activated:

- S1: This is a cautious and anxious person. The results show that this person is constantly worried of getting into troubles that she could not be able to overcome. Also this person is worried about what other people think or speak about her.
- S2: There is a possibility for phobic and obsessive-compulsive behavior.
- S3: It looks that you have some problems. Is that right? You have to visit a psychiatrist.
- S4: For further analyses you have to consult a psychiatrist. Your results show anxiety and some other pathological problems.

The agent that presents information to subjects will display the alternative S3. The alternative S4 is less suitable because of the low performance on some of the criteria. The explanation that alternative S4 offers might have negative impact on the subject.

The agent that covers psychiatrist-agent form of interaction will present detailed information about the pathological problems of the subject. This agent will display alternatives S1 and S2.

5 CONCLUSION

This work describes a human-computer interface with agents that deliver information about the affective profiles.

Agents are able to adapt their behavior by changing parameters related to the social roles, personality traits, emotions and linguistic styles. The formal model of the agent includes transformation of the decision-making situation according to the agent goals and under the affective influence.

A framework for affective user modeling is presented based on the assessment of the user emotional state. User emotional state is obtained from the partial-ordering scheme of personality traits.

The social role of an agent is associated with certain responsibilities, duties, rights and behavioral constraints, and contributes to achieving convincing behavior and to the believability of the agents.

References

[1] A. Damasio. Descartes' Error: Emotion, Reason, and the Human Brain. *Grosset and Putnam*.New York.1994

[2] R. Picard. Affective Computing. *The MIT Press*. 1997

[3] D. Cañamero, C. Numaoka, P. Petta. (eds.) *Proc. Workshop on Grounding Emotions in Adaptive Systems. Simulation of Adaptive Behavior '98: From Animals to Animats*. 1998

[4] D. Cañamero. Emotional and Intelligent: The Tangled Knot of Cognition. *Proc. AAAI Fall Symposium*. 1998

[5] T. Bickmore, J. Cassell. Social Dialogue with Embodied Conversational Agents. In: J.van Kuppevelt, L. Dybkjaer, N. Bernsen (eds.) *Naturals, Intelligent and Effective Interaction with Multimodal Dialogue Systems*. New York: Kluwer Academic. 2003

[6] E. André, T.Rist, S. van Mulken, M. Klesen. S.Baldes. The Automated Design of Believable Dialogues for Animated presentation Teams. In: J. Cassell, J. Sullivan, S. Prevost, E. Churchill (eds.) *Embodied Conversational Agents*. Cambridge MA:MIT Press 2000. pp. 220-255

[7] L. Johnson, J. Rickel, J. Lester. Animated Pedagogical Agents: Face-to Face Interaction in Interactive Learning Environments. *International Journal of AI in Education*. 2000. vol. 11. pp. 47-78

[8] J. Lester, B. Stone, G. Stelling. Lifelike Pedagogical Agents for Mixed-Initiative Problem Solving in Constructivist Learning Environments. *User Modeling and User-Adapted Interaction.* 1999.vol.9(1-2) pp.1-44

[9] C. Lisetti, P. Gmytrasiewicz. Can a Rational Agent Afford to be Affectless? A Formal Approach. *Applied Artificial Intelligence 16.* 2002. pp.1-33

[10] C. Conati. Probabilistic Assessment of User's Emotions in Educational Games. *Journal of Applied AI, spec. issue on Merging Cognition and Affect in HCI.* 2002. vol. 16 (7-8) pp. 555-575

[11] R. Plutchik. Emotion: *A Psychoevolutionary Synthesis*. Harper and Row. New York. 1980

[12] C. Martinovska, S. Bozinovski. Emotionally Intelligent Interactive Agents for Delivering Information about User Affective Profiles. *Proc. IEEE 4th International Conference on Intelligent Systems Design and Applications*. Budapest, Hungary. 2004. pp. 783-788

[13] R. Yager. Ordered Weighted Averaging Aggregation Operators in Multi-Criteria Decision Making. *IEEE Transactions on Systems, Man and Cybernetics.* 1988. vol. 19 pp. 183-190

LITERATURE MINING: POTENTIAL FOR GAINING HIDDEN KNOWLEDGE FROM BIOMEDICAL ARTICLES

Ingrid Petrič[1], Tanja Urbančič[1,2], Bojan Cestnik[2,3]
[1]University of Nova Gorica
Vipavska 13, 5000 Nova Gorica, Slovenia
[2]Jozef Stefan Institute
Jamova 39, 1000 Ljubljana, Slovenia
[3]Temida, d.o.o.
Dunajska 51, 1000 Ljubljana, Slovenia
e-mail: *ingrid.petric@p-ng.si, tanja.urbancic@p-ng.si, bojan.cestnik@temida.si*

ABSTRACT

This study investigates the potential of text mining for increasing the possibility of discovering implicit knowledge in biomedical literature. Based on Swanson's suggestion for hypotheses generation we focused on articles from database PubMed Central when trying to identify potential contributions to a better understanding of autism. First, we used them for ontology construction with OntoGen in order to obtain better insight into the domain structure. Next, we extracted a few rare terms that could potentially lead to new knowledge discovery for the explanation of the autism phenomena. We present a concrete example of such constructed knowledge about a substance calcineurin and its potential connections with autism.

1 INTRODUCTION

Huge bibliographic databases often contain interesting information that may be inexplicit or even hidden. One of such databases is MEDLINE, the primary component of PubMed, which is the United States National Library of Medicine's bibliographic database. It covers over 4.800 journals published in more than 70 countries worldwide and thus contains over 14 million citations from 1966 to the present (PubMed, 2006). There is an urgent need to assist researchers in extracting knowledge from the rapidly growing volumes of databases (Fayyad et al., 1996). In fact, important information hidden in huge databases could be discovered by data mining and knowledge discovery techniques. Therefore, one of the major challenges of biomedical text mining over the next 5 to 10 years is to make these techniques better understood and more useful to biomedical researchers (Cohen, Hersh, 2005).

In the PubMed database we found 10.821 documents (till August 21, 2006) that contain derived forms of *autis**, the expression root for autism. Our aim was first to review the autism literature and to identify the most frequent topics researched in this domain. With this intention we built the autism domain ontology with OntoGen on 214 articles from database PubMed Central that treat problems of autism. Ontologies in general with their capability to share a common understanding of domains support researches with ability to reason over and to analyze the information at issue (Joshi, Undercoffer, 2004). Many tools that help constructing ontologies from texts were developed and successfully used in practice (Brank et al., 2005). Among them, OntoGen (Fortuna et al., 2006) received a remarkable attention.

In this article we first describe several data mining approaches in real settings towards extracting knowledge from data. We focus on the areas and methods where data mining potentially enriches biomedical science and thus interdisciplinary connects information technologies with biomedical expert knowledge. Then we present our approach towards integration of real problem analysis and extraction of potentially useful information from data. Our main aim was to extract some implicit and previously unknown interesting information from texts about autism.

2 DATA MINING POTENTIAL FOR BIOMEDICINE

The practice of biomedicine is, as well as other activities of our society, inherently an information-management task (Shortliffe, 1993). In MEDLINE database there are between 1.500-3.500 complete references added since 2002 each day from Tuesday to Saturday (PubMed, 2006). The daily increasing number of biomedical articles provides a huge potential source of new data. For such reasons, the ability to extract the right information of interest remains the subject of the growing field of knowledge discovery in databases. Knowledge discovery is the process of discovering useful knowledge from data, which includes data mining as the application of specific algorithms for extracting patterns from data (Fayyad et al., 1996).

Although the technology for data mining is well advanced, its potential still seems to be not sufficiently recognized. On the other hand, the continued cooperation with professional communities such as the biomedical research community is required to ensure that their needs are properly addressed. There are several biomedical examples, where data mining has been successfully applied (Van Someren, Urbančič, 2006). Examples include diagnosis, where data mining relates symptoms and other attributes of patients to their disease, subgroups of patients that are at risk for certain disease, and gene expression, with a growing number of applications, where predictions and identifications of disease markers are made, based on features of genes.

Methods that have been recently used for text mining tasks, include the following items (Cohen, Hersh, 2005):

- *Named entity recognition* in order to identify all of the instances of a name for specific type of domain, within a collection of text;
  Examples of recent areas of biomedical research:
    - drug names within published journal articles,
    - gene names and their symbols within a collection of MEDLINE abstracts.

  Text mining approaches: lexicon-based, rules-based, statistically based, combined.
- *Text classification* with the goal to automatically determine whether a document or a part of it has particular attributes of interest;
  Examples of recent areas of biomedical research:
    - documents discussing a given topic,
    - texts containing a certain type of information.

  Text mining approaches: classification rule induction.
- *Synonym and abbreviation extraction* with the attempt to speed up literature search with automatic collections of synonyms and abbreviations for entities;
  Examples of recent areas of biomedical research:
    - gene name synonyms,
    - biomedical term abbreviations.

  Text mining approaches: combination of named entity recognition system, with statistical, support vector machine classifier-based, and automatic or manual pattern-based matching rules algorithms.
- *Relationship extraction* with the goal to recognize occurrences of a pre-specified type of relationship between a pair of entities of specific types;
  Examples of recent areas of biomedical research:
    - relationships between genes and proteins,
    - text-based gene clustering.

  Text mining approaches: neighbour divergence analysis, vector space approach and k-medoids clustering algorithm, fuzzy set theory on co-occurring dataset records, type and part-of-speech tagging.
- *Integration frameworks* with intention to address many different user needs;
  Examples of recent areas of biomedical research:
    - comparison of gene names and functional terms,
    - gene based text clusters.

  Text mining approaches: template-based, text profiling and clustering based.
- *Hypothesis generation* that focuses on the uncovering of implicit relationships, worthy of further investigation, that are inferred by the presence of other more explicit information;
  Examples of recent areas of biomedical research:
    - connection between patient benefit and food substances,
    - potential new uses and therapeutic effects of drugs.

  Text mining approaches: Swanson's ABC model-based.

3 SWANSON'S MODEL OF HYPOTHESIS GENERATION

Idea known as Swanson's ABC model consists of discovering complementary structures in disjoint journal articles. This model assumes that when one literature reports that agent A causes phenomenon B, and second literature reports that B influences C, we could propose that agent A might influence phenomenon C (Swanson, 1990). To find some published evidence leading to an undiscovered knowledge, the A and C literatures should have few or no published articles in common. In such way, Swanson discovered eleven relationships between migraine and magnesium literature (Swanson, 1988).

Weeber et al. experimented with Swanson's idea of searching the literature for generating new potential therapeutic uses of the drug thalidomide with the use of a concept-based discovery support system DAD on the scientific literature (Weeber et al., 2003). Another example of discovering new relations from bibliographic database according to Swanson's model is identification of disease candidate genes by an interactive discovery support system for biomedicine BITOLA (Hristovski et al., 2005).

4 IDENTIFICATION OF PROBLEM DOMAIN

For successful data mining a wide background knowledge concerning the problem domain presents a substantial advantage. In fact, hypothesis generation from text mining results relies on background knowledge, experience, and intuition (Srinivasan, 2004). With this consideration we started our examination of autism phenomena with the identification of its main concepts and the review of what is already known about autism.

Frequently used in text mining and one of the simplest representations of texts is word-vector representation, where the word-vector contains some weight for each word of text, proportional to the number of its occurrences in the text (Mladenić, 2006). Such representations are performed also by OntoGen, which enables interactive construction of ontologies in certain domain. We used it to construct several autism ontologies. The input for the tool is a collection of text documents. With machine learning techniques OntoGen supports phases of ontology construction by suggesting concepts and their names, by defining relations between them, and by automatic assignment of documents to the concepts (Fortuna, 2005).

4.1 Target dataset

We chose to analyze the professional literature about autism that is publicly accessible on the World Wide Web in the database of biomedical publications, PubMed. There were 354 articles with their entire text published in the PubMed Central data base. Other relevant publications were either restricted to abstracts of documents or their entire texts were published in sources outside PubMed. From the listed 354 articles we further restricted the target set of articles on documents to those that have been published in the last ten years. As a result, we got 214 articles from 1997 forward, which we decomposed to titles, abstracts and texts for the purpose of further analysis.

4.2 Ontology of autism domain

To identify some useful pieces of knowledge from the large amount of digital articles one approach would be to read and manually analyse all available data. Since this is evidently a time consuming task, we instead chose to guide our attention only on the most relevant information about the domain of interest. We identified such information by ontologies construction, which we found a very fast and effective way of exploring large datasets. Ontologies built with OntoGen, as an example shown in figure 1, actually helped us to substantially speed up the process of reviewing and understanding the complex and heterogeneous spectrum of scientific articles about autism.

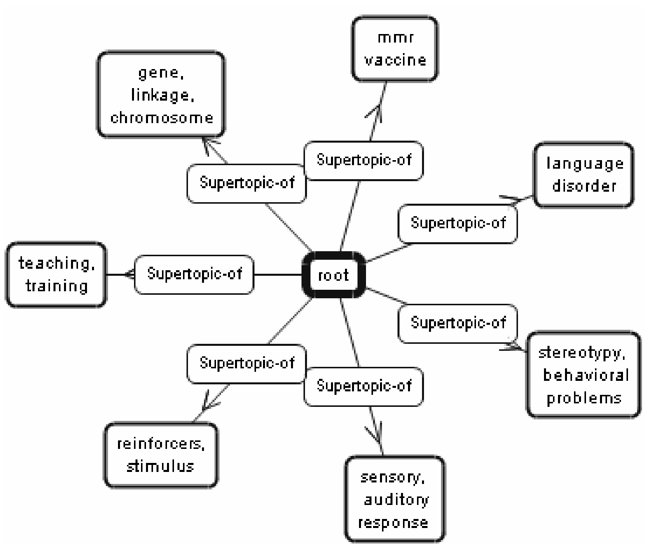


Figure 1: *Concepts of autism ontology with 7 subgroups, built on 214 abstracts from the PubMed Central data base.*

The main concepts of autism phenomena as they result from the first level of our ontology model (first level subgroups of autism domain) are: genetics; teaching and training; reinforcers and stimulus; sensory and auditory response; stereotypy and behavioral problems; language disorders, and MMR (Measles, Mumps, and Rubella) vaccine. Important confirmation of the resulted ontology construction is the recent state of autism research as described by Zerhouni (2004), that summarizes the main scientific activities of autism research in the major areas of epidemiology, genetics, neurobiology, environmental factors and specific treatments of autism.

5 EXTRACTION OF IMPLICIT RELATIONSHIPS FROM AUTISM DATA

Besides constructing an ontology on the input file of texts, OntoGen creates also a *.txt.stat file with statistical incidence of terms as they appear in documents collected in the input dataset. We utilized this OntoGen's byproduct as the source for our approach toward the identification of the rare relations between autism data. As our goal was to discover undocumented knowledge about autism phenomena, we assumed that starting our search on rare connections between data rather than on frequent ones, we would have better chances to discover implicit relations that are still unknown and might, however, be useful for the autism researchers.

We took the **.txt.stat* file that OntoGen made while constructing ontologies and first concentrated our attention on listed terms that appear only in one article from the input dataset. On the base of our background knowledge about autism we chose words that could be useful for autism discovery. Three of such terms are: lactoylglutathione, calcium_channels, and synaptophysin. The reasons for these three choices are: first, that we found that an increase in polarity of glyoxalase I in autism brains was reported, and that glyoxalase system involves also lactoylglutathione; second, as the altered synaptic function was also discussed in autism articles, we took in consideration synaptophysin, a protein localized to synaptic vesicles; and third, abnormal calcium signaling was found in some autistic children, thus we chose also term calcium_channels for further discovery. Then we searched what all this terms have in common.

The text mining goal in hypothesis generation is to automatically discover interesting hypotheses from a potentially useful text collection (Srinivasan, 2004). By text mining on PubMed articles that treat these selected terms domains, we constructed their ontologies and from the OntoGen's **.txt.stat* files we retrieved the words, they all have in common (the words that appeared in the three **.txt.stat* files). One of such terms, listed also in Figure 2, that in our opinion could be interesting for the hypothesis generation and forward research on autism phenomena, is *calcineurin*. Calcineurin is calcium- and calmodulin-dependent serine/threonine protein phosphatase, which is widely present in mammalian tissues, with the highest levels found in brain (Rusnak, Mertz, 2000). Our literature mining in disjoint journal articles showed that it could be related to autistic disorders, however to the present no evidence of calcineurin role in autism has been reported on the World Wide Web.

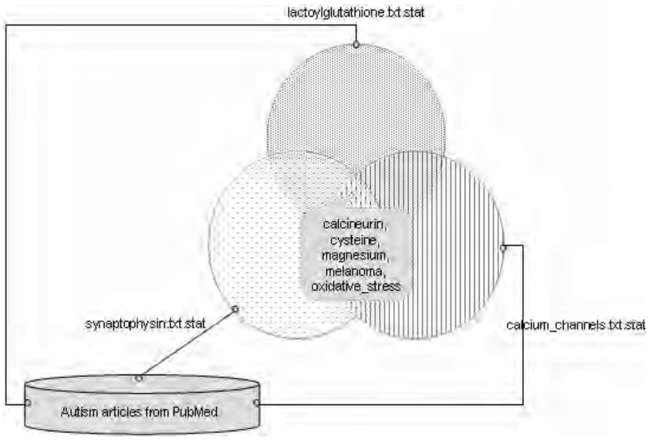


Figure 2: *Results of our approach to literature mining on autism domain.*

6 CONCLUSIONS AND FUTURE WORK

Our study confirms the potential of ontology construction by OntoGen on biomedical literature to systematically recognise main concepts. The evaluation of the ontology constructed on autism showed important similarity to the reported state of autism research.

Considering OntoGen’s statistical data from its **.txt.stat* files can lead to discovery of potentially useful and previously unknown information related to the researched phenomena. Thus the OntoGen's functionality can be extended to retrieve new information from vast amounts of textual data that experts otherwise have to explore manually. As connecting sets of literature about synaptophysin, lactoylglutathione and calcium channels, that we took as three experimental interesting rare terms from autism articles, we found calcineurin, cysteine, magnesium, melanoma, oxidative stress and many others. Further experimental assessment of their possible role in autism is needed to justify our methodological approach and to see if it can contribute to the knowledge corpus of autism phenomena.

Acknowledgement

This work was partially supported by the Slovenian Research Agency programme Knowledge Technologies (2004-2008). We thank Nada Lavrač for her suggestion to use OntoGen and Blaž Fortuna for his discussions about OntoGen's performance. We also appreciate help and support we got from Marta Macedoni-Lukšič in our efforts to better understand autism.

References

1. Brank J, Grobelnik M, Mladenić D: A survey of ontology evaluation techniques. In: SIKDD 2005 at multiconference IS 2005, Ljubljana, Slovenia.
2. Cohen AM, Hersh WR: A Survey of Current Work in Biomedical Text Mining. Briefings in Bioinformatics 2005, 6(1): 57-71.
3. Fayyad U, Piatetsky-Shapiro G, Smyth P: Knowledge Discovery and Data Mining: Towards a Unifying Framework. In Proceedings of the Second International Conference on Knowledge Discovery and Data Mining, Portland, Oregon, August 1996.
4. Fortuna B:[http://ontogen.ijs.si/index.html], OntoGen: Description, 2006.
5. Fortuna B, Grobelnik M, Mladenić D: System for semi-automatic ontology construction. Demo at ESWC 2006. Budva, Montenegro, June, 2006.
6. Hristovski D, Peterlin B, Mitchell JA, Humphrey SM: Using literature-based discovery to identify disease candidate genes. International Journal of Medical Informatics 2005, 74: 289-298.
7. Joshi A, Undercoffer JL: On Data Mining, Semantics, and Intrusion Detection. What to Dig for and Where to Find It. In: Data mining. Next Generation Challenges and Future Directions. Menlo Park, California, 2004. 437-460.
8. Mladenić D: Text Mining: Machine Learning on Documents. In: Encyclopedia of Data Warehousing and Mining. Hershey: Idea Group Reference, 2006: 1109-1112.
9. PubMed: Overview [http://www.ncbi.nlm.nih.gov/], June 2006.
10. Rusnak F, Mertz P: Calcineurin: Form and Function. Physiological Reviews, 80(4): 1483-1521. American Physiological Society, October 2000.
11. Shortliffe EH: The Adolescence of AI in Medicine: Will the Field Come of Age in the ‘90s? Artificial Intelligence in Medicine, April 1993, 5(2): 93-106.
12. Srinivasan P: Text mining: Generating hypotheses from MEDLINE. Journal of the American Society for Information Science and Technology 2004, 55(5): 396-413.
13. Swanson DR: Medical literature as a potential source of new knowledge. Bulletin of the Medical Library Association, 1990, 78(1): 29-37.
14. Swanson DR: Migraine and magnesium: eleven neglected connections. Perspectives in Biology and Medicine, 1988, 31(4): 526-557.
15. Van Someren M, Urbančič T: Applications of machine learning: matching problems to tasks and methods. The Knowledge Engineering Review, 20(4): 363-402. Cambridge University Press, United Kingdom, 2006.
16. Weeber M, Vos R, Klein H, De Jong-van den Berg LT, Aronson AR, Molema G: Generating Hypotheses by Discovering Implicit Associations in the Literature: A case Report of a Search for New Potential Therapeutic Uses for Thalidomide. Journal of the American Medical Informatics Association 2003, 10(3): 252-259.
17. Zerhouni EA for National Institutes of Health and National Institute of Mental Health: Congressional Appropriations Committee Report on the State of Autism Research. Department of Health and Human Service, Bethesda, Maryland, 2004.

Overview of agents systems

Joël Plisson
Jožef Stefan Institute
Jamova 39, 1000 Ljubljana, Slovenia
Tel: +386 14773125
e-mail: joel.plisson@ijs.si

ABSTRACT

First softwares were built upon the idea we had about human cognition. Nowadays, softwares are developed with another perspective which is to mimic the behaviour of a society of humans. Several components (called agents) of this society realize specific tasks, interact and communicate between each other in order to accomplish a global activity.
In addition agents may have some other cognitive properties. As any human society they can reorganize and adapt themselves to the changes in the external environment. There exist already several applications in the domain of document management and e-commerce, many products aim at resolving part or complete problems. This paper[1] will briefly describe the multi-agent technology and then present the main categories of multi-agent systems and focus on the most outstanding applications.

1 INTRODUCTION

Multi-agent systems are usually used to simulate, resolve problems or to facilitate the management of a complex system. By definition [1], an agent can be a physical or virtual entity that can act, perceive its environment (in a partial way) and communicate with others, is autonomous and has skills to achieve its goals and tendencies. It is in a multi-agent system (MAS) that contains an environment, objects and agents (the agents being the only ones to act), relations between all the entities, a set of operations that can be performed by the entities and the changes of the universe in time and due to these actions.
A multi-agent system is composed by a set of objects within an environment. Among these objects, some of them are agents, others are passive objects that can be used, destroyed, modified or created by agents. A set of relations is defined between the objects within the environment, including relations between agents, and between passive objects and agents.

[1] This work is part of a course on Network Intelligent Systems and Agents in the program of New Media and e-science at the international postgraduate school Jožef Stefan in Ljubljana.

An agent works without direct intervention from the user. Its autonomy can range from simply running a backup at a certain time to negotiating shares on the stock market. During its process the agent is also able to report on possible errors that it has encountered or refine its search with additional directives given by the user. Agents may have mobility capabilities either by sending requests on several servers or even by stopping its execution on the current servers and starting a new execution on a new server. For instance, a backup agent may move from one machine to the other in order to backup files.

Agents can be used to perform many different tasks [2]. We will address in this paper only a subset of categories:

- Agents that improve the research of information
- Agents for e-commerce
- Agents for chatting

2 META-SEARCH WITH AGENTS

Existing search engines often provides too much information that is not always well organized. Some search engines may not retrieve some results whereas others do. It is usually difficult for the user to find relevant information among the large amount of results that search engines return. With this problem in mind, some systems are developed using agent technology, in order to facilitate search. One solution is still to use existing general purpose search engines like Google, Yahoo!, Altavista, etc. The agents then call automatically these search engines in parallel and then process the results in order to sort and filter out redundant and useless information. Usually each agent is responsible of one part of the search.
Search can also be performed inside specialized sources of information such as newspapers' databases or industrial sectors.

<u>On-line systems:</u>

- **DogPile** [3] is a system that combines up to 25 different search engines including Google, Yahoo! Search, MSN, Ask.com, About, MIVA, LookSmart, etc. It is possible to search for web documents, news, or files through FTP. The system allows the use of Boolean operators (AND, OR, NOT) to combine words or phrases. The search results are then processed to filter out duplicates and sorted by pertinence.

- **Ixquick** [4] sends the request to 12 different search engines: AltaVista, EntireWeb, Excite, Francite, Go, Google, Mirago, MSN, Open Directory, Overture, Voila and Yahoo! It offers different services: search the web, phonebook, price comparison, search images, etc. In order to sort the results from the 12 search engines, it uses a system with stars. Each time a web site enters the top ten of one search engine, it receives one star. A result having five stars means that five search engines have found that the result is good.

- **Metacrawler** [5] is also combining the results of several standard search engines such as Google, Yahoo! Search, MSN Search, Ask Jeeves, About, MIVA, LookSmart, etc. It removes duplicates and sorts the results by pertinence.

- **Vivisimo** [6] is using several search engines (MSN, Lycos, etc.), news (CNN, Reuters, Yahoo! News, etc.), etc. The search can also be limited to only one source. Vivisimo is using clustering to display the results, which means that it is grouping similar document in categories.

- **FindForward** [7] is a meta-search engine with various types of search. "Normal search" queries Google with the same syntax as in the original search engine. "Get questions" search will find questions related to the keywords given in the search string. "Backlinks search" will show the pages that link to the URL passed for search. "Meta search" will combine the results of several search engines. Each result is presented with a small preview of the web page. It is also possible to add a comment on some websites that will be shown next time they are found.

Software systems:

- **Autonomy** [8] is a system where each agent is responsible for searching specific information. Before the search, the notion of briefing is used to specify the information that the agent is supposed to extract. This is done with natural language where it is even encouraged to use long sentences to describe the information that one is looking for. It is possible to specify sentences in French or English, remove some words or phrases from the query, etc. The agent can retrieve documents or images on the web according to the information that was passed to it during the briefing. The agent can also operate in automous mode without intervention of the user. After the search has finished, the notion of debriefing is used to refine the parameters of search by telling to the agents which sites are the most interesting.

- **WebSeeker** [9] comes preconfigured with more than 100 possible search engines to use for search. It also allows to add new search engines and to sort them into categories like Arts, Automotive, Business, Computers, etc. It uses Boolean logic, And, Or, phrase, and substring. Its main advantage is to allow scheduling searches in advance, for instance if one wants to monitor an on-going subject. It is also possible to save the results.

- **WebCompass** [10], like the others, uses several search engines to perform search. It is also possible to group search engines by categories. In addition, it uses an agent as a separate application outside the browser, in order to retrieve and index articles selected as a result of a previous search. The agent also performs searches automatically for you.

- **Copernic** [11] performs search on several search engines and presents the results on the fly. For each of them the title is displayed with a description and other information (URL, number of occurrences, etc.). Results are classified by pertinence and duplicates are automatically removed. Afterwards, it is possible to perform a search within the results.

3 AGENTS IN E-COMMERCE

To search information about products and prices, it is possible to use search engines with key words. Nevertheless, there exist also specialized portals for web shops and agents to compare prices. In reality, search engines only provide a list of results from the web sites that their crawler is authorized to access. One can distinguish two different technologies: the pull technology where the user will ask information to the agent by using key words, and the push technology where the agent will propose by itself information or products to the user. Programs implementing the pull system are called buying agents and programs using the push system are called selling agents.

Buying agents are controlled by the client and aim at facilitating the process of buying. Searching, identifying and checking a commercial offer is always a difficult task on internet. These systems do not use keywords like standard search engines but directly the product names and brand names. It can then check the availability of the product and propose a list of potential sellers. This list can be created and ordered according to the preferences that the user can specify. Here are some examples of agents using the pull system:

- **MySimon** [12] was one of the first propose a service to compare prices. The user selects a category and a product. It is possible to compare products with four criteria: the lower price, the most popular, the manufacturer and the name of the product. It is also possible to compare the price of the same product in several different chops.

- With **Kelkoo** [13] it is also possible to choose a product in one category, to specify the model, the brand and the range for the price. In addition it is also possible to search prices for trips by plane, insurance and second hand products.

- **BargainFinder** [14] is specialized in the music domain. Given the name of an album and the name of the artist, it can find the prices and sellers among a list of 10 partners. It is then possible to compare the prices and order them.

- **Bargainbot Agent** [15] works similarly with books. It uses ten bookstores, including Amazon, WordsWorth, and Books.com, etc. With the name of the book and the name of the author provided, it contacts directly the bookstores and presents the results.

Selling agents systems are able to manage potential clients and to analyze their expectations. One of the best examples of agents using the push system is profiling agents. They establish a profile of the user in order to refine their search when they want to propose a product. The profile is updated after each transaction. They can be used in many domain such as selling airplane tickets, music, books, etc. The system presents products to the client and sometimes can even make the transactions. It is also possible for the client to register as a potential buyer on a web site and then agents search this database of users to find the most appropriate clients for their products. The client is then treated as a buying agent and can communicate with the selling agent to negotiate a possible transaction.

- **Firefly** [16] was created by Patty Maes and served as a model for several other systems. Initially, Firefly was used in the domain of selling music. The user is invited to evaluate a product, then the system search into its knowledge base in order to find other users with similar taste. The agent is then able to suggest new choices based on the taste of the others users. The more products are reviewed, the better are the suggestions.

- **Acheter moins cher** [17] searches and references the products of on-line shops. It is possible to compare prices but also to receive alerts when the price of one product is getting down.

- **Google** [18] has introduced the concept of **adsense**. The owner of a Web site can install the system from the search engine and receives advertising links that are adapted to the content of the Web site. If a visitor clicks on one link then the owner receives money. With this system Google can share some of its revenues with its partners.

4 CHATTERBOTS

A chatterbot is literally a robot that can chat with you. The first chatterbot was created in 1966 by Dr. Jozeph Wizenbaum from the MIT. He named it Eliza and it has the goal to act as a psychologist. Eliza was reformulating sentences from the user into questions to encourage the user to give more explanations infinitely. Since then many other systems have been developed and it is more and more often to find this kind of application on web sites to guide the user through its search or to help him finding information. Here are few descriptions of such systems:

- **A.L.I.C.E** [19] is a chatterbot using AIML (Artificial Intelligence Markup Language), which is an XML-compliant language to encode knowledge. This language defines pairs of questions/answers where the dialogue generation system is searching answers according to the question asked by the user. It is based on pattern-matching where patterns can be organized into categories. This technology works pretty well but depends a lot on the quality of the knowledge base that is given to the program.

- The **Billy** [20] project resulted in a chatterbot that uses natural language processing and generation. It is able to generate its own language, based on rules it has learned from natural language analysis. This system contains no pre-programmed language. Billy is also able to learn facts from humans and then answer questions about these facts. It has a special module to teach the system from text files. It has also a special feature that allows recognizing who is talking just by looking at the sentences. Billy can also answer basic arithmetic questions. Any of the basic operations can be used, plus exponents, and any level of parenthesization.

- **Corby** [21] is a language independent chatterbot. Its purpose is to simulate human verbal behaviour. It is based on a very simple stimulus-response model. The stimulus consists in a statement provided by the user, which causes

Corby to provide an appropriate response. Corby learns from the normal interaction with its users. The basic learning model uses a pair of paragraphs where one of them constitutes the stimulus and the other is the appropriate response to that stimulus. This can be done automatically during normal system use; in this case Corby will consider any statement input by the user as the appropriate response to its previous production. You can also submit text or HTML files for Corby to learn from, in an autonomous way.

6 CONCLUSION

The agent technology is a very active and promising area with a lot of conferences and journals covering all different aspects of the discipline, involving a lot of people and institutions. However it is still hard to find a real leader when the actors are mixed between big companies, small companies and even the free software community. Except information agents there are only few mature projects, mainly because of security problems restricting the mobility of the agents.

Concerning information agents, the analysis [22] shows that most of the web users prefer search engines to agent-based systems. However, people from industries evaluate and experiment more agent systems in order to find a performant system to monitor specific information on the web automatically. 71% of this group has downloaded an agent and 40% have bought at least one product, in contrary to the people in universities. These tools have a real potential. Their main problems are their complexity and low speed, which hardly compensate the advantages that they can bring. Some of them like Webseeker, Metacrawler and Autonomy offer powerful techniques for search for instance allowing queries in natural language or using a combination of several operators.

Agents in e-commerce have problems with both buyers and sellers. Sellers are usually afraid that the results of the agents will not reflect exactly the specificities of their products. On the other hand buyers would want more confidentiality, especially for payment and also more complete information on the products when the list is displayed in order to choose or compare them.

Chatterbots are also a promising topic which drains a lot of interest within the community. However their efficiency is still limited and most of them are still based on patter-matching techniques, which do not allow reasoning or any kind of intelligence. There are attempts to build more "intelligent" [23] systems but they remain experimental and are developed mainly inside universities or research institutions.

Even if these systems present some problems, it is obvious that they will evolve and the agent technology will expand even more in the next decades. Their communication and collaboration skills make the agents the perfect platform for future applications in distributed environments, e-commerce and search of information.

References

[1] J. Ferber. Multi-Agent System: An Introduction to Distributed Artificial Intelligence. *Addison Wesley Longman*. 1999.

[2] M. Gams. Intelligent assistants to the rescue, *V: 4th World Multi-Conference on: Circuits, Systems, Communications and Computers*, 2000.

[3] DogPile - http://www.dogpile.com/

[4] Ixquick - http://www.ixquick.com/

[5] Metacrawler - http://www.metacrawler.com/

[6] Vivisimo - http://vivisimo.com/

[7] Findforward - http://www.findforward.com/

[8] Autonomy - http://www.agentware.com/index.html

[9] Webseeker- http://www.bluesquirrel.com/products/webseeker/

[10] Webcompass - http://www.quarterdeck.com/

[11] Copernic - http://www.copernic.com/

[12] Mysimon - http://www.mysimon.com/

[13] Kelkoo - http://www.kelkoo.co.uk/

[14] Bargainfinder - http://www.bargainfinder.com

[15] Aoun B., "Agent Technology in Electronic Commerce and Information Retieval on the Internet", *In Proceedings of AUSWEB96*, 1996.

[16] U. Shardanand and P. Maes, Social Information Filtering: Algorithms for Automating Word of Mouth, *In Proceedings of the CHI-95 Conference*, Denver, CO, ACM Press, May 1995.

[17] Acheter-moins-cher- http://www.acheter-moins-cher.com/

[18] Adsense - https://www.google.com/adsense/

[19] A.L.I.C.E. - http://www.alicebot.org/

[20] Billy- http://www.leedberg.com/glsoft/billyproject.shtml

[21] Corby - http://futalgo.planetaclix.pt/corby/index.htm

[22] Wisdom J. R. - Les agents intelligents sur Internet : enjeux économiques et sociétaux. *Thesis*. 2005. http://pastel.paristech.org/bib/archive/00001548/01/thesis.pdf.

[23] Gams M. - Weak intelligence: Through the principle and paradox of multiple knowledge, *Advances in computation: Theory and practice*, Volume 6, Nova science publishers, inc., 2001.

USING BI-SETS THAT CHARACTERIZE BI-PARTITIONS AS FEATURES FOR CLASSIFICATION: AN APPLICATION TO MICROARRAY DATA ANALYSIS

Ivica Slavkov[1], Ruggero Pensa[2], Sašo Džeroski[1]

1. Department of Knowledge Technologies, Jožef Stefan Institute
Jamova 39, SI-1000, Ljubljana, Slovenia
{Ivica.Slavkov,Saso.Dzeroski}@ijs.si
2. INSA Lyon, LIRIS CNRS,
UMR 5205 F-69621, Villeurbanne cedex, France
Ruggero.Pensa@insa-lyon.fr

ABSTRACT

As part of the efforts for building a unified Inductive Databases (IDBs) framework, an important step would be to find a way to combine discovered local patterns from the data with global models of predictive nature. In this paper, we investigate the possibility of using bi-sets (local patterns) as features during classification. When searching for bi-sets from Boolean data, despite reasonable frequency constraints, a large number of sets are usually generated. In order to discern which of these bi-sets could be potentially useful as features for classification, we are using a scoring function which includes as parameters the bi-sets coverage and size. After a feature construction process, we perform an experimental evaluation on Huntington's disesase (HD) microarray data. We apply Predictive Clustering Trees for the problem of distinguishinh between HD and healthy subjects and also for determining the stage of the development of the disease.

1 INTRODUCTION

A recent emerging area in data mining are Inductive Databases (IDBs), which offer a database perspective on the process of knowledge discovery. IDBs contain not only data, but also patterns. They can be either local patterns (e.g., frequent itemsets), which are of descriptive nature, or global models (e.g., decision trees), which are generally of predictive nature. The idea behind IDBs is that data and patterns (models) are handled in the same way and the user can query and manipulate the patterns (models) of interest by means of a query language [4] As part of this general framework, in this paper we are exploring the use of bi-sets (as local patterns) for classification purposes (as global models). We first perform a feature construction procedure and test the performance of these features by constructing decision trees. The data that was used for testing is Huntington's disease microarray data, which was previously discretized i.e. binarized.

This paper is organized as follows. In Section 2 we describe the dataset and the discretization technique that was used. Section 3 gives an overview of the methodology, including a short definition of bi-clusters and bi-sets followed by the feature scoring and selection process. Section 4 concerns the experimental design and results. Finally, in Section 5 we give conclusion and discussion of the obtained results.

2 DATA DESCRIPTION AND PREPROCESSING

2.1 Huntington's disease microarray data

Huntington's disease (HD) is an autosomal dominant neurodegenerative disorder characterized by progressive motor impairment, cognitive decline, and various psychiatric symptoms, with the typical age of onset in the third to fifth decades [1]. It is caused by the expansion of an unstable triplet repeat in *huntingtin* gene, which encodes for the ubiquitously distributed huntingtin protein. The microarray data is from Slovene patients and it consisted of three different types of samples. The first two types are samples from HD patients, which are in two distinct stages of the disease: presymptomatic and symptomatic. The third type are control (healthy) subjects. All together, there were 24 samples of which: 9 presymptomatic, 5 symtomatic (14 HD) and 10 control. For each sample the expression levels for 54.675 probes from an Affymetrix HG.U133A 2.0 chip were measured. The expression levels were obtained by using the MAS 5.0 software.

2.2 Data preprocessing

The first step of the data preprocessing was filtering out the measured microarray transcripts which could be considered as unreliable. This was a simple elimination of genes, which under all experimental conditions had signal strength less than 100. The number of genes was reduced to 8910. Furthermore, there was need for discretization of the numerical data and converting it into a Boolean format.

After the discretization each gene had three possible values: overexpressed, normaly expressed and underexpressed. We had two threshold for discretization of the values of each gene. Values under threshold 1 were considered as underexpressed, values above threshold 2 were overexpressed and the rest were normally expressed. We tried different values of the two threshold and discretized the data several times. We assessed which threshold values were optimal by using the score described in [8].

3 METHODOLOGY

3.1 Predictive Clustering Trees (PCTs)

Decision trees are usually considered for classification purposes. Each tree consists of three elements: internal nodes, branches and leaves. The internal nodes are labeled with some attribute (variable name) and each branch is labeled with a predicate that can be applied to the attribute associated with the parent node. The leaves however, are labeled with a class. Following the branches from the root to a leaf gives sufficient conditions for classification (Figure 1).

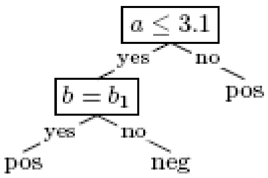


Figure 1: *A typical classification tree with classes "pos" and "neg"*

An alternative view of decision trees is that they correspond to the concept of hierarchical clustering [2,10]. Each node (and leaf) corresponds to a cluster and the tree as a whole represents a kind of taxonomy or hierarchy. Thus we can use the concept of **TDIDT** (Top-Down Induction of Decision Trees) for inducing clustering trees. We assume that two types of functions exist. A prototype function, which is used to get the best description of the members of a cluster, and a distance function for measuring the distance between prototypes and also between members of the cluster and the prototype. This leads to a simple method for building trees that allow prediction of multiple target variables at once.
When inducing the clustering tree the TDICT (Top-Down Induction of Clustering Trees) algorithm uses as a heuristic the minimization of intra-cluster variance (and maximization of inter-cluster variance). The minimization of the intra-cluster variance means minimizing the average distance between the members of the cluster and the prototype, which describes it. Maximization of the inter-cluster variance maximizes the distance between the prototypes. At the end we get a clustering tree in which the top-level node corresponds to one cluster containing all of the data, which is recursively partitioned into smaller clusters while moving down the tree. The leaves of the clustering tree are clusters, but they also store information about the cluster prototype. Because in essence the prototype describes the cluster, it can also be considered as a prediction of the values in that cluster with a certain amount of error.

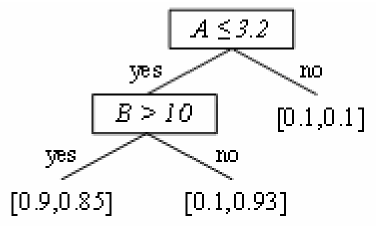


Figure 2: *A multi-objective regression tree with two predicted values in the leaves*

When PCTs are used for prediction of one target variable, they are actually regular decision trees. But their real advantage is when predicting multiple variables at the same time (multi objective classification or regression) shown in Figure 2.

3.2 Bi-sets and bi-clustering

When mining for local patterns in Boolean data (Figure 3) it is interesting to see not only which items appear together often, but also which items occur together in which situation (i.e. object). The sets which give us this information are called bi-sets[7]. One such bi-set from Figure 2 would be (*{o*1*; o*2*};{i*1*; i*2*}*).

	Items		
	i_1	i_2	i_3
o_1	1	1	1
o_2	1	1	0
o_3	1	0	1
o_4	1	0	0
o_5	0	1	0

Figure 3: *Boolean table*

Bi-clustering has been previously used for mining microarray data [3] and for discovering co-expressed sets of genes. The bi-clustering algorithms are performing clustering on the data by taking into account the rows as well as the columns. Esentially, given a set of m objects and n items (i.e. an m × n matrix), the bi-clustering algorithm generates subsets of objects that exhibit similar behavior across a subset of items, or vice versa.

3.1 Feature construction for classification

In order to use the information from the bi-sets and bi-clusters (local patterns) for constructing classifiers a process of feature construction is needed. The algorithm for feature construction [9] is given as:

Input: Boolean labeled data **D,** maximum number of features **f**
Output: List of features feature for classification **Lf**

1. **S**= empty; score of each bi-set
2. **Bp=** generate bi-partitions from labeled data **D**
3. **Bs** = generate bi-sets from labeled data **D**
4. ***Repeat***
5. **bs**=first bi-set from **Bs**
6. **Bs**=**Bs****bs**
7. **s=**score(**bs, Bp**)
8. **S=S** U **s**
9. ***Until*** **Bs** is empty
10. **S**=sort(**S**)
11. ***Repeat***
12. **l**=extract genes from concept **bs** with score **S**[**l**]
13. **Lf=Lf** U **l**
14. **l--**
15. ***Until*** **f** =/=0
16. Return **Lf**

The whole process of feature construction begins by generating the bi-partitions from the data. When generating the bi-partitions we constrain one of the dimesions of clustering to match to the classes. This means that the number of clusters is identical to the number of classes and members of one cluster are the same type of samples. Furthermore, we mine for all of the bi-sets from the Boolean data. We asses (score) each of the bi-set by taking into account its' relationship with each of the bi-clusters [9]. We have four main parameters which we take into account:

1. Coverage ratio *C:* number of covered class examples/number of class examples
2. Object Confidence *OC*: number of covered objects from the bi-partition /total number of covered objects by the bi-set
3. Item Confidence *PC:* number of covered items from the bi-partition /total number of covered items by the bi-set
4. Feature size *N* (i.e., maximum number of genes, N)

As the three parameters are between 0 and 1, we can calculate the score by:

$$score = \frac{\sqrt[3]{C \times OC \times PC}}{N};$$

After scoring each bi-set in terms of how good it describes a bi-cluster and sorting the bi sets by the score, we can extract the top *f* features where *f* is user defined. As features we consider the co-expressed genes extracted from the top scoring bi-sets.

4 EXPERIMENTAL DESIGN AND RESULTS

As a classification model we used ordinary decision trees and the previously described Predictive Clustering Trees (PCTs), which can predict several class values at the same time (Figure 4).

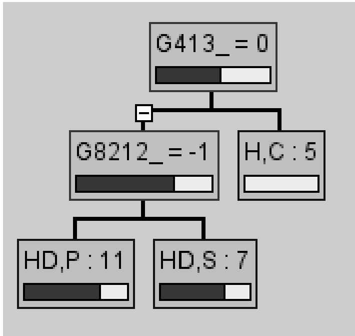


Figure 4: *Example of the constructed PCT*

Due to the small sample size we performed a leave-one-out cross validation We compared our results against those obtained by constructing predictive models on the original, numeric data. First we selected the "relevant" features from the training data and then we performed feature construction for the full set. We then built a model from the training data and tested the model on the left-out sample. The results are summarized in Table 1.

Type of model	Class	Class values	LOO-CV accuracy for numerical data	LOO-CV accuracy for discretized data
Classification tree	Huntington	{HD,C}	51%	75%
Classification tree	Stage	{P,S,C}	44%	62,5%
Predictive Clustering Tree	Huntington Stage	{HD,C} {P,S,C}	74% 74%	79,1% 62,5%

Table 1: Experimental results from the original and from the discretized data with features *f*=12

When constructing the features we selected number of features *f*=12. From the results the following can be seen: For ordinary decision trees, when using the discretized data and the feature construction process, there is a significant improvement in accuracy compared to the numerical data. The same is true when constructing PCTs, but only for the class "Huntington". For the class "Stage" the accuracy is worse compared to the numerical data, but it is the same as when constructing ordinary decision trees. This could mean that ordinary decision trees have a significant benefit when used in conjuction with the bi-sets feature construction process, while PCTs do not have the same improvement (leverage) of performance.

The set of genes that were identified as important when using the numerical data was different than the genes used as features from the discretized data. This was expected due to the different type of modeling the data, but also because of the biological complexity involved. The number of genes which are interconnected between themselves and have a role in the genesis of the disease is numerous. That is why we searched for the role of these genes in the Gene Ontology (GO) database. Although they were not the same set of genes, there was an overlap in some of their functions, which by previous studies were conected to the mechanism of Huntington's disease. This included disturbed transcriptional activities [5,11] and disturbed protein functioning [6].

5 CONCLUSION

An important aspect when working with high-dimensional data is selecting the features which are most informative (important). In this paper we are attempting to demonstrate the possibility of using a feature construction (selection) process for microarray data, which combines local pattern mining with global predictive modeling. The results showed that there could be two possible benefits when using the bi-sets feature construction process: first, the significant reduction of features (in this case from 8910 to 12) and second, the improvement of accuracy.

This scenario for analysis of microarray data can be further expanded towards any type of data. Further work would include testing this type of analysis to other type of data besides microarray and also in the direction of exploring other types of scenarios for analysis which combine different types of local patterns (association rules, frequent itemset) with predictive models.

References

[1] Borovecki et al. : Genome-wide expression profiling of human blood reveals biomarkers for Huntington's disease. In Proceedings of the National Academy of Sciences of the USA, August 2 2002, vol 102., no 31, p 11023-11028

[2] H. Blockeel, L. De Raedt and J. Ramon. Top-down induction of clustering trees. In Proceedings of the 15th International Conference on Machine Learning, p.55-63, 1998.

[3] Y. Cheng, G. M. Church. Biclustering of Expression Data Source. Proceedings of the Eighth International Conference on Intelligent Systems for Molecular Biology , p. 93 – 103, 2000

[4] L. De Raedt. A perspective on inductive databases. SIGKDD Explorations, 4(2):69-77, 2002.

[5] Dunah AW, Jeong H, Griffin A et al. Sp1 and TAFII130 transcriptional activity disrupted in early huntington's disease. Science, 2002; 296: 2238-43.

[6] Harjes P, Wanker EE. The hunt for huntingtin function: interaction partners tell many different stories. Trends Biochem Sci. 2003; 28 (8): 425-33.

[7] R. Pensa, J-F. Boulicaut. Boolean property encoding for local set pattern discovery: an application to gene expression data analysis. Local Pattern Detection. Springer-Verlag LNAI 3539, p. 115-134, 2005.

[8] R. Pensa, C. Leschi, J. Besson, J-F. Boulicaut. Assessment of discretization techniques for relevant pattern discovery from gene expression data. Proceedings of the 4th ACM SIGKDD Workshop on Data Mining in Bioinformatics BIOKDD'04 , 2004. pp. 24-30.

[9] R. Pensa, J-F. Boulicaut. From local pattern mining to relevant bi-cluster characterization. Proceedings of the 6th International Symposium on Intelligent Data Analysis IDA 2005, Madrid, Spain, September 8-10, 2005. Springer-Verlag LNCS Volume 3646, A. F. Famili, J.M. Pena, A. Siebes, J. Kok (Eds.), pp. 293-304, 2005

[10] J. Struyf and S. Dzeroski, Constraint based induction of multi-objective regression trees. In proceedings of the 4th International Workshop on Knowledge Discovery in Inductive Databases, pages 110-121. 2005.

[11] Sugars KL, Rubinsztein DC. Transcriptional abnormalities in Huntington disease. Trends in Genetics, 2003; 19: 233-238.

NAPOVEDOVANJE POJAVLJANJA PROMETNIH NESREČ V SLOVENIJI

Vladimir Slemenšek
Univerza v Ljubljani
Ekonomsko poslovna fakulteta
Kardeljeva ploščad 17, 1000 Ljubljana, Slovenia
Tel: +386 40 637165

e-mail: *vladimir.slemensek@email.si*

POVZETEK

V članku je predstavljeno iskanje povezave med pojavljanjem prometnih nesreč v Sloveniji in dejavniki, ki bi lahko na njih vplivali. To povezavo sem iskal s pomočjo inteligentnega sistema WEKA. Za pravilno napovedovanje so bili uporabljeni podatki o prometnih nesrečah v mesecu marcu leta 2004 in v mesecu marcu leta 2005. Pri delu z inteligentnim sistemom WEKA sem moral nato zmanjšati količino atributov na minimum, da sem lahko prišel do uporabnih rezultatov. Pri delu sem bil posebej pozoren na klasifikacijske točnosti pri uporabi učne množice, pri uporabi 10- kratnega prečnega preverjanja in pri uporabi 60 % razdelitve. Rezultati so bili presenetljivi, saj so kot ključna dejavnika izpostavili gostoto prometa in alkotest. Zaenkrat ti dobljeni rezultati v Policiji niso uporabni kot dobra podpora pri odločanju o učinkovitem pristopu k zmanjševanju števila mrtvih v prometnih nesrečah. Lahko se pa zgodi, da bo Policija kdaj kasneje uporabila kak zmogljivejši inteligentni sistem.

1. UVOD

Hiter razvoj računalništva in informatike je povzročil, da že skoraj pri vseh oblikah delovanja uporabljamo računalniške programe, ki povečujejo učinkovitost in natančnost našega dela. Posebej vznemirljivo je uvajanje inteligentnih sistemov. V Policiji imamo geografski informacijski sistem – GIS, ki nam služi kot sistem za podporo pri odločanju. Toda trenutni sistem, ki je v operativni uporabi, vsebuje samo analize podatkov iz preteklih let, nima pa razvitega sistema, ki bi lahko iz teh podatkov napovedoval trend pojavljanja prometnih nesreč v prihodnosti. Reagiralo se je samo na dana dejstva, ki so nam jih izkazovale narejene analize. Glede prihodnosti pa smo vedno tipali v temi. Inteligentni sistem bi verjetno bil Policiji v zelo veliko pomoč pri uresničevanju programa za zmanjševanje števila smrti v prometnih nesrečah.

Tako se mi je porodila ideja, da ugotovim ali lahko s pomočjo inteligentnega sistema WEKA napovem trend pojavljanja prometnih nesreč v prihodnosti.

Pristopil sem k izdelavi seminarske naloge, s katero sem želel ugotoviti, kateri od zabeleženih dejavnikov mi lahko ponudi uspešno napoved prometnih nesreč v prihodnosti. Pri izdelavi sem uporabil podatke o prometnih nesrečah v mesecu marcu leta 2004 in v mesecu marcu leta 2005. Pomembno se mi zdi poudariti, da je pravilno napovedovanje možno le, če lahko s podatki iz prejšnjega obdobja natančno napoveš prometne nesreče za naslednje enako obdobje. Sklepal sem, da bom imel v tem primeru podobne dejavnike, ki bi lahko bolj prišli do izraza (letni čas, prazniki, migracije…).

2. Inteligentni sistem in prometne nesreče

2.1 Priprava podatkov

Želel sem ugotoviti povezavo med pojavljanjem prometnih nesreč in dejavniki, ki bi lahko na njih vplivali. Zato sem poiskal zbrane podatke o prometnih nesrečah, ki so se zgodile v mesecu marcu leta 2004 ter v mesecu marcu leta 2005. Ti podatki so bili zbrani s pomočjo policistov, ki so jih zabeležili na kraju dogodkov in posredovali v podatkovno bazo na centralnem računalniku. Tam se je podatkom dodelilo x in y koordinate in jih programsko ustrezno pripravilo za prostorske analize v geografsko informacijskem sistemu Policije.

Predvideval sem, da na pojavljanje prometnih nesreč vplivajo naslednji atributi:

- X in Y koordinata
- cesta
- odsek
- kraj nesreče
- datum
- ura
- dan v tednu
- vzrok
- tip nesreče
- posledice
- vremenski pogoji
- gostota prometa
- površina cestišča
- stanje cestišča
- spol povzročitelja

- starost povzročitelja
- vozniški staž povzročitelja in
- prisotnost alkohola pri povzročitelju.

Originalne podatke sem pridobil na Generalni policijski upravi v operativnem komunikacijskem centru, kjer pripravljamo prostorske analize prometnih nesreč za geografski informacijski sistem Policije. Podatke sem iz DBASE tabele pretvoril v EXCEL-ovo tabelo.

2.2 Obdelava podatkov s programom WEKA

Za obdelavo podatkov sem uporabil program WEKA (Waikato Enviroment for Knowledge Analysis), ki je znan kot orodje za strojno učenje. Napisan je bil v programskem jeziku Java (dobiti se ga da na spletnem naslovu: http://www.cs.waikato.ac.nz/ml/weka). Ker WEKA uporablja ARFF format, sem moral moje podatke ustrezno pretvoriti. Podatke sem najprej iz Excela uvozil v Access, od tam pa sem jih izvozil v CSV (Comma delimited) format. Ugotovil sem namreč, da mi izvoz Excel CSV povzroči, da so podatki med seboj ločeni s podpičji, namesto z vejico, kot to zahteva WEKA pri uvozu CSV datotek. Žal sem imel težave tudi z vejicami v CSV datoteki, zato sem v Accessu podatke izvažal v CSV datoteko, kjer so bili podatki med seboj ločeni s tabulatorji. WEKA je takšen format podatkov sprejela brez težav. V WEKI sem nato podatke izvozil v ARFF datoteko, s katero sem delal v nadaljevanju. Za prometne nesreče v marcu leta 2004 sem imel zbranih 3464 primerov. Za mesec marec v letu 2005 sem imel zbranih 2308 primerov prometnih nesreč. Originalni podatki so imeli 24 atributov, od katerih je bilo 11 numeričnih in 13 nominalnih atributov. V programu WEKA sem kasneje pri klasificiranju podatkov ugotovil, da imam absolutno preveč atributov. Generirala so se prevelika drevesa, kar je povzročilo, da se je program zaradi preobsežnega preračunavanja in premajhnega spominskega prostora obesil. Zato sem moral atribute, za katere sem menil, da jih lahko pogrešim, odstranil. Odstranil sem atribute:

- X in Y koordinata
- cesta
- odsek
- datum
- posledice
- vzrok nesreče
- vremenski pogoji
- število hudih poškodb
- število lahkih poškodb
- število ostalih poškodb
- skupno število poškodb
- starost povzročitelja in
- vozniški staž povzročitelja.

Pozornost sem usmeril na pojavljanje števila smrtnih nesreč glede na kraj nesreče, uro nesreče, dan v tednu, tip nesreče, gostoto prometa, površino cestišča, stanje cestišča, spol povzročitelja in alkotest (Slika 3). Atribut Ura nesreče sem poenostavil s tremi vrednostmi: Ponoči, Dopoldne in Popoldne. Tabeli za obe obdobji sem združil v eno tabelo, v kateri so se na njenem začetku nahajali podatki za marec 2004, v drugem delu tabele pa podatki za marec 2005.

Pri obdelavi podatkov sem ugotovil, da je najbolje uporabljati odločitvena drevesa (klasifikacijski algoritem C4.5 - J48). In sicer sem klasificiranje podatkov primerjal z različnima modeloma minNumObj =1 in minNumObj =3.

3. REZULTATI

Pri vseh primerjanjih sta mi izstopala dva atributa. To sta bila Gostota prometa in Alkotest. Primerjave sem delal na učni množici, pri 10 – kratnem prečnem preverjanju in pri 60% razdelitvi (60% Percentage split). 60% razdelitev sem uporabil zato, ker mi podatki za marec 2004 predstavljajo ravno prvih 60 % vseh zbranih podatkov v skupni tabeli. Pri pregledu rezultatov sem prišel do zanimivih rezultatov. Ugotovil sem, da je bila največja klasifikacijska točnost pri Gostoti prometa, ko sem uporabil učno množico (Tabela 1).

Zanimivo je bilo to, da 10 – kratno prečno preverjanje ni dalo tako visoke klasifikacijske točnosti. Vrednosti so bile nekje med točnostmi učne množice in 60% razdelitve (Tabela 2).

Za atribut Alkotest sem dobil največjo klasifikacijsko točnost pri 60% razdelitvi (Tabela 3).

Klasifikacijska točnost je takrat obakrat znašala nad 85,5 %. Pri tem preverjanju je bila klasifikacijska točnost za Gostoto prometa najnižja, okoli 57,3 %.

Za oba atributa je program WEKA zgradil odločitveno drevo. Zaželjeno je bilo, da bi bilo drevo čim manjše, vendar se to ni zgodilo pri vseh atributih. Pri nekaterih atributih je program naredil tako ogromna drevesa, da mu je zmanjkalo spomina za preračunavanje in se je program zaradi tega obesil. Pri drugih atributih pa drevesa kljub mojim pričakovanjem ni zgradil.

Najbolj uporabni rezultati so bili dobljeni pri uporabi modela minNumObj = 3. Takrat je imelo odločitveno drevo za atribut Gostota prometa 21 listov in 25 vozlišč. Pri atributu Alkotest se s spreminjanjem modela minNumObj globina drevesa ni spremenila. Vedno je imelo 3 liste in 4 vozlišča.

Atribut	Učna množica (minNumObj = 1)	Št. listov	Št. vozlišč	Učna množica (minNumObj = 3)	Št. listov	Št. vozlišč
Gostota prometa	**59,4%**	75	88	**59,1%**	21	25
Alkotest	85,0%	3	4	85,1%	3	4

Tabela 1: Klasifikacijska točnost pri uporabi učne množice

Atribut	10-kratno prečno preverjanje (minNumObj = 1)	Št. listov	Št. vozlišč	10-kratno prečno preverjanje (minNumObj = 3)	Št. listov	Št. vozlišč
Gostota prometa	58,3%	75	88	58,5%	21	25
Alkotest	85,1%	3	4	84,9%	3	4

Tabela 2: Klasifikacijska točnost pri uporabi 10- kratnega prečnega preverjanja

Atribut	60 % razdelitev (minNumObj = 1)	Št. listov	Št. vozlišč	60 % razdelitev (minNumObj = 3	Št. listov	Št. vozlišč
Gostota prometa	57.3%	75	88	57.3%	21	25
Alkotest	**85.9%**	3	4	**85.5%**	3	4

Tabela 3: : Klasifikacijska točnost pri uporabi 60 % razdelitve

4. ZAKLJUČEK

Program WEKA kot inteligentni programski sistem je uporaben, če so na voljo pravi vhodni atributi. V tem primeru je bilo na voljo ogromno atributov v zvezi s prometnimi nesrečami.

Prvi poskusi so bili usmerjeni na iskanje klasifikacijske točnosti na celotnih, neokrnjenih podatkih, vendar je program WEKA zaradi prevelikega števila atributov delal prevelika odločitvena drevesa. Pri tem mu je zmanjkalo spomina za preračunavanje klasifikacijske točnosti in se je enostavno – obesil. Zato je bilo v naslednjih poskusih število atributov skrčeno s 24 na 10. V teh desetih atributih je bila ohranjena osnovna informacija o smrtnih prometnih nesrečah (kraj nesreče, ura, dan v tednu, tip nesreče, gostota prometa, površina in stanje cestišča, spol, alkotest in število mrtvih). Da bi dobili čimbolj uporabne rezultate, sem poenostavil atribut Ura na vrednosti Dopoldne, Popoldne in Ponoči.

Rezultati so pokazali, da sta pri napovedovanju prometnih nesreč s smrtnim izidom ključnega pomena dejavnika Gostota prometa in Alkotest, kar je zanimiv rezultat.

Pri obeh dejavnikih je bila izračunana dokaj visoka klasifikacijska točnost. Odločitveni drevesi sta bili majhni. Škoda je le, da se izrisanih dreves ni dalo izvoziti v kako grafično datoteko, da bi se lahko liste in vozlišča dreves bolje pregledovalo. Pri izrisu odločitvenih dreves v drevesih ni bilo vključenih vseh atributov. Zaradi tega se mi dobljeni rezultati zdijo vprašljivi, saj je bilo upoštevano premalo atributov in njihova teža v izračunu ni razvidna. Zato bi manjši klasifikacijski točnosti navkljub uporabil za napovedovanje atribut Gostota prometa.

Pri dogodku, kot je prometna nesreča, je vpleteno ogromno dejavnikov in se jih pri napovedovanju naslednje nesreče ne da kar tako izključiti. Zaradi tega dobljeni rezultati v Policiji niso uporabni kot dobra podpora pri odločanju o učinkovitem pristopu k zmanjševanju števila mrtvih v prometnih nesrečah.

V programih, kot je WEKA, se skriva ogromen potencial. Lahko se zgodi, da se bo nekoč kak zmogljivejši inteligentni programski sistem uveljavil tudi v Policiji Slovenije.

5. LITERATURA

[1] Matjaž Gams: Predavanja Inteligentni programski sistemi 2005/2006

[2] Robič, T.: Strojno učenje s programom WEKA; Odsek za inteligentne sisteme; Inštitut „Jožef Stefan"; [URL: http://ai.ijs.si/Mezi/pedagosko/WEKATea.pdf], 01.06.2005.

[3] Suran Goonatilake, Philip Treleaven: Intelligent Systems for Finace and Business.

[4] Adrian A. Hopgood: Intelligent Systems for Engineers and Scientists.

[5] Efraim Turban: Decision support systems and intelligent systems.

ANALIZA PROMETNIH NESREČ S PROGRAMOM WEKA

Peter Smole, študent
Univerza v Ljubljani, Ekonomska fakulteta
e-mail: *peter.smole@email.si*

POVZETEK

Vsako leto se na naših cestah srečujemo z velikim številom prometnih nesreč. Za zmanjšanje njihovega števila in posledic lahko največ storimo s preventivno dejavnostjo. V uvodu tega prispevka lahko najdemo primerjalne statistične podatke, izpostavljena pa so tudi nekatera vprašanja, ki se postavljajo pri snovanju preventivne dejavnosti. Drugo poglavje na kratko predstavi faze odkrivanja znanja iz podatkov. V naslednjem poglavju je na primeru prometnih nesreč, ponazorjeno, kako si lahko s sodobnimi programskimi orodji in dovolj zmogljivo računalniško podporo pomagamo najti odgovore na vprašanja, ki so omenjena v uvodu. V zaključku pa lahko najdemo nekaj dejstev in misli, ki se porajajo pri vključevanju odkrivanja znanja iz podatkov v redno delo Policije.

1 Uvod

Stanje na področju prometne varnosti v Sloveniji prav gotovo ni takšno, kot bi si ga želeli. Vsako leto se srečujemo z velikim številom prometnih nesreč na naših cestah, katerih posledice so tako materialna škoda na vozilih in prometni infrastrukturi kot tudi poškodbe in v najhujših primerih celo smrt oseb, ki so v njih udeležene. Glede na leto 2004 se je v letu 2005 sicer res zgodilo za 31,1% manj prometnih nesreč vendar s tem še zdaleč ne smemo biti zadovoljni. Kot kaže je bil to le kratkoročni trend, vzrok katerega bi bilo zanimivo odkriti, saj se je v prvih štirih mesecih letošnjega leta zopet pripetilo več prometnih nesreč kot v enakem obdobju lanskega leta. Dejstvo je, da je s prvim januarjem leta 2005 stopil v veljavo nov Zakon o varnosti cestnega prometa, ki je prinesel korenite spremembe na področju postopkov o prekrških in nenazadnje tudi višje kazni za kršitelje. To bi bil lahko eden izmed vzrokov za tako velik upad števila prometnih nesreč napram letu 2004. Glede na zadnje trende, ko število prometnih nezgod zopet narašča, pa je zelo verjetno da se bodo uresničile napovedi o kratkoročnem učinku tega zakona. Eden izmed načinov reševanja problematike v cestnem prometu je tudi preventiva. Pri organiziranju preventivnih dejavnosti pa se pojavijo številna vprašanja, kot so: Na katero populacijo udeležencev v cestnem prometu vplivati? Kako vplivati na neko določeno populacijo udeležencev v cestnem prometu? Kako spremeniti prometno ureditev na črnih točkah, da bodo bolj varne? Kaj so vzroki za nastanek črnih točk? Prav pri iskanju odgovorov na tovrstna vprašanja, pa naj se zdi še tako čudno, si lahko pomagamo tudi z računalnikom. Danes je na voljo veliko število programskih paketov za odkrivanje znanja iz podatkov. Eden takšnih je tudi program Weka. Z njegovo pomočjo sem poizkušal ugotoviti vpliv posameznih atributov (vremenske razmere, stanje prometa, stanje vozišča, ipd.) na posledice prometne nesreče in priti do zanimivih pravil.

2 Odkrivanje znanja v podatkih

Še ne dolgo nazaj so se računalniki uporabljali predvsem za avtomatizacijo opravil ter zbiranje, obdelavo in hranjenje podatkov. Danes pa se je obseg njihove uporabe razširil tudi na procesiranje znanja. Če združimo človeško inteligenco in računalniško hitrost dobimo novo kvaliteto. To je tudi osnovna zamisel inteligentnih sistemov (Gams, 2004). Informacijska tehnologija nam tako danes s številnimi možnostmi pridobivanja, obdelave in hranjenja podatkov omogoča, da iz podatkov odkrijemo doslej nepoznane vzorce in zakonitosti. To novo znanje lahko uporabimo npr. za izboljšanje poslovanja in odločanja, za napovedovanje prihodnjih dogodkov in podobno (Bohanec, 2006). Odkrivanje znanja iz podatkov (knowledge discovery from data) je netrivialen proces odkrivanja implicitnega, doslej neznanega in potencialno uporabnega znanja iz podatkov. Faze tega procesa so: priprava podatkov, podatkovno rudarjenje ter interpretacija, vrednotenje in predstavitev dobljenega rezultata.

3 Odkrivanje znanja v podatkih s programom WEKA

Programski paket Weka (Waikato Environment for Knowledge Analysis) predstavlja enoten programski vmesnik različnim algoritmom za strojno učenje, vsebuje pa tudi obsežno zbirko teh algoritmov. Nudi štiri delovna okolja: simple CLI, explorer, experimenter, knowledge flow (Witten in Frank, 2005). Za potrebe tega prispevka sem uporabil le explorer, ki je grafični uporabniški vmesnik, v katerem lahko uporabljamo vse glavne pakete Weke, t.j. filters (filtri, predprocesorji), classifiers (klasifikatorji), clusters (razvrščanje v skupine), associations (povezovalna pravila) in podobno.

3.1 Priprava podatkov

Prva faza pri iskanju znanja v podatkih je seveda priprava podatkov. Prvi problem pri pridobivanju podatkov je njihova razpršenost. Podatki se ponavadi nahajajo v različnih podatkovnih bazah različnih vrst, datotekah in drugih zunanjih virih. Podatke iz vseh teh virov je zato potrebno zbrati skupaj v neko celoto (Bohanec, 2006). Ker pa se strukture podatkov iz posameznih virov razlikujejo, jih je potrebno »spraviti na skupni imenovalec«. Ponavadi se ta problem rešuje s podatkovnim skladiščem in ETL procesom, ki skrbi za prečiščevanje in integracijo podatkov. Podobno rešuje omenjeni problem tudi Policija. Podatki o prometnih nesrečah se zbirajo v »živih« podatkovnih bazah, ki se nato prepisujejo v podatkovno skladišče. Pridobivanje podatkov, ki sem jih uporabil za pripravo tega prispevka, je bilo zato mnogo lažje. Podatki so namreč že prečiščeni in urejeni in imajo enotno strukturo. Vendar pa oblika nekaterih podatkov, ki se hrani v podatkovnem skladišču, ni najbolj primerna za namen tega dela. Poleg tega je atributov mnogo preveč, kot jih dejansko potrebujemo. Zato je bilo potrebno opraviti tudi selekcijo in transformacijo podatkov. Pri snovanju tega prispevka sem uporabil tri nabore podatkov. Na prometne nesreče sem namreč hotel pogledati s treh zornih kotov. Prvič so bili v ospredju sami udeleženci (osebe) oz. atributi, ki so z njimi povezani. Drugič so me zanimala vozila, ki so bila udeležena v prometnih nezgodah, predvsem njihova starost (varnost) in vrsta vozila. Kot tretjič pa so me zanimali od posameznika »neodvisni« atributi, kot so vremenske razmere, razmere na cestišču, stanje prometa in podobno. Po opravljeni selekciji in transformaciji sem dobil tri relacijske sheme:

PROMETNA NESREČA – UDELEŽENEC (spol, starost, staž, udeleženec, povzročitelj, pas, alkohol, poškodba)

PROMETNA NESREČA – VOZILO (vrstav, starost, tipn, poškodba)

PROMETNA NESREČA – OSTALO (vzrok, tip, vreme, promet, vrstav, stanjev, naselje, kraj, poškodba)

3.2 Obdelava podatkov s programom WEKA in interpretacija rezultatov

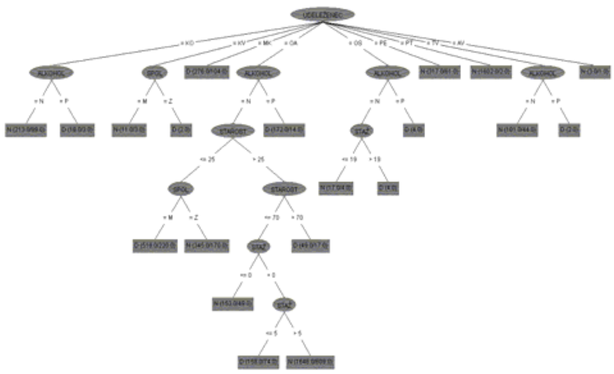
Po opravljeni pripravi podatkov sem se lotil »rudarjenja« na vsakem izmed treh naborov podatkov posebej. Pri tem sem uporabil Weka Explorer, ki je eden izmed delovnih okolij Weke.

3.2.1 Prometna nesreča – udeleženec

Pri prometnih nesrečah je ponavadi ena izmed večjih težav ugotoviti povzročitelja, zato me je zanimala klasifikacija udeležencev na povzročitelje in nepovzročitelje. Pri tem sem se omejil le na tiste prometne nesreče, ki so imele za posledico telesne poškodbe ali smrt in so se zgodile med 1.1.2006 in 31.5.2006. V ta namen sem uporabil klasifikacijski algoritem J48 z naslednjimi nastavitvami: ConfidenceFactor = 0.25, MinNumObj = 2, NumFolds = 3.

Kot rezultat, z uporabo 10-kratnega prečnega preverjanja, sem dobil drevo, prikazano na sliki 1.

Slika 1: Klasifikacija udeležencev prometnih nesreč



Dobljeno drevo ima 32 vozlišč, od tega 20 listov. Klasifikacijska točnost pri 10-kratnem prečnem preverjanju je 72.3222%.

Kot nepovzročitelji so bili klasificirani vozniki avtobusov, potniki v vozilih (pričakovano) ter pešci. Kot povzročitelji pa vozniki motornih koles. Pri ostalih udeležencih pa je bila klasifikacija odvisna še od drugih atributov. Zanimivo je, da je bil pri voznikih kombiniranih vozil ključen atribut, ki je odločil ali je voznik povrzočitelj ali ne, spol voznika. Če je bil spol moški, potem je bil voznik klasificiran kot nepovzročitelj, sicer pa kot povzročitelj. Pri ostalih vrstah udeležencev je bil odločujoč atribut alkohol, malo manj pa starost, vozniški staž in spol. Če je bila vrednost alkohola pri udeležencu nad dovoljeno mejo, je bil udeleženec klasificiran kot povzročitelj. Povsem obratno kot pri voznikih kombiniranih vozil pa je pri voznikih osebnih avtomobilov (OA), ki so stari do 25 let. Moški v tej skupini so bili klasificirani kot povzročitelji, ženske pa kot nepovzročiteljice. Zanimivo je tudi, da so bili vozniki OA starejši kot 70 let klasificirani kot povzročitelji, pri mlajših pa je bil odločujoč atribut vozniški staž. Če je imel udeleženec manj kot 5 let vozniški izpit, potem je bil klasificiran kot povzročitelj, v nasprotnem primeru pa kot nepovzročitelj.

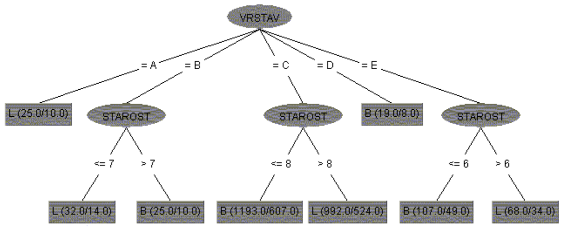
Rezultat uporabljenega klasifikatorja je že odgovoril na eno izmed vprašanj iz uvodnega poglavja tega prispevka in sicer na katero populacijo udeležencev vplivati pri preventivnih akcijah.

Na podoben način sem poizkušal ugotoviti tudi vpliv uporabe varnostnega pasu na težo poškodb, vendar nisem uspel priti do zadovoljivega rezultata. Drevesa, ki sem jih dobival s pomočjo klasifikatorja J48, so imela bodisi le eno vozlišče (vse je klasificiral v razred lažjih poškodb), ali pa se v drevesu atribut varnostnega pasu sploh ni pojavil. Eden izmed razlogov za neuspeh je mogoče dejstvo, da je delež uporabe varnostnega pasu (v naboru podatkov, ki sem jih imel) izredno velik (nad 90%). Podatkov o tem, kakšne bi bile posledice pri neuporabi, pa nisem imel.

3.2.2 Prometna nesreča – vozilo (drugi nabor podatkov)

Drugi nabor podatkov vsebuje podatke o vozilih, ki so bila udeležena v prometnih nesrečah od 1.1.2006 do 31.5.2006. Pri tem sem se omejil le na naslednje vrste vozil: motorna kolesa, kombinirana vozila, osebna vozila, avtobuse in tovorna vozila. V zadnjih letih postaja varnost vozila eden najpomembnejših atributov vozila. Prav zato sem poizkušal ugotoviti vpliv varnosti vozila na posledice prometne nesreče. Ker pa Policija ne zbira podatkov o varnosti vozila, sem se moral zadovoljiti le z atributom starost vozila. Tako sem poizkušal ugotoviti vpliv starosti vozila na posledice. V ta namen sem uporabil klasifikator J48 z naslednjimi nastavitvami: ConfidenceFactor = 0.25, MinNumObj = 20, NumFolds = 3. Pri nižjih vrednostih parametra MinNumObj sem dobil občutno prevelika drevesa, pri večjih vrednostih pa je bilo drevo že »preveč« porezano. Kot rezultat, z uporabo 10-kratnega prečnega preverjanja, sem dobil drevo s 47 vozlišči od tega 34 listov. Klasifikacijska točnost pri 10-kratnem prečnem preverjanju je 70.0252%. Za grafični prikaz je to drevo »preširoko«. Težava je v tem, da v korenu drevesa nastopa atribut TIPN (tip nesreče), ki ima 10 različnih vrednosti. Zaradi tega sem se za prikaz omejil le na poddrevo za čelna trčenja (glej Slika 2).

Slika 2: Poddrevo za čelna trčenja

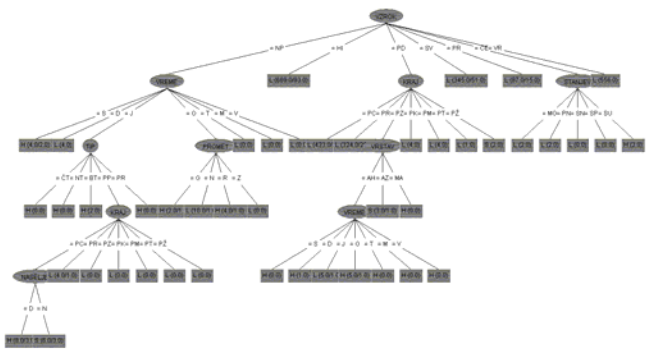


Pri čelnih trčenjih je klasifikator voznika in potnike na motornih kolesih klasificiral v razred poškodb, voznika in potnike v avtobusih pa v razred brez poškodb. Pri ostalih vrstah vozil je bil odločujoč atribut starost vozila. Pri osebnih vozilih je bila mejna vrednost 8 let. Če je vozilo mlajše kot 8 let, potem so udeleženci klasificirani v razred brez poškodb, sicer pa v razred poškodb. Pri tovornih vozilih mejna vrednost starosti vozila znaša 6 let. Pri kombiniranih vozilih je zgodba ravno obratna. Voznik in potniki so klasificirani v razred telesnih poškodb, če je vozilo mlajše kot 7 let, in v razred brez poškodb, če je vozilo starejše kot 7 let.

3.2.3 Prometna nesreča – ostalo (tretji nabor podatkov)

S tretjim naborom podatkov, sem poizkušal ugotoviti vpliv ostalih atributov (vremenske okoliščine, stanje in vrsta vozišča, lokacija nesreče in podobno) na klasifikacijo prometne nesreče. Zajete so bile vse prometne nesreče, ki so imele za posledice telesne poškodbe ali smrt in so se zgodile med 1.1.2006 in 31.5.2006. Tako kot v prejšnjih primerih sem uporabil klasifikator J48. S privzetimi nastavitvami je klasifikator vrnil drevo z le enim vozliščem. Vse nesreče je namreč klasificiral v razred lažjih telesnih poškodb. S spreminjanjem nastavitev (predvsem parametra confidenceFactor, ki sem ga nastavil na 0.5) sem dobil uporabnejše drevo (Slika 3).

Slika 3: Klasifikacija prometnih nesreč glede na ostale atribute (vreme, …)



Drevo, ki sem ga dobil ima 42 vozlišč, od tega 35 listov. Njegova klasifikacijska točnost pri 10-kratnem prečnem preverjanju znaša 89.4779%. V korenu drevesa nastopa atribut »vzrok prometne nesreče« in ker je drevo precej veliko, sem se za interpretacijo omejil le na tri vzroke in sicer: nepravilnost pešcev, odvzem prednosti in nepravilnosti na cestišču.

Če je bil vzrok prometne nesreče nepravilnost pešca, potem so bile nesreče, ki so se zgodile v snežnih razmerah, klasificirane v razred hudih telesnih poškodb. Pri jasnem vremenu je bila klasifikacija odvisna od lokacije, kjer se je zgodila nesreča. Če se je zgodila na cesti v naselju, je imela za posledico hudo telesno poškodbo, izven naselja pa smrt. Povoženja pešcev, ki so se zgodila na prehodih za pešce, so imela za posledico le lažje telesne poškodbe.

Pri odvzemih prednosti, so bile nesreče, ki so se zgodile na železniških prehodih, klasificirane kot nesreče s smrtnim izidom, kar je bilo tudi pričakovano. Če se je odvzem prednosti zgodil na prehodu za pešce (voznik ni upošteval prednosti pešca), potem je na klasifikacijo vplivala vrsta vozišča oz. podlage na vozišču. Pri gladki (spolzki) asfaltni podlagi so imele nesreče za posledico smrt, sicer (hrapav asfalt) pa hude telesne poškodbe.

Eden izmed vzrokov prometnih nesreč so tudi nepravilnosti na cestišču. Sem štejemo razne poškodbe na vozišču, poškodovano ali nedelujočo signalizacijo, napačne označbe in podobno. Zanimivo je, da je klasifikator uvrstil prometne nesreče, katerih vzrok so bile nepravilnosti na cestišču, in ki so se zgodile v suhem vremenu, v razred hudih telesnih poškodb, pri ostalih vremenskih okoliščinah pa v razred lažjih telesnih poškodb. Nepravilnosti na cestišču imajo očitno v suhem vremenu težje posledice kot npr. v dežju ali sneženju.

4 ZAKLJUČEK

Policija pri svojem vsakodnevnem delu zbira velike količine podatkov. V preteklosti in v nekaterih primerih še danes ti podatki služijo le kot evidenca dogodkov, da se ve kaj, kje in kdaj se je kaj zgodilo. Dejstvo je, da imajo podatki, ki se zbirajo le za takšen namen, majhno vrednost. Počasi so se na podlagi teh podatkov začele izvajati razne statistične obdelave, katerih rezultate se je uporabljalo predvsem za primerjave uspešnosti dela na posameznih področjih, redkeje pa za izboljšanje svojega poslanstva. S sodobnimi metodami in orodji za odkrivanje znanja iz podatkov pa lahko Policija to novo pridobljeno znanje učinkovitejše uporabi tudi za izboljšanje svojega dela, predvsem preventivnega. Na primeru prometnih nesreč sem poizkušal ponazoriti, kako si lahko s sodobnimi programskimi orodji in dovolj zmogljivo računalniško podporo pomagamo najti odgovore na številna vprašanja, ki se pojavljajo pri snovanju preventivnih dejavnosti. Problem, ki sem ga opazil tekom pisanja tega prispevka, je, da tak način iskanja koristnega znanja zahteva nekoliko drugačen pristop k delu, predvsem pa nova znanja. Bolj kot sama programska orodja je pomembno spoznati in razumeti metode ter podatke, ki so nam na voljo. Problem je tudi v kompleksnosti. Že v tako trivialnem primeru, kot so prometne nesreče, nastopa veliko število atributov. Če bi pri iskanju znanja iz teh podatkov uporabili vse hkrati, bi dobili povsem nepregledne in zelo kompleksne rezultate. Izbor ustreznih atributov pa je vse prej kot lahek. Odkrivanje novega znanja iz podatkov v redno delo Policije z namenom izboljšanja njenega poslanstva ni mogoče uvesti »čez noč«. Največja težava v vsej zgodbi je interpretacija rezultatov, saj ravno pri tem lahko zelo hitro zaidemo, še posebej, če ne poznamo dobro podatkov in orodij, s katerimi delamo. Ker pa lahko napačna interpretacija rezultatov privede do napačnih odločitev, je potrebno imeti sposoben, motiviran in ustrezno izobražen kader.

5 LITERATURA

1. Bohanec Marko: Odkrivanje znanja v podatkih. Učno gradivo za predmet Metode umetne inteligence. [URL: http://www-ai.ijs.si/MarkoBohanec/ai/KDD.PPT], 1.6.2006.

2. Gams Matjaž: Inteligentno napovedovanje cen nafte: umetna inteligenca in inteligentni sistemi. Ljubljana: Delo, 2004.

3. Witten Ian H., Frank Eibe: Data Mining: Practical machine learning tools and techniques. San Francisco: Morgan Kaufmann, 2005.

6 VIRI

1. Interna gradiva Policije RS.
2. Statistična poročila Policije RS
3. Weka presentation. [URL: http://weka.sourceforge.net/presentations/KDD05.ppt], Weka, 1.6.2006.

Computer System in Financial Management

Andy Ştefănescu andystefanescu73@yahoo.com
Department Economic Informatic
University of Craiova, Faculty of Economic and Business Administration
A.I.Cuza street no:13, Craiova, Dolj, **Romania**

Laura Ştefănescu laurastef73@yahoo.com
Department Economic Informatic
Spiru Haret University, Faculty of Financial Accounting Management
Brazda lui Novac street no:4, Craiova, Dolj, **Romania**

Keywords: informational system, financial management, integrated processing of the financial - accounting data, the modelling of the financial management activity, the distribution of data and of processing.

Analyzing the aspects that concern the business market, we realized the obvious necessity of organizing an informational fluids system for the firm, which the manager could direct towards the leader position of his own organization on the competitional market. Starting from the premise that the enterprise is a dynamic system that evolves in a continuous changing market, we consider that the role of the financial area should be stressed and the way in which this one can be assisted information ally.

1. Introduction

Nowadays the economical agents face more and more competitional economical markets, in which, to survive, they need to reduce the costs, permanently, and adopt the most intelligent business strategies. These realities trigger the economical agents to exploit the best management methods and we refer here, both to the traditional methods and the modern ones between which the information management takes shape more and more[5].

The consolidation of the informational infrastructure from the financial management helps in defining the strategical purpose revealing keys and levers to improve the activities done by the economic agents. The perspectives offered by the existence of the informational infrastructure offer multiple possibilities for:

- The efficiency growth of certain activities/processes in terms of productivity, be it punctual for key employment jobs or at a macro level through projects or integrated solutions, vast modelling of processes;
- The growth of the products quality, increasing competition and processes flexibility (shortening the time for market access and production reconversion);
- The growth of the deposits of data (digital archives), we refer here to the information reusing, also of knowledge and of experience acquired.

2. Related Work

The complex business environment requires financial management processes with the ability to adapt to changes and to collaborate in activities. Based on business rules concerning process routing, operational constraint, exception handling and business strategy are used by such computer systems to perform appropriate actions. The mechanism of this approach is investigated, and a case application is developed by [10] to demonstrate the validity and benefits of this approach.

The challenge of the changing business environment requires managing complex in non-procedure paradigms. Non-procedure paradigms do not depend on systems giving exact details to solve problems, but let systems determine how to accomplish tasks [4].

3. Arguments for the developing of the computer information systems from the financial management area

The objective of computer system is to enhance the economic agent financial management activity and to forecast new trends. Thus, the system provides the manager with a clear perspective on his/her company while also paving the way to further objectives [9]. Under the circumstances, the user-manager establishes a set of objectives according to which the data base structure is build up alongside with transactions and queries about:

- ✓ the efficient and rapid providing with the information necessary for the global system: indices, reports, diagrams;
- ✓ providing a basis for the financial management decisions;
- ✓ forecasting the essential variables of the turnover;
- ✓ evaluating the company position in comparison with its competitors;
- ✓ focus on the strategic financial indices and permanent evaluation of economic efficiency.

3. The System Development

In developing a computer information system for the financial management the tracking of a methodology [1], [2] is imposed, able to catch in detail the important aspects of the financial management. At the end of this, the informational system becomes an useful tool to satisfy the manager's requests in taking the best decisions.

The methodology that we will track here represents a gradual approach which means in fact the accomplishment, basically, of the following stages:

The global modelling takes place on a whole level and it applies to the financial management area, and it has as purpose clarifying the structure, the efficiency and the interconnections among the elements which define this kind of activity.

To systematize this stage is focussed to find solutions to the informational requests of the user, reason for which this is the stage in which there will be studied:

- definitions of the area and of the financial management activities meaning: the analysis of the informational sources, respectively of the synthesis documents and of the intermediary ones, of the way in which these will be used;
- the specification of work procedures and means to accomplish the financial management;
- the links and the informational circuits connected to functions and attributes of financial management;
- solutions that will be used for description, data and processing, all in an informational approach;
- the users' requests realized in and functional managerial objectives of the model.

Data Modelling constitutes the stages in which the operations are identified and need to be done on data from the moment of their release, to generate significant and relevant information. These operations take place on a conceptual, logical, physical level and allow catching data through their structure under the shape of attributes and of internal relations.

The main purpose of the data modelling is to describe the structure of the data base, re-defining and updating transactions associated, ensuring the data collecting by the user-manager. We'd rather have all these elements synthesized through the sequence shown in Figure 1 and not insist theoretically upon them [see 7 for theoretical approaches].

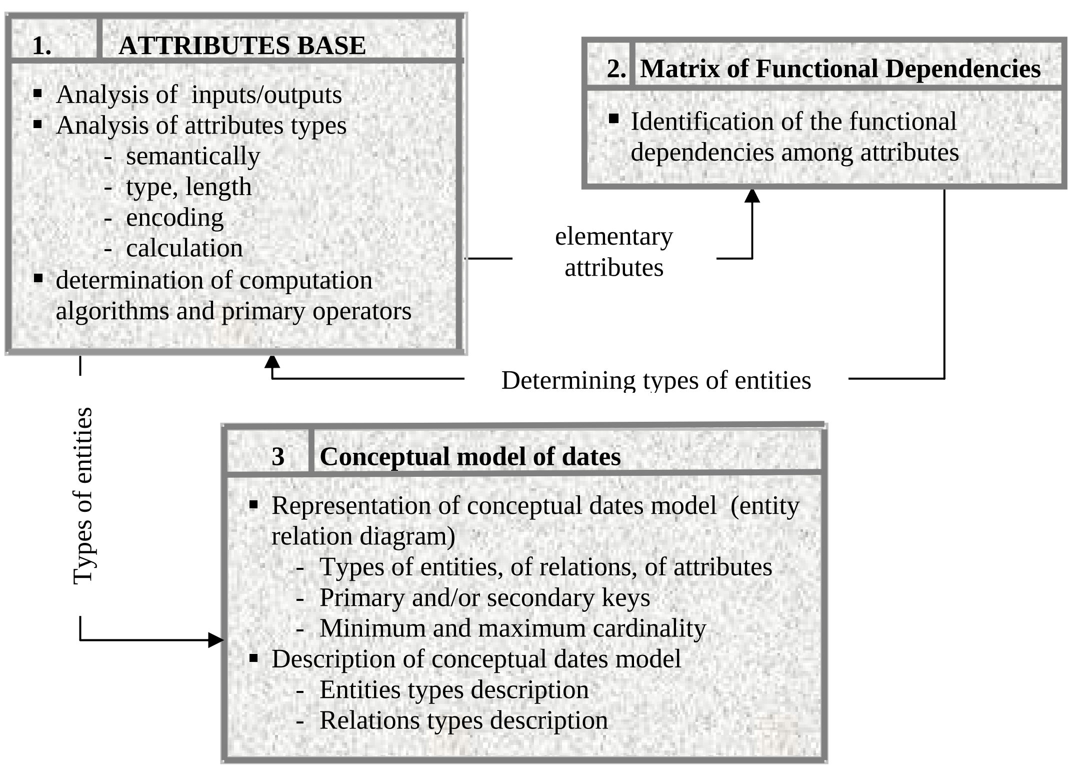


Figure1 – Data modelling for the computer system

Processing modelling will take place in the outmost detail and thoroughly, beginning gradually from conceptual level where there will be identification of event, the specific tasks for the inquired area, establishing an event-results table in order to facilitate the specification of synchronization among these depending on management already existing rules: **at** *a logical level* when there will be identified: place, moment and the persons involved **and at** a *physical level* when the operation will respect the structure or the syntax of a certain programming language (Visual C++).

The processing parts represent the dynamic side of the computer information system. They describe the actions exercised upon data to obtain the required information. The processing parts represent in fact the materialization in actions of the management rules specific for the financial management.

The modelling of the system processing has as its purpose to clarify aspects referring to: identification of the activities that took place and releasing events of these => the conceptual model of processing; identification of place, moment or of the persons involved => the logical model of processing; the way to processing operations => physical model of processing.

The conceptual model of processing has the purpose to answer the question what processing is done in the activity of the financial management. To answer to this question we will have to identify the complex process, their contraction in elementary processes, in/out events, synchronization and management rules, used the financial management, for an economical agent. All these, we'd rather have them presented in Table 1.

Table 1

Activity	Characteristic complex processes	Elementary Processes
Economical Operations	Opening the work session	-confirmation of the possibility of system use; -specification of password and username; -giving the access level.
	Processing information from accounts	-introduction of data in the required working files of the Checking Balance; -processing the clearance scales: debtor/creditor to make the Balance of Accounts; -processing the net hauling time to accomplish the Profit and Loss Account.
Activity Analysis	The structural analysis of the patrimonies	-data taking over from the Balance of Accounts and obtaining the Financial Balance-Sheet; -elements processing from the Financial Balance-Sheet for 2 consecutive years and obtaining the cumulative Financial Balance.
	Analysis of the results formation	- obtaining a set of indicators to quantify the activity; - checking the levels obtained; - interpretation of results economically and financially.
Financial Diagnosis	Profitableness diagnosis	- obtaining the profitableness indicators; - results interpretation.
	Risk diagnosis	-determination of the position indicators I% and comparison with the known criteria to determine the relative value of the exploitation and financial risk; -determination of a set of indicators; -models of evaluating the bankruptcy risk.
Financial Anticipation	Elaboration of the financial anticipation documents	-estimations for the indicator level the turnover taking into account the level of the estimated availability; -identification of position from Financial Balance, the Profit and Loss Account which modifies together with the estimated Turnover; -determination of the necessary of the external financing; -specification of the financing ways.

4. Study Case. Data processing and analysis to support an efficient financial management

The computer system analyses in point of quality and quantity the financial-account data to develop an efficient financial management for the economic agent.

The system allows the collection and data stocking, presentation of transformations and of processing and analysis procedures and it creates tables and graphics for results. The data are introduced using video-formats of entrance projected in such a way as to show the informational content of the entrance documents used there, and the results are seen separately in exit windows which can be manipulated simultaneously, maximized, restaured, minimized. The entrance data and the result can be saved independently for the next work session.

The computer system has the role to support each operation and activity from the financial department, to establish the procedures and rules that must be applied in each situation. Such an informational system for the financial management allows the automatisation of the activities of the type:

- *Financial Analysis* → activating the button from the main window of the programs, the user has the possibility to generate automatically, the synthesis documents the Financial Balance and the Profit and Loss Account. The box of data and processing distribution which accompanies permanently the system allows the activation of the year for which the financial situations are done.

- *The financial Diagnosis Module* – is used by the manager to answer rapidly and correctly, at any given time, to the questions about the financial state of the company. In order to provide as much information as possible on efficiency, balances and risks in the Financial Diagnosis window, a list of tabs have been used; they open frames which contain commands buttons. On activating such tools, using the attached code, we can generate the required operations:
  - the Efficiency tab, which determines the efficiency rates, uses as data base the Balance sheet and the Profit and Loss Account.
  - the Balance tab, provides 3 methods of calculating the balance. By activating one of the 3 commands, we can determine the indices of the chosen method and indicate the balance type.
  - the Risk tab, allows for the assessment of bankruptcy and solvency via the 3 recommended methods (Altman, Conan-Holder and The national Bank of France) [5]. By ticking one option in the frame, we have a value for the Z function which will be compared to the indices of every method.
- *The Financial Forecasting Module* – allows for the financial data analysis in the synthesis and analysis documents of several financial exercises. The module implements the 2 methods of forecasting: “percentage of sales” and „the simple linear regression” [see 8]

The main window of computer system what constitute the subject of this paper, realized by author to sustain the financial management activity includes:

- *the application modules (3)*, which designate the activities pertaining to financial management: financial analysis, diagnosis and financial forecasting;
- *the application menus*: Windows menus have been preserved: File, Edit, View, Help alongside with new menus: Data input, Financial Reports;
- **„***data processing and distribution***”** dialogues box accompanies the main window and allows for gradual activation of the financial exercises, using the corresponding data base.

5. Conclusions

Each stage has involved serious research and analysis of the recurrent problems and characteristics of financial management

The conclusion to be drawn is that financial management is a complex process, having as a starting point the analysis documents: The balance sheet, The profit and loss account. The information gathered from these documents allows for the drawing up of some other analysis documents, reports and final documents, essential to the diagnosis and evaluation of the financial state and can make to financial forecasts as they trace future lines of actions.

The modeling of the financial management activity made possible not only the setting of the general and particular objectives for computer system but also the directions to be followed in the channeling of the efforts of data gathering and processing.

The model is likely to be successful and therefore needs refinement by providing a solution for data processing and distribution as the most companies have another division which are geographical desperately but they function similarly.

Because, the computer system has an conceptual, logical and physical support a relation database, we have analyzed the additional factors influencing such a database. More precisely, we have examined the data distribution strategies, their global and local distribution and data processing distribution in order to successfully use this computer system in such a distribute medium.

Finally, I do hope that I have made my fair contribution in the field of computer system as support for the financial management decision making process.

References:

[1] Airinei, D., and all , *Medii de programare*, Editura Sedcom Libris, Iaşi, 2002

[2] Andone, I., Mockeler R.J., Dologite D.G, Ţugui Al., *Dezvoltarea sistemelor inteligente în economie. Metodologie şi studii de caz*, Editura Economică, Bucureşti, 2001

[3] Boehm, B.W., *Software Engineering Economics*, Englewood Cliffs, New York, Prentice Hall, 2001

[4] Giarratano J., Riley G., Expert systems: principles and programming, PWS Publishing Company, Boston, 1998

[5] Johnson R., Melicher R., *Financial Management*, Editura Teora, 2002

[6] Raţiu-Suciu C, *Modelarea & simularea proceselor economice*, Editura Economică, Bucureşti, 2001

[7] Ştefanescu A., Ştefanescu L., *Comparative Study between the model data objects oriented and relational data model*, *Economy Informatics*, no*:*1/2003, Editura Economică, Bucureşti, 2003

[8] Ştefanescu, A., *A Data Processing Model for Financial Management of Economic Agents, in* Economic Computation and Economic Cybernetics Studies and Research, volume 39, 1-4/2005

[9] Ţugui AL, *Produse informatice generalizate pentru contabilitate*, Editura CECCAR, Bucureşti, 2003

Intelligent Agents to Support Transactioning Decision

Laura Ştefănescu laurastef73@yahoo.com
Department Economic Informatic
"Spiru Haret" University, Faculty of Management Financial Accounting
Brazda lui Novac street, no:4, Craiova, Romania

Andy Ştefănescu andystefanescu73@yahoo.com
Department Economic Informatic
University of Craiova, Faculty of Economic and Business Administration
A.I.Cuza street no:13, Craiova, Dolj, **Romania**

Keywords: intelligent financial agents, assisting decisions, functionalities

In the near future, the intelligent agent's type programs will constitute the preponderant way to exploit the enormous quantity of information which is on the internet. The intelligent financial agents, subject to discussion in this paper, are able to follow the evolution of the movable values, to give warnings regarding their evolution and to formulate recommendations concerning the purchasing and the selling of certain financial products. The new generations of financial agents have to be able to negotiate certain transactions for the managers in the given commission. Some broker-type societies have already applied some computerized transactions with the help of the intelligent agents.

1. Introduction

For the potential or operational managers, the intelligent agents represent or will represent an important economical opportunity. Their use in the area of transactioning financial products can prove to be a very profitable business. Taking into consideration their multiple abilities in progress, we can assert that the intelligent agents will constitute one of the most attractive business opportunities. The intelligent agents are strictly linked to the existence of informational and communicational technologies, especially the Internet; outlined as a type of specialised activity, autonomous, very useful for an important part of business. According to the specialists' opinion the intelligent agents represent a new type of logicians, specialised in [2, 12].

Researching, extracting and treat information automatically for the user in an informational network or in a database. An agent is a computational system located in an execution environment, capable of autonomous action in that environment in order to achieve the planned objectives [7].

Unlike the classical interface ways with the computer, the intelligent agent is autonomous and much more active, representing a hardware or software system which has a series of properties, that we also find in [2]: autonomy, initiative, adaptability, rationality, communication and co-operation, mobility.

2. Related Research

To assess the possible magnitude of the context problem in intelligent agents to support decisions, one research team examined information on Honda from two different sources, Disclosure and Dataline [6]. Their analysis showed major definitional differences in the information on the two sites. Also, their study looks at non-financial information found on corporate web sites that may have important implications for users understanding of the company's sales, earnings, stock price/market value, general financial condition or expected results.

Landqvist and Pessi notes in [4] how the use of intelligent agent-enabled decision support in conjunction with the organizational trends of more dispersed and decentralized organic organized enterprises, enables new practice in the field of Business Intelligence. Their research focuses on empirical data from two business cases and what organizational implications it might have. The behaviors of the applications in the described business cases shows a trend that is very interesting to further investigate.

Research within agent-technologies usually explore different lab related studies regarding how to cope with the vast information overflow, using intelligent agents mainly based on different rules-based mechanism [5].

Decision support systems are usually focused on historical data behavior, and analytical approaches. Many researchers discuss the extension of these mart models, to include real-time data [1]. With an extended model on the use of enterprise decision support environments, future business intelligence will be combination of more traditional decision support systems and intelligent agents.

The applications of agents to support transactioning decision has been studied in a flurry of research. Agent technology provides an extension and alternative to process management with flexible, distributed, and intelligent features [10], [11]. In existing applications, an agent-based workflow system usually consists of multiple agents, each responsible for specific work items. More efforts are needed to investigate the mechanism how to employ multi-agent technology into support decisions, especially focusing on solving the problem through the essences of agents.

3. Functionalities offered by the intelligent financial agents for the transactioning of financial products.

The dynamics of operations with derived financial products and the informational explosion from the "stock exchange rink", a necessity make from the use of the intelligent agents.

Despite the limitations imposed by the impossibility of perfect reproduction by the computer of the human reasoning, these represent the indispensable tool for the modern portfolio manager, because the great majority of the routine decisional activities, the total volume of the necessary information for the decisional model together with the searching and finding information techniques are completely taking over by these.

The functionalities offered by the intelligent financial agents to the portfolio management are drawn from the general advantages which undergo from the introduction of soft systems in decision support referring to:

- Access to the pertinent information and access control;
- Manipulating the information and results presentation;
- Information structuring under model shape: relations among the variables, systems of relations, decision shafts;
- Simulations processes, generating alternatives (scenarios) and their evaluation;
- Presentation as library of concepts and useful information in results interpretation;
- Automatic-expertise.

By referring to the informational product which uses intelligent agents, imitated by the authors to support the management of operations with financial products, its functionalities as an interactive support decision system consists mainly of:

- Gathering and quick processing of a large data volume but also the possibility to download from the specialised servers in providing the stock exchange quotations.
- Using the methods and the economical - mathematical models in analysing and information interpretation, but also a series of decisional models already known, such as:
  - the market model has constituted the origination in the elaboration of the study concerning the modelling of he exposed decisional situation;
  - the algorithm "excess of efficiency" - derives from the market model and it is the one that assures very well, with very good results to the necessity of selection from a batch of transactioned financial product, those which gathered in a strategically portfolio should bring profit to the investor;
  - regression functions - allow the prediction of the course's evolution, indicating values that can get in the future, depending on the specified trend.
- Mobile media - adjust the chronology series if the data batch is large enough, it is practised successfully, it the chosen gap is at least 200 days.
- The oscillating stock exchange markers - they successfully assist the user in the foundation of the transactioning decision, because they are capable to notice the intensity of the evolutions, on any trend (bi it ascending or descending).
- Realising some multiple correlations between the elements and the phenomena specific for the analysed decisional situations, correlations that offer the possibility of some analyses and interpretations complex substantiated, presented very suggestively for the decision taker.
- Description and basic information analysis with statistical instruments (data analysis, anticipations).
- Obtaining reports and centralising situations, for their use and interpretation we use information synthesising under graphics.

In order to implement these functionalities, the authors have initiated a first step in defining these agents of that type to get a real instruments in decisions, support, with numerous options of data processing, of information analysis, having the *capacity of adaptation individually or organisationally*.

To add more, the system will rum on a large variety of equipment's, not necessarily sophisticated and pretentious, being able to manage large data volumes, all by itself and economically also, in a computer network. Built for technology with verified performances, the system's database is relationally - distributed and conceived in such a way as to decrease the maintenance costs and exploitation costs of the computation system, to manage all data types, to offer access to information to all types of users.

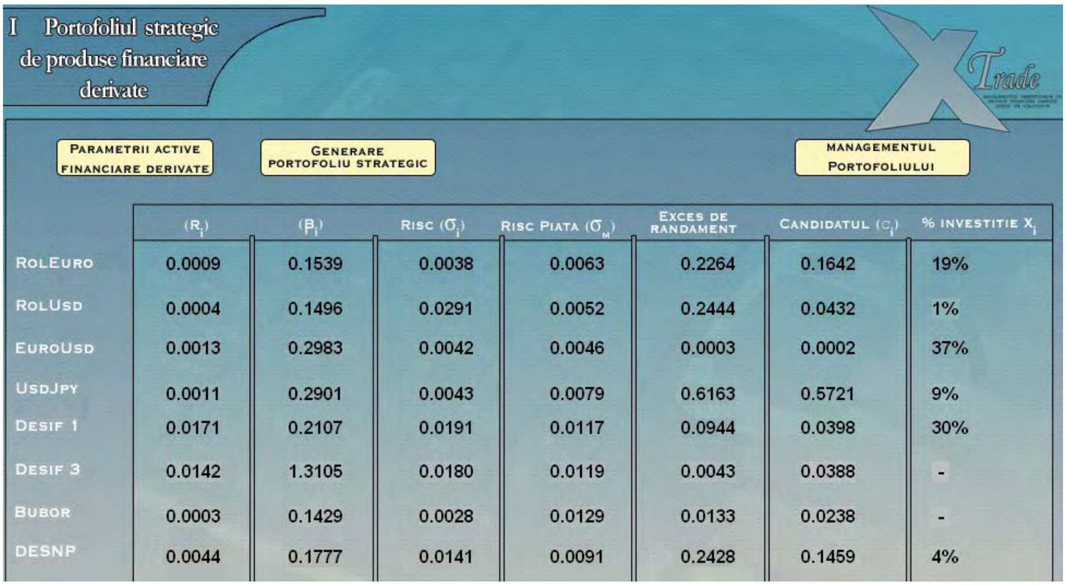
4. Study case

The main advantage of the intelligent agents is, as the same in the case of expert system the inferences engine. Using the database, this one built in inferences dynamically choosing the rules that are to be released and establishing the order of enchaining linkage. No matter the inference used the basic cycle of an inference engine comprising 4 stages: the selection, the filter, conflicts solving and the execution itself (releasing the chosen rules).

The authors during a large process of accomplishing intelligent agents, which could be used to assist the portfolio manager in the transactioning activity of the financial products, have defined the algorithms for each stage of the basic cycle. Here follows:

- Determining in relative sizes a batch of parameters (profitableness, volatility, risk) for each transactioned financial product, on the basis of which its performances are being established (see Table 1, column R_i, β_i, σ_i)
- Selection of these financial products which fulfil the conditions special for the algorithm: "excess of

efficiency”, see [8]. The proportion measures the additional efficiency of an active on the non-manifold risk unit (the risk that cannot be eliminated). The value obtained for the proportion $\frac{R_i - R_F}{\beta_i}$ constitutes the critical point C_i, depending on it the actives’ performances are being ordered. The C_i ‘s superior values indicate the portfolio structure. In the Figure 1 the most advantageous situation is presented identified by the system with the help of the intelligent agents. It can be seen clearly that the selection done along the releasing of the algorithm and the (X_i) proportion in which the selected products participate at the profitableness, volatility and portfolio’s risk σ_i a diagram is inserted.



	(R_i)	(β_i)	Risc (σ_i)	Risc Piata (σ_M)	Exces de randament	Candidatul (C_i)	% investitie X_i
RolEuro	0.0009	0.1539	0.0038	0.0063	0.2264	0.1642	19%
RolUsd	0.0004	0.1496	0.0291	0.0052	0.2444	0.0432	1%
EuroUsd	0.0013	0.2983	0.0042	0.0046	0.0003	0.0002	37%
UsdJpy	0.0011	0.2901	0.0043	0.0079	0.6163	0.5721	9%
Desif 1	0.0171	0.2107	0.0191	0.0117	0.0944	0.0398	30%
Desif 3	0.0142	1.3105	0.0180	0.0119	0.0043	0.0388	-
Bubor	0.0003	0.1429	0.0028	0.0129	0.0133	0.0238	-
DESNP	0.0044	0.1777	0.0141	0.0091	0.2428	0.1459	4%

Figure 1: Manager assistance in defining the portfolio’ structure

- Anticipation of the trend on which quotations will be marked, on the basis of stocked information in the database. The identification of the quotations’ trend is done by the regressions model implemented to analyse which of the regression types approximate the courses’ evolution best. In this way, one can determine an error margin computed as a difference between the chart’s area marked by the stock exchange quotations and of that which identifies the trend depending on regressions, the lowest error obtained mean that this approximates the better the quotations evolution (see Figure 2). Relying on these data, extrapolations will be done, which should provide information concerning the quotation level for a future data or viceversa, an what date a certain level is attained a chart is inserted.

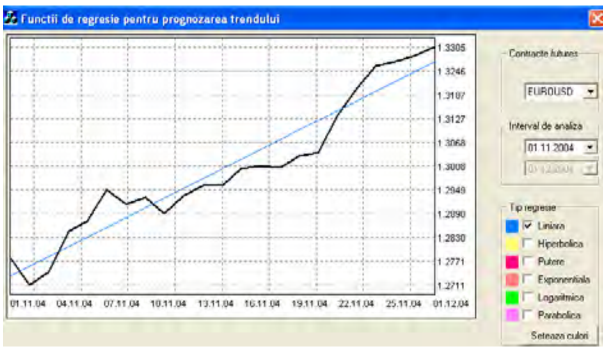


Figure 2: The quotation trend

- The support of transactioning decisions uses two financial instruments; the mobile media and the stock exchange oscillator factors which will guide the manager to:
- establishing the number of the transactioned products;
- identification of the moment of in/out in the market;
- emission of signals of purchasing/selling signalled by Relative Strength Index;
- determination of relative positions of prices of closing in the maximums and minimum’s registered for a specified number of days (Stochastic) .

The intelligent agents will test the current values of quotations, minimum and/or maximum values and they will compare with the values computed for each financial instrument, giving suggestions of the type:

Suggestions:
- *The market trend is descendent* → **We recommend**: opening the selling positions
- *Signals of alertation of the market trend are foreseen* → **We recommend**: reconsideration of the opened positions, using the other indicators to validate or invalidate.

5. Conclusions

Obviously, the intelligent agents are placed in the early stages of the evolution. In the future, they will be able to make activities with much more complex and notable decisional character. Concomitant, the intelligent agents can be used to develop the already existing business, increasing their functional and financial performances.

To conclude, we can assert that the intelligent agents represent a smart solution for the increasing necessities of a large number of users, functional, flexible, relatively, independent and adaptable to different platforms and communicational systems. Through the automatization of the work task which presuppose a high degree of time consumption are presuppose repetitive actions done by the user of a computer, the intelligent agents free the users from their tasks, allowing, in exchange, task accomplishments, much more valuable for these. The agents are those who do the boring and exhausting tasks, faster, cheaper and more efficiently than the human part.

The intelligent financial agents improve the man-computer interaction through the hiding of the complexity of difficult tasks, accomplishing elaborating tasks, transaction administration from the user's side, training and learning, monitoring events and diverse procedures.

The competence variety that can be given to the intelligent agents is practically unlimited and includes e-mail filters, database search, shopping in virtual shops.

References:

[1] Bolloju N., Extended Role of Knowledge Discovery Techniques in Enterprise Decision Support Environments, Conference on System Sciences, 2001

[2] Franklin S., Graesser A., *Is it an Agent, or just a Program?: A Taxonomy for Autonomous Agents*, Proceedings of The Third International Workshop on Agent Theories, Architectures and Languages, Springer-Verlang, 1996

[3] Houari N., Far B., *Application of Intelligent Agent Technology for Knowledge Management Integration*, Third IEEE International Conference on Cognitive Informatics, 2004

[4] Landqvist F., Pessi K., *Agent Action: Business Cases with Individualized information Services in a Business Intelligence Context*, Proceedings of the 37th annual Hawaii International Conference on System Sciences, 2004

[5] Liu S., *Strategic Scanning and Interpretation Revisiting: Foundations for a Software Agent Support System* – Part 2: *Scanning the business environment with software*, Industrial Management & Data Systems, 1998.8: p362-372

[6] Scholtz S., Zeppetella M., Nelson K., *Managing the Context Issues of Non –Financial Accounting Information on the Internet*, 33th annual Hawaii International Conference on System Sciences, 2000

[7] So R., Sonenberg L., *Situation Awareness in Intelligent Agents: Foundations for a Theory of Proactive Agent Behavior*, International Conference on Intelligent Agent Technology, 2004

[8] Stefanescu L., *Managmentul operatiunilor cu produse financiare derivate asistat de calculator*, Editura Didactica si Pedagogica, Bucuresti, 2005

[9] Wang M., Wang H., *Intelligent Agent Supported Business Process Management*, Proceedings of the 38th annual Hawaii International Conference on System Sciences, 2005

[10] Wang H., Mylopoulos J. and Liao S., *Intelligent Agents and Financial Risk Monitoring Systems*, Communications of the ACM, vol.45 (3), 2002, pp.83-88

[11] Wang M., Wang H., *Agents and Web-services Supported Business Exception Management*, Lecture Notes in Artificial Intelligence, 2004, vol. 3157, pp.615-624, Springer

[12] Wooldridge M., Jennings N., *Intelligent Agents*, Communications of the ACM, Berlin, Springer Verlang,1999

ONTOLOGY-BASED DECISION MODELING AND SUPPORT

Ana Šaša
Information Systems Laboratory
Faculty of Computer and Information Science
University of Ljubljana
Tržaška 25, 1000 Ljubljana, Slovenia
Tel: +386 1 47 68 367; fax: +386 1 47 68 704
e-mail: ana.sasa@fri.uni-lj.si

Vladislav Rajkovič
Laboratory for Decision Processes and
Knowledge-Based Systems
Faculty of Organizational Sciences
University of Maribor
Kidričeva 55/a, 4000 Kranj , Slovenija
e-mail:vladislav.rajkovic@ijs.si

ABSTRACT

As knowledge management has become an emerging paradigm its application in various domains is being researched. Ontologies as a means of knowledge representation are gaining their importance, even though its practical use is still somewhat limited. One of the more important goals of knowledge management is to improve decision processes. In this paper we propose an alternative approach for decision modeling and support, in which we use OWL ontologies and ontology reasoners. One of the most important aspects of this approach is that it can be used not only to directly support a human actor in a decision process, but that it can also be used by application systems, which we find especially appropriate for agents in a multi-agent system. Our research has been focused mainly on multi-attribute decision making, but we have also proposed solutions for other types of decision making models, such as group decisions.

1 INTRODUCTION

There is a growing recognition in the business community about the importance of knowledge as a critical resource for organisations. The purpose of knowledge management is to help organisations create, share and use knowledge more effectively, because that causes fewer errors, better decisions, less reinventing of wheels etc. Ontologies were developed to facilitate knowledge sharing and re-use. The reason ontologies are becoming popular is largely due to what they promise: "a shared and common understanding of domain that can be communicated between people and application systems" [Lavbič, 2006].

The purpose of this article is to present use of standard ontologies in decision modeling and support. We define required steps of a decision making process based on the principle of multi-attribute decision making and we research other possible implementations of our proposed model for different types of decision making, such as decisions with a component of uncertainty and group decisions. One of the advantages of using standardized ontology languages to build a decision model is that we could come to a solution of a decision problem with any reasoner. With a defined decision model we could make a better use of our existing knowledge and derive new needed facts. This would contribute to a wider applicability of ontologies and expand its practicality. Moreover, as ontologies can be used by application systems this could also mean a step forward in certain other fields of research, where ontologies are used. An example are multiagent systems. Since agents' behavior is decision based the proposed decision model represents an efficient mechanism for implementation of their reasoning.

The remainder of this paper is organised in the following sections. In section 2 we present ontologies and their roles in knowledge management. In section 3 we discuss our proposed decision model and finally, in section 4, we provide a summary and conclusions.

2 ONTOLOGIES

Ontologies are increasingly gaining their importance in interoperable systems. They are used to capture knowledge about some domain of interest, describe concepts of the domain and relationships that hold between those concepts. [Gruber, 1995] defines the ontology as an explicit specification of a conceptualisation of the real-world entities of an application domain. They are very useful whenever two or more actors have to work together. There are several languages available for ontology representation. The most recent development in standard ontology languages is OWL (Ontology Web Language), developed by the World Wide Web Consortium [W3C, 2004]. One of the advantages of its logical model is that it allows use of a reasoner which can check consistency of a model, classify taxonomy and compute inferred types. We chose OWL for our decision model implementation due to the high level of semantic expressiveness and wide acceptance of the language.

OWL ontology consists of Individuals, Properties and Classes. Individuals (also known as instances) represent objects in the domain that we are interested in. Properties are binary relations on individuals – i.e. properties link two individuals together. OWL classes are interpreted as sets that contain individuals. They are described using formal descriptions that state precisely the requirements for membership of the class.

3 ONTOLOGY-BASED DECISION MAKING AND SUPPORT

In this section we discuss our proposed decision model. We first give a brief overview of multi-attribute decision making as our ontology decision model is based on it. Then we describe main characteristics of our approach and the phases of the decision making process. At the end of the chapter we discuss its applicability in multiagent systems and propose guidelines for implementation of the model for other types of decision making.

3.1 Multi-attribute decision-making

In complex decision-making processes the goal is to choose the best option from a set of possible options and to rank them from the best to the worst one. To achieve this evaluation models are used. Evaluation models are a technique which helps to estimate the worthiness (utility) of each option for the decision maker [Bohanec, 1999].

The main concepts of multi-attribute decision-making are options, attributes and evaluations. If $A = \{a_1, a_2 \ldots a_N\}$ is the set of options and $X = \{x_1, x_2 \ldots x_M\}$ the set of attributes, the utility function x_i translates an option a_j to a certain value: x_i: $A \rightarrow D_i$, where D_i is the range of i-th's attribute, $i \in \{1, 2..M\}$ and $j \in \{1,2...N\}$. This value represents the evaluation of the option by the i-th attribute. The final decision is the rational decision, i.e. the choice for the option a from A, which is the most preferred. This is defined with the utility function v(a) and the preference relation P:

$$v(a) = v(x_1(a), x_2(a) \ldots x_M(a)),\ a \in A,$$
$$a\ P\ b \ldots a \text{ is preferred over } b,$$
$$a\ P\ b \leftrightarrow v(a) > v(b).$$

Models are not necessarily quantitative. Qualitative models use qualitative variables which are presented by words rather than numbers. In the proposed model we use qualitative values.

Typically steps in the decision making process are as follows: 1. Problem identification, 2. Attributes identification – 2.1 Attributes definition (usually this means creating a list of all the attributes), 2.2 Defining a decision tree, 2.3 Defining the range of the attributes in the decision tree, 3. Decision rules definition, 4. Options description, 5. Option evaluation and analysis.

3.2 Concepts and decision-making process

It may not be obvious how the concepts of an OWL ontology can correspond to the concepts of multi-attribute decision making. Actually, these two groups of concepts do not have a direct translation. For example, we can use one ontology for more than one decision model, in which case a certain element of the ontology can present an attribute in one model and an option in the other. Because of the fact that ontologies are not explicitly meant to serve only for decision making, our goal is to clearly define a model in which elements comprising the decision model in an ontology unambiguously correspond to the concepts of multi-attribute decision making.

In OWL ontology options correspond to instances of a class. Therefore this class represents the set of options. Attribute candidates are all the classes and properties, which have any direct or indirect relationship with the options' class.

In the remainder of this section we describe required steps of the ontology-based decision making process and how the concepts in each step correspond to the concepts of classical multi-attribute decision making process. For better understanding we show how to build a model on an example which comes from the domain of tourist agencies. The example ontology (Figure 1) is very simplified as it serves only for explanation of the concepts. For a comparison with the classical multi-attribute decision making a corresponding decision tree is given (Figure 2).

For construction of our ontology we used Protégé [Stanford, 2004], since it is currently one of the most powerful and widespread tools for this purpose. For inference support we used Racer [RACER, 2004], which is a semantic web inference engine for developing ontologies and query answering.

Step 1 - Problem identification:

Description: Identification of the class which represents the set of options.

Example: In the case of tourist agency ontology we would like to find the most appropriate holiday. The class which represents the set of options is Holiday.

Step 2 - Attributes identification:

Description: Identification of classes and properties which influence in our decision and identification of their relationships to the option class.

Classes and properties chosen as attributes correspond to the list of attributes, before they are structured in a decision tree. In the decision tree these attributes can be found in the leaves of the tree.

Example: An example of an attribute in the decision tree is Type of holiday. In the ontology this corresponds to all subclasses of Holiday which comprise types of holidays (City, Skiing, Holidays_at_seaside).

Step 3 - Attributes structuring and attribute values identification:

Description: Grouping of the related attributes and their structuring in subclasses.

For each derived attribute from the decision tree (all the attributes in the tree which are not leaves) we identify the corresponding class in the ontology. If the attribute is a property the corresponding class is its domain. We create a group of subclasses for each of them – we create as many subclasses as there are possible different values of an attribute. For the attribute class a covering axiom has to be added for all attribute groups of subclasses. In addition for every subclass its disjoint subclasses have to be defined – these are all the subclasses which represent other values of the attribute.

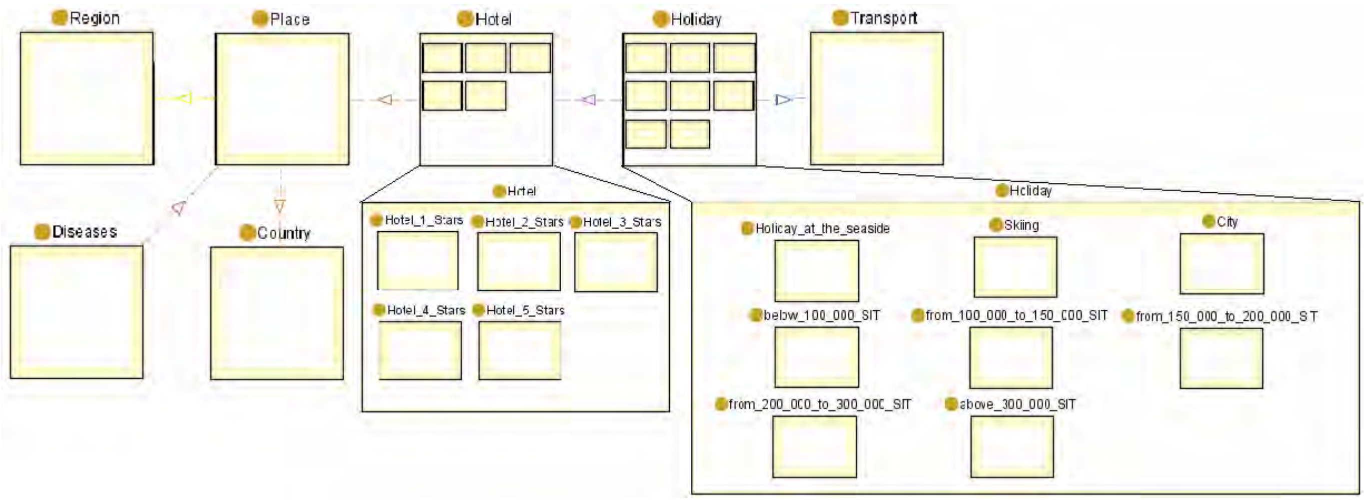


Figure 1: *Example ontology – turist agency.*

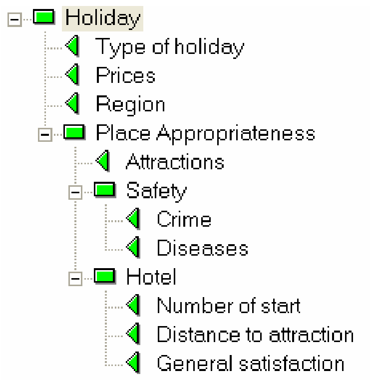


Figure 2: Example decision tree – tourist agency

Formally, if $N_1, N_2 ... N_n$ are attribute subclasses and M is the attribute class, then:

$$N_1 \cup N_2 \cup ... \cup N_n = M, \text{ and}$$

$$\forall N_i, N_j: N_i \cap N_j = \emptyset; i, j \in \{1,2...n\}, i \neq j.$$

In multi-attribute decision making structuring of attributes corresponds to creation of the decision tree. The difference in the name of the phase comes from the fact that that there is no explicit decision tree in the ontology.

Example: In the decision tree there are four derived attributes: Safety, Hotel, Place Appropriateness and Holiday. If we focus on safety we have to choose the class that safety is in fact describing. That is safety of a Place. Afterwards we identify possible values and create the corresponding subclasses of the class Place, for example: Safe_place, Average_safety_place and Not_safe_place. The covering axiom which has to be added to the class Place would in this case be: Safe_place ∪ Average_safety_place ∪ Not_safe_place. Then all the three subclasses have to be specified as disjoint.

Step 4 - Decision rules definition:

Description: In OWL ontology decision rules are represented by necessary and sufficient conditions of a class. If an individual satisfies these conditions then it must be a member of the class. They have to be added to all the attribute subclasses created in the previous step.

Use of *complementOf* expression is recommended, because it helps to decrease the number of rules and possible errors. Often we come in a situation when we know what we prefer and what is still acceptable, while all the other options are not appropriate. In cases like these *complementOf* can be very useful.

Example: Example is given for the safety attribute subclasses: Safe_place: Place∩desease_risk "low" ∩ crime_level "low", Not_safe_place: Place ∩ (desease_risk "high"∪crime_level "high"), Average_safety_place: Place ∩ ¬Not_safe_place ∩¬Safe_place.

Step 5 - Option description:

Description: We assume to work on an existing ontology, which means that the options are already described.

Example: Options are all the instances of the class Holiday.

Step 6 - Option evaluation:

Description: Option evaluation is done by an ontology reasoner. Reasoner computse the inferred types based on the necessary and sufficient conditions and options are sorted into corresponding subclasses. Subclass which we created to represents the most appropriate option now contains instances whish represent the solution to the decision problem.

Example: Suppose the attribute sublasses of the class Holiday are Most_appropriate_holiday, Appropriate_ holiday, Not_appropriate_holiday and that all the decision rules have already been defined. After computing the inferred type instances belonging to the subclass Most_appropriate_holiday are the best options.

Step 7 - Option analysis

Description: Option analysis does not differ radically from option analysis with other tools, like DEXi. There is no support for charts, but there are other types of graphical views. The model can be used for a what-if analysis or a sensitivity analysis.

3.2 Ontology-based decision-making in multiagent systems

Similarities between the agent in a multiagent system and the human actor in a business organisation in terms of their characteristics and coordination lead us to a conceptualisation where intelligent agents in a multiagent system are used to represent actors in human organizations. Furthermore agents are commonly modeled using "mentalistic" notions, such as knowledge, belief, intention, obligation and goal [Wooldridge, 2002]. Agent's behavior should be goal-oriented, which means that agents take actions for which they believe are the most likely to lead them to achieving their goals.

On the other hand since multiagent systems are a relatively young field in computer science research has been mainly limited to smaller academic groups. Due to the lack of standardization in the field of multiagent systems there are also many different ways of presenting and implementing agents' cognitive concepts. We believe that with the standardisation of ontology languages, use of ontologies in multiagent systems would contribute to the area of multiagent systems with a more standardised approach to multiagent system development. As proposed decision model is based on these standardized ontologies it represents a promising solution to implementing agents' decision-based behavior.

3.4 Possible implementations and other types of decision-making

The proposed model can not be directly used in other types of decision-making. For example, to implement decision-making with a component of uncertainty prediction of states has to be taken in consideration. If $S = \{s_1, s_2 \ldots s_M\}$ is a set of states we perform the evaluation of the utility on the pair: (a_i, s_j). As properties are binary relations this relations can not be defined explicitly. In order to achieve this we have to construct an additional class whose individuals will relate all the three elements of each such relation.

In case quantitative values are required a special mechanism can be used, such as SWRL rules. In this way decision-making in a complete uncertainty can be realized, for example based on the pessimistic, optimistic or Hurwitz's criteria. An disadvantage of this approach is that not all the reasoners support SWRL rules inference.

With an implementation of the proposed model in a multiagent system we can realize group decision support. Each agent represents an actor from an organisation who participates in decision making. Firstly each agent ranks the options based on the actors criteria, then if the interests are conflicting (which is usually the case) they try to come to a common decision based on the implemented negotiation strategy.

4 CONCLUSION

We have presented an alternative approach for decision modeling and support based on the recent development in the area of ontologies and standardisation of ontology languages. There are several advantages, such as the fact that we build our decision model on existing knowledge which facilitates the decision process as we do no have to describe attributes and options. Furthermore, OWL language allows the use of any DIG compliant reasoner and can be used by application systems, which is especially appropriate in multiagent systems. The biggest disadvantage of the proposed method is that a priori knowledge is required, especially in the description logic. Another disadvantage is that a model can get quickly become complex and hard to follow. In this case it s very important to choose clear names for classes.

Our current work is focused on testing the presented approach and trying to find possible improvements to expand its applicability and practicality.

References

[1] **[W3C, 2004]** W3C: OWL Web Ontology Language Overview. http://www.w3.org/TR/owl-features, 2004.

[2] **[SWRL, 2004]** W3C: SWRL: A Semantic Web Rule Language, Combining OWL and RuleML. http://www.w3.org/Submission/SWRL/, 2004.

[3] **[RACER, 2004]** Racer Systems GmbH & Co: RacerPro. http://www.sts.tu-harburg.de/~r.f.moeller/racer/, 2004, 2005.

[4] **[Stanford, 2004]** Stanford University of School of Medicin, Stanford Medical Informatics: Protege-OWL. http://protege.stanford.edu/overview/protege-owl.html.

[5] **[Bohanec, 1999]** Bohanec, M., Rajkovič, V.: Multi-Attribute Decision Modeling: Industrial Applications of DEX. *Informatica, Vol. 23*, Slovene Society Informatika (1999), 487-491.

[6] **[Lavbič, 2006]** Labič, D., Šaša, A., Krisper, M.:Knowledge Management in Multi-Agent Systems, *Knowledge Management in Organizations Proceedings*, 2006, 128-133.

[7] **[Gruber, 1995]** Gruber, T.: Towards principles for design of ontologies used for knowledge sharning, *International Journal of Human-Computer Studies, Vol. 43*, Elsevier (1995), 907–928.

[8] **[Wooldridge, 2002]** Wooldridge, M.: An Introduction to MultiAgent Systems. *John Wiley & Sons Ltd*, 2002.

Semantic Web Technologies in Corporation Information Systems

Viljem Tisnikar
Jozef Stefan International Postgraduate School
Jamova 39, 1000 Ljubljana, Slovenia
Tel: +386 41 690619; fax: +386 5 6400525
e-mail: vili@inka.si

ABSTRACT

Semantic Web is a project aimed to make web pages understandable by computers. We could use these technologies for integration of different applications and data in corporations for enhancing productivity. We discovered that using mathematical Category Theory concepts and constructions can help a lot with performing these tasks. We give references to related work and short presentation of our realized practical solutions and problems encountered. An abstract mathematical model is only briefly presented.

1 INTRODUCTION

Humans are capable of using the Web to carry out tasks such as finding the Swedish word for "car," to reserve a library book, or to search for the cheapest DVD and buy it. However, a computer cannot accomplish the same tasks without human direction because web pages are designed to be read by people, not machines. The Semantic Web is a project aimed to make web pages understandable by computers, so that they can search websites and perform actions in a standardized way. But this means that one has to make bigger efforts with construction and maintenance of web site. The issues of costs against benefit arise here.

Corporations are confronted with cost / benefit questions on daily basis and in all areas of their activities. Before spending money for solutions that will make life easier for some potential virtual buyer (supplier) out there they have to integrate their own internal information system. Typically in today's organizations these information systems consist of "information islands" – data and applications not appropriately connected. Application for correspondence with the buyer (e-mail, fax...) has no connection to accounting application where the invoice for the same buyer is processed.

The problem of different applications and data integration within a corporation has two basic components: a conceptual one and an engineering one. With conceptual problem we mean that usually nobody knows all processes that are going on in an organization as a whole and their (dynamic) interdependencies. The engineering problems are due to different technologies used for different applications and therefore problems with technical interoperability. These problems are accented also with different "closed" proprietary solutions. We will show in this paper some guidelines for addressing these complex problems with help from mathematical Category Theory.

The paper is organized as follows: in chapter 2 we give a very brief presentation of history and some basic concepts from Category Theory; in chapter 3. we list some of existing related work; in chapter 4. we briefly present our practical solutions; in chapter 5. we present our on-going work on mathematical model of knowledge; and finally in chapter 6. we draw conclusions.

2 CATEGORY THEORY

Category theory (CT) arose from attempting to explain the meaning of the word "natural" in mathematics. The original paper on the subject by Eilenberg and Mac Lane was titled: "The general theory of natural equivalences" and published in 1945. We see that it's a relatively young brunch in mathematics itself and even much younger in terms of its use in other sciences. Only recently CT is becoming popular in Computer science and in other sciences beside Mathematics, too [1].

We give here only hints and intuitions for some basic concepts and constructions of CT, and refer to standard texts for formal definitions and proofs [1, 7, 9]. There are suggestions to introduce CT into schools as a new foundation of mathematics because it provides more general concepts as set-theoretic approach. On the other hand there are objections that CT is an "abstract nonsense". Indeed it is the (mathematically coherent) abstraction and generality of CT that makes it a possible tool for dealing with complex problems presented in the introduction. We can always take a specific problem, make a trip to rich and powerful CT machinery, solve the problem in an abstract category, and bring the solution back to the specific level.

We can make a *category* from any collection of (abstract mathematical) *objects* and relations between them. We call these relations *morphisms or simply arrows*. Arrows can be composed in a category. There are only two requirements for such a collection to make a category – every object has an identity arrow associated with it and composition of arrows has to be associative. It then makes sense to form a category with somehow similar objects. But it is arrows that are all about CT and objects can be viewed as merely the placeholders for arrows.

If we are interested in collections of different objects we better make different categories for them and relations between these categories are modeled with *functors*. Functors are kind of more complex arrows that connect object from one category to objects of another category, and arrows from one category to arrows of another category. Intuitively a functor brings a picture of source category into the target category.

There could exist many such pictures in the target category and we can compare them with *natural transformations*. These are again a collection of arrows, this time in the same (target) category. They are also the focus of the above cited first paper in the field. It took then a decade for finding another basic concept – *adjoint functors*. This concept makes a connection of arrows in two categories, functors between the two categories and natural transformations. It seems that with concept of adjoint functors can be modeled many complex relations found in the nature and society [5, 6]. “Adjointness is a concept of fundamental logical and mathematical importance that is not captured elsewhere in mathematics [1].”

Categories can have an initial, final or zero object. An object A is initial if for each object B in the category there is precisely one arrow from A to B. An object A is final if for each object B in the category there is precisely one arrow from B to A. Zero objects are both initial and final. Categories are often characterized by these special objects.

3 RELATED WORK

The Semantic Web is close related to questions about different ontology. As CT also ontology can be presented as concepts (objects) with some relations between them (arrows). But in the wild these relations can vary depending on the specific situations and we are faced with great variety of ontology for concepts we humans see as similar. Some authors [2] show how it is possible to represent the complex data structures needed to support electronic commerce applications in the Semantic Web using ontology. The conventional mereological or subtype-oriented refinement of the ontology is supplemented by a method of coordinated refinement based on CT. The combined methods make ontology a much more powerful tool for organizing the Semantic Web.

Semantic Web is about automatic communication of software agents. (Intelligent autonomous software) Agents and Multi-Agent Systems are a technology within Artificial Intelligence science field since around 1990. There are lots of difficult questions to be resolved for such communications like interoperability standards and the mathematical nature of a dialog. Significant effort was devoted recently to the design and implementation of languages and protocols for communications and interaction between software agents. Some authors [8] proposed the first steps toward a formal mathematical theory of agent interaction languages and protocols. They argue that such a theory needs to account for the semantics of agent interaction, and propose the first mathematical theory which does this. Their framework incorporates CT entities for the utterances made in an agent dialog and for the commitments incurred by those utterances, together with maps between these.

Despite its success in practical applications, AI as science is a failure as claimed by Prof. Winston – after a half of a century it still didn’t provide a good explanation of a natural phenomenon, namely the intelligence. Some authors [3, 4] model processes in human (and higher animals) brains with CT. They consider the intelligence conditioned on high performance memory capabilities. They developed a (Memory evolutive) model for autonomous evolutionary systems, such as artificial “living” systems. It is shown [5, 6] that with adjunctions can be modeled also such complex and subtle relationships as teacher to student, manager to subordinate, counselor to client, psychologist to patient, and helper to doer where the first party tries to influence, control, or otherwise determine the actions and beliefs of the second party.

Knowledge management (KM) in today's organizations brings together two worlds: the world of (human relations) management and the world of computers [12]. It is very desirable then to have a common mathematics for both of them to model (business) processes and systems. Successful interoperability of systems requires a sound basis for activity across levels and up to the highest global level. Some authors [11] claim the interoperability is non-local and subject to the conditions of *naturality* found in reality. The axiomatic models over the last two centuries can guarantee no reliability at higher levels. CT is free from these twin problems and can therefore offer a theoretical basis on which to base standards for interoperability. They use four levels to give closure for policy, organization, instantiation, naming, classification and meta and metameta relationships. Such constructions provide facilities for relating arrows in general, both descriptive and manipulative, including the specification of constraints and a calculus.

4 OUR PRACTICAL SOLUTIONS

In 2002 special software was built within a small company that supported cooperation between coworkers on investment projects. The software was built upon some innovative ideas and with most modern (object oriented, web based) technology. The usage of that software enhanced the productivity in a previously unimaginable manner. It seemed that we found some really important solution but also very complicated and invisible. We also tried to develop further the software but the jump in productivity was never again as big as with the first solution. So in 2004 we stopped the engineering development and concentrate to theoretical basis instead.

The aim of the design was to enable the delegation of tasks from an expert leader to different members of the working group. The existing and known project software solutions and other groupware seemed somehow *unnatural*. The idea was to implement a workflow solution but with strict rule that any specific business content is not the matter for software developers. We wanted to provide just a communication tool - in our specific case, between one expert and several "assistants". The workflow was designed with three main (and several partial) steps, the approval of: the goal, the proposal and the conclusion of the specific task. So the workflow enabled the communication between expert and assistant, oriented to the specific task.

The delegation of a new task from the expert to an assistant started with informal talks. In these talks the expert recognized the appropriate assistant for a specific task. The "appropriateness" derived from expert's experience with the assistant in previous tasks and from active interest of the specific assistant. In the next step the assistant had to write the goal in the system explicitly and fill in also the estimation for due dates. Two due dates were provided: 1. for submitting the proposal and 2. for completion of the task. The proposal had to explain to the expert how the assistant intends to accomplish the task at hand. All this procedure (supported with workflow) had a very important goal: to convert the tacit knowledge of assistants to the explicit form. It is not easy to write down in a few words the precise goal of a task if you don't have at least a clue what the real situation is.

Several times we wanted to decompose a higher level goal to some lower level goals. We saw these higher level tasks as projects and tasks as their constituents. We developed some prototype software but the gain of every new solution was far from the effort invested in its development. There were both – conceptual and engineering problems. Things became very complicated. We considered to use the Topic maps paradigm [10] in order to solve these problems. The idea was (and still is) appealing because Topic maps is an ISO standard (interoperability) and there exist solutions in Python/ZOPE open source technology we used.

5 MATHEMATICAL MODEL OF KNOWLEDGE

From 2004 we seek for appropriate mathematical tools in order to solve application development problems we encountered. First we searched in the direction of graphs but concluded that it is the transitions from one graph to another that we are interested in. Then it seemed that mathematical groups could provide for some answers. Finally at the end 2005 we discovered Category Theory which integrates both into a single and more general approach.

Only recently we constructed [13] an abstract mathematical model based on CT concepts and constructions and we propose it as a conceptual basis for practical software solutions. The model is aimed to solve hard problems in Knowledge management and Robots control. It is designed as relations and interplay between categories of memorized perceptions, generated plans and actions representations category inside an abstract agent. These subcategories are characterized by their final, initial and zero element respectively and relations between them are modeled by adjoint functors.

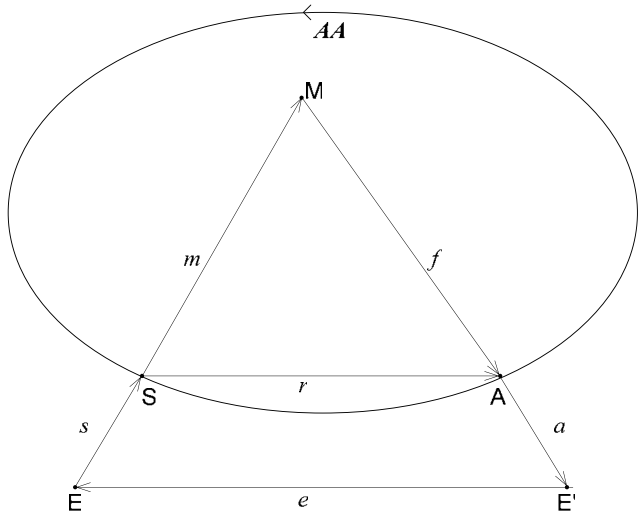


Fig. 1: An abstract agent with memory

Fig. 1 shows an abstract agent ***AA*** with memory M, where S stands for sensors, A for activators, and E for environment. The arrow *r* represents reactive actions of the agent and the composition of arrows $f \circ m$ represents proactive actions.

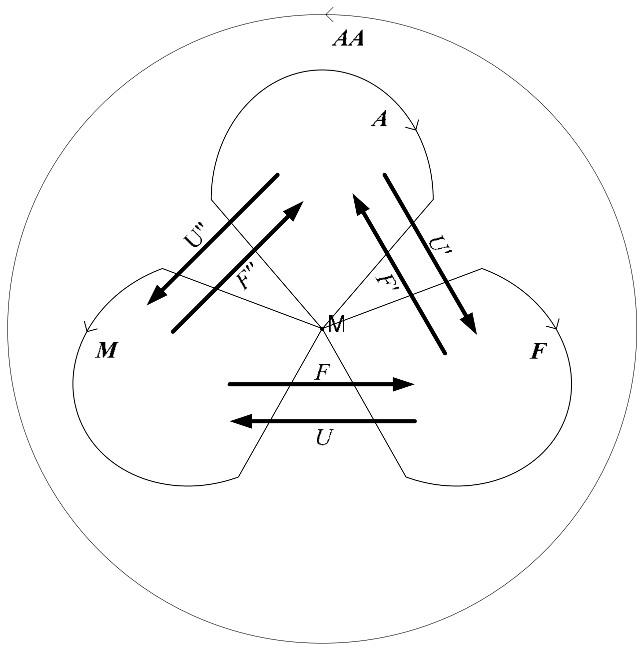


Fig. 2: Adjunctions in an abstract agent ***AA***

On Fig. 2 it's shown how these arrows in a longer period of time build three sub-categories in the category ***AA*** – the Abstract Agent. Sub-category ***M*** (memory) has a final element M, which is also an initial element in the sub-category ***F*** (fantasy) and a zero element in the sub-category ***A*** (actions representation). The bold arrows between sub-categories represent (adjoint) functors.

Sub-structures in the sub-category ***M*** could be viewed as a mathematical definition of declarative knowledge and sub-structures of ***A*** as definition of know-how or procedural knowledge. Currently we develop a detailed algorithm with simple step by step operations in order to test it for diverse practical purposes.

6 CONCLUSIONS

Semantic Web is a project aimed to make web pages understandable by computers. Corporations have to integrate their business processes and Semantic Web technologies can help with that. We used Category Theory in order to understand better both human coordinated activities and computer system integration. We presented some of the related work from variety of science fields. We presented also our experiences with practical knowledge management software solutions. These experiences opened some hard conceptual questions which are now explored with powerful tools from CT. We are currently working on the mathematical definition for knowledge, based on CT and our previous work.

References

[1] Awodey, S.: (2006) Category theory, http://www.andrew.cmu.edu/course/80-413-713/notes/

[2] Colomb, R.M., Dampney, C.N.G.: An Approach to Ontology for Institutional Facts in the Semantic Web, Information and Software Technology, Volume 47, Issue 12, 2005, pp 775-783.

[3] Ehresmann, A.C., Vanbremeersch, J.-P.: Emergence Processes up to Consciousness Using the Multiplicity Principle and Quantum Physics, A.I.P. Conference Proceedings (ed. D. Dubois), CASYS, 2001, (pp. 221-233).

[4] Ehresmann, A.C., Vanbremeersch, J.-P.: Memory Evolutive System, http://perso.wanadoo.fr/vbm-ehr/AnintroT.htm

[5] Ellerman, D.: A Theory of Adjoint Functors – with some Thoughts about their Philosophical Significance, http://www.ellerman.org/Davids-Stuff/Maths/Math.htm#Itaf

[6] Ellerman, D.: What are Adjoint Functors? http://www.ellerman.org/Davids-Stuff/Maths/Math.htm#Itaf

[7] Fokkinga, M.M.: "A Gentle Introduction to Category Theory - the calculational approach", Lecture Notes of the 1992 Summerschool on Constructive Algorithmics, pp. 1-72, University of Utrecht, 1992.

[8] Johnson, M.W., McBurney, P. and Parsons, S.: "A Mathematical Model of Dialog", Electronic Notes in Theoretical Computer Science, Volume 141, Issue 5 , 22 December 2005, Pages 33-48, (FInCo 2005).

[9] Mac Lane, S.: (1971) Categories for the Working Mathematician, Springer, 2nd ed. 1998.

[10] O'Reilly: What Are Topic Maps, http://www.xml.com/pub/a/2002/09/11/topicmaps.html

[11] Rossiter, N., Heather, M., Nelson, D.: A Natural Basis for Interoperability, I-ESA'06, Interoperability for Enterprise Software and Applications Conference, University of Bordeaux, 22-24 March 2006. Preproceedings 12pp.

[12] Tisnikar, V., Gams, M.: Knowledge Representation for the Working Manager. In Heričko, M., Živkovič, A. (eds.). KMO'2006: Knowledge management in organizations: proceedings of the First int. conference New trends in knowledge management, Maribor, June 13 - 14, 2006. pp. 152-158.

[13] Tisnikar, V.: From Management to Robotics and Back, unpublished work, Aug. 2006.

STATE OF THE ART AND THE FUTURE OF AGENT TECHNOLOGY IN ENTERTAINMENT INDUSTRY

Aki Vainio
Department of Computer Sciences
University of Vaasa
Box 700
65101 Vaasa
Tel: +358-6-324 8438; fax: +358-6-324 8467
Email: aki.vainio@uwasa.fi

ABSTRACT

With the recent developments of agent technology, agents are constantly moving to new areas. Since the turn of the millennia, one of the new areas has been entertainment. With the constantly growing budgets of both movies and computer games, it is a fertile area of research. In movies, the main focus is in multiagent systems modeling crowds, in games there are similar aspects, but there is also the added importance of learning and sometimes the ability to act in a personable manner. This paper presents some of the ways agents have been used in the entertainment industry.

1 INTRODUCTION

In the prologue of the movie *Lord of the Rings: The Fellowship of the Ring* includes a massive battle sequence involving more than 70,000 combatants [8]. Directing such a crowd, be they human or digital, is practically an impossible task. However, if the 70,000 characters can think for themselves with a limited amount of instruction, the whole problem is instantly solved. If the characters are digital, the instructions are easy enough to disperse, but making them think is still problematic. The answer was agent technology. Each of the 70,000 combatants was given its own brain, with deliberation processes, set of possible actions and sensory input. After that, all they needed was an enemy and they were set to go.

In the 90's there was a short-lived meme (cultural virus) of virtual pets. They were simple gadgets, which would harass their owners for food and attention. Feeding them and playing with them required a few presses of a button. This approach quickly grew into "ant-farm" games, such as The *Sims* or *Creatures*. These were more like simulations than actual games due to lack of goals.

Soon enough, the ideas were put to use in games such as *Black and White*, which employed learning agents called "Creatures", which served their masters in a way they were taught to do. These creatures are highly personable and their appearance changes based on how the player treats them.

Concepts such as coordination and negotiations could bring realism into game genres such as role-playing games and real-time strategy, if implemented properly.

2 MOVIE INDUSTRY

Any scene with a crowd used to be real hard to achieve. They required a lot of logistics as the assistant directors tried to control the masses of extras. In time, the fees for the extras grew and movies with massive crowd scenes became less common. With the advent of digital technology, this problem was overcome by copying small groups numerous times. Still, this requires a lot of work, especially since the repetition should not be visible to the regular viewer.

A company called Massive Software overcame this problem by using agents. The agents used by Massive Software are in some ways fairly simple as they do not learn. The lifetime of an agent used in a movie is so short that it doesn't have the time needed to learn in any case. They must be able to do two things: work as a part of a crowd and follow the director's wishes if the director has a special need for a certain agent.

Massive began its work with the *Lord of the Rings* trilogy, which included a number of complicated battle sequences, each of which would have been very time consuming with earlier methods.

Figure 1: *Early test of a battle scene for* Lord of the Rings.

Working as a part of a crowd has many different aspects as crowds have different motivations. A stadium full of agents doesn't need to interact with each other. They just need to seem different enough from the persons next to them. People in the background of a scene in a city are a bit more complex. They need to be able to move in a natural way without hitting each other. Each of these types must be able to do things the viewer would expect from a crowd like that: cheering, chants, eating hot dogs, talking to a mobile phone and so forth.

After *Lord of the Rings*, the Massive Software has been used for example on *King Kong* (2005) for panicking crowds, in *Elektra* for masses of writhing snakes and traffic for *Fast & Furious: The Tokyo Drift.* [5]

3 GAME INDUSTRY

Game industry has somewhat different goals from the movie industry for their agents. Most of the agents in games are reflexive agents similar to the ones used in the movies. There are also agents in some games, which are programmable by the player to work as a part of their team, although in a manner which resembles expert systems with rules such as if A happens, than B.

A newer breed computer games has taken this approach a step further. Instead of using simple reflexive agents, they are using deliberating agents, which have an ability to learn by forming a model of the world based on what they have learned.

3.1 Simulations

Simulations, popularly categorized as games, but lacking in actual goals for the player, have been very successful, with *Sims* being the best-selling PC game of all time with over 16 million copies sold. [23]

In *Sims*, the people in the game are left to roam in the world which is under control of the player. The people can interact with each other and the things around them. The things themselves include instructions on how the people should behave. A television will tell a person interested in it to sit down to watch it and a ball will tell the person to throw or kick it around.

In games such as *The Creatures,* the simulation includes learning by the simulated organisms known as Norns. The Norns can not be directly controlled by the player, but they will interact with different objects found within the game, which the player can add or remove as he or she wishes. The player can also punish or reward the Norns which will guide their actions in the future. Since each Norn is unique, the player can also breed new specific Norns by guiding certain adult Norns into reproducing. Norns lay eggs, which can be traded over the Internet with other players. [3]

3.2 Humanlike characters and sociable agents

A real-time strategy game *Close Combat* first introduced a psychological model for the soldiers depicted in the game. This meant that instead of blindly following the orders of the player, the soldiers might look for cover instead of facing gunfire, attempt something foolish or even panic and attempt to flee the battleground. This brought a sense of reality as the player would have to take the morale of the troops into account, which meant that the usual tactic of mass full frontal assault implemented by players of many of other games would not work as well, but the players would have to use real life tactics instead.

Although the soldiers of *Close Combat* can hardly be called agents, the same model can be used with agents to bring them personality beyond what most games have. Generally humans are quite easily manipulated with programmed sociable behavior, such as the behavior of AIBO, the robot dog. [11]

In order to bring realism into a computer role-playing game, the characters could have different social behaviors. Some might lie, some might be more willing to talk, some might overstate and so-forth. This would require the player to learn to know the characters before being able to know which ones to trust.

3.3 Coordinated planning

FIRA (Federation of International Robot-soccer Association) holds annual international competitions for several different leagues of robotic soccer players (including humanoid, cubic and four-legged robots among others). Just like human teams, robotic teams need to have coordination. Since communication during the game is limited, they have to coordinate their game with a "locker-room agreement" [25, 26]. This agreement becomes a part of the robots beliefs and therefore it changes its plans accordingly.

Similar methods could be used to bring realism into games such as aforementioned *Close Combat.* Instead of the player having the troops work in a coordinated manner, they could perform military maneuvers themselves. In a realistic manner, this could be achieved by using preparing plans for the platoons to use and their leader could perform the decision-making between the plans.

In [10] planning has been used to create stories. Characters have BDI-based behaviors, including a plan. The story emerges from the plans as the characters interact. By adding a player controlled character within the story, this could easily be implemented as a game with a clear socially based goal.

3.4 Adversarial planning

Often in strategy games, the computer player uses very simple strategies based on search trees. However, if the computer player has limited perceptions of the playing field, this is not sufficient as the computer would fare much better if it could anticipate the intention of its opponent.

This can be achieved by using adversarial thinking, which has been used successfully in Go [17]. In adversarial thinking, the agent gathers percepts of the opponents' movements and forms a model of the opponents thinking based on those percepts. If it has enough knowledge, it can reason about the plans of its opponent or in time it can even find out the desires or beliefs, if they are not known beforehand.

3.5 Creatures in *Black and White*

In *Black and White*, the player is a god, with some godlike powers over the world they inhabit. Since the player is not omniscient, he has a sort of avatar known as the “Creature” to help. The Creature can learn to perform miracles, use the environment and other such preprogrammed things. However, it can also learn to act the way the player wants it to. For example, the Creature needs energy and therefore it needs to eat. The player can direct its eating habits by giving it food. When the Creature is given food it learns that it is the sort of food the player wants it to eat when it looks for food independently. Also, when the Creature eats food, the player can give the Creature feedback by either slapping it or scratching it. If the player wishes to remain a good god (as opposed to being evil), he or she should for example stop the Creature from eating the villagers and slap it afterwards if it does.

Figure 2: *An ape Creature slapped for eating its own poo.*

The player's Creature is not the only Creature around. Computer controlled gods have their own avatars too and some Creatures roam the world freely. The Creature learns about these beings by interacting with them. These relationships are quite straightforward: either they like each other or they hate each other. This is largely dependent on whether they have fought or not.
The Creature also learns about its environment. In knows where it can find food and if it has been taught to help the villagers, it can learn to find forests for wood and so forth or bring food to those who need it.

4. CONCLUSIONS

Agent technology has reached the point in which they can be used to bring realism and color into movies and games. With good design, one agent can easily be reproduced with slight variation into a group or even an army of realistic agents. Even though different forms of entertainment have different needs for their agents, the same ideas of BDI and communications have implementations across the board.
Agents have been implemented for a multitude of purposes in both movies and games in the recent years. In both cases, it is a matter of realism, but also a matter of cost-efficiency. It is not unusual for a movie budget to reach 100 million dollars or much more, but despite the massive resources, director’s have to make creative decisions based on the resources available. Today, more and more often the decision is to use agents.
With the advances in storytelling through character planning, movies and games will resemble each other more and more. Movies can become interactive and certain genres of games will have more storytelling components, which will not require much input from the player.
Agent technologies will bring the social aspect of the games to the fore. Instead of having one-dimensional characters, the player can truly interact with them and become part of their society or perhaps their enemy. Perhaps in the future, not all problems in computer-based role-playing games are met with violence.

References

[1] Box Office Mojo. http://boxofficemojo.com
[2] The Numbers. http://the-numbers.com
[3] Game AI. http://gameai.com
[4] Evans, Richard: AI in Games: A Personal View (2001). http://gameai.com/blackandwhite.html
[5] Massive Software, http://www.massivesoftware.com/
[6] Internet Movie Database (IMDb), http://imdb.com
[7] Di Marzo Giovanna, Marie-Pierre Gleizes and Anthony Karageorgos: Self-Organization and Emergence in MAS: An Overview (2005). Informatica 30, 45–54.
[8] Wired News: Digital Actors in Rings can think (2002). http://www.wired.com/news/digiwood/1,56778-0.html
[9] Norling, Emma: Folk Psychology for Human Modelling: Extending the BDI Paradigm (2004).
[10] Cavazza Marc, Fred Charles and Steven J. Mead: Emergent Situations in Interactive Storytelling (2002)
[11] Breazeal Cynthia: Towards Sociable Robots (2002)
[12] Christian David & R. Michael Young: Strategic Deception in Agents (2004)
[13] Wilkins David E., Thomas J. Lee & Pauline Berry: Interactive Execution Monitoring of Agent Teams (2003)
[14] Willmott Steven, Alan Bundy, John Levine & Julian Richardson: Adversarial Planning in Complete Domains (1998)
[15] Smith Stephen J.J. & Dana S. Nau: Strategic Planning for Imperfect-Information Games (1993)

[16] Rao Anand S. & Graeme Murray: Multi-Agent Mental-State Recognition and its Application to Air-Combat Modelling (1994)
[17] Klinger Tamir: Adversarial Reasoning: A Logical Approach for Computer Go (2001)
[18] Yu Bin & Munindar P. Singh: Detecting Deception in Reputation Management (2001)
[19] Yu Bin & Munindar P. Singh: Searching Social Networks (2002)
[20] Pollack Martha E.: The Uses of Plans (1992)
[21] Goldman Claudia V. & Jeffrey S. Rosenschein: Emergent Coordination through the Use of Cooperative State-Changing Rules (1994)
[22] Schillo Michael, Bettina Fley, Michael Florian, Frank Hillebrandt, Daniela Hinck Self-Organization in Multiagent Systems: From Agent Interaction to Agent Organization (2002).
[23] The Sims Franchise Celebrates Its Fifth Anniversary and Continues to Break Records, http://www.tmcnet.com/usubmit/2005/feb/1114806.htm (2005)
[24] AIBO: http://www.sony.net/Products/aibo/
[25] Veloso Manuela & Peter Stone: Individual and Collaborative Behaviors in a Team of Homogeneous Robotic Soccer Agents (1998)
[26] Stone Peter & Manuela Veloso: The CMUnited-97 Simulator Team (1997)
[27] Federation of International Robot-soccer Association, http://www.fira.net/about/greetings.html

DECISION SUPPORT FOR A WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT TREATMENT SYSTEM

Milan VERDEV[1], *Marko BOHANEC*[2], *Sašo DŽEROSKI*[2]
[1] Gorenje, IT Department, Partizanska 12, SI-3320 Velenje, Slovenia
Tel: +386 3 899 2342; fax: +386 3 899 1700, e-mail: milan.verdev@gorenje.si
[2] Institut Jožef Stefan, Jamova 39, SI-1000 Ljubljana, Slovenia

ABSTRACT

This paper presents the current state of the project *Decision Support for the Waste Electrical and Electronic Equipment Treatment System in Slovenia*. The aim of the project is to design a decision support system to help decision makers of the Waste Electrical and Electronic Equipment (WEEE) treatment system in the development of incineration, disposal, treatment and recycling integrated programs. In the paper, we describe the WEEE, taking a broad view of various types of decisions in the field of WEEE. A detailed explanation of the decisions in the WEEE Logistics is given in the main part. We present two decision models, developed to support decisions in the WEEE Logistics. We also explain the role and activities involved in the management of the WEEE Treatment Decision Support System, which is implemented as a supplement to the decision support model.

1 INTRODUCTION

Waste management is one of the priority issues concerning the protection of environment and conservation of natural resources. As a significant treatment part of the waste management is the waste of electrical and electronic equipment (WEEE) [7].

WEEE (also called electronic waste or "e-waste") is waste consisting of broken or unwanted electrical or electronic appliances. It is a point of concern considering that many components of such equipment are toxic. E-waste includes computers, entertainment electronics, mobile phones and other items that have been discarded by their users. While there is no generally accepted definition of e-waste, it in most cases consists of expensive and more or less durable products used for data processing, telecommunications or entertainment in private households and businesses. Despite its common classification as a waste, WEEE is a considerable category of secondary resource due to its significant suitability for direct reuse, refurbishing, and material recycling of its constituent raw materials.

The Waste Electrical and Electronic Equipment Directive (WEEE Directive) is the European Community directive on waste electrical and electronic equipment which, together with the RoHS Directive [8], became European law, setting the collection, recycling and recovery targets for all types of electrical goods.

Slovenia has accepted the WEEE Directive and already transposed it into the legislation in November 2004. Like many other European Union member states, Slovenia has postponed the responsibility of producers and importers. The implementation is required until 1st January 2007, when all the activities should be prepared.

Producers and importers are individually responsible for the WEEE treatment. Because of the common activities, optimal processes and therefore expectations for minimal costs, they have joined in several non-profit collective schemes. One of them is called ZEOS, which includes the majority of most representative producers and importers. Gorenje, a household appliances producer, is a member and also one of the 8 founders that hold shares in ZEOS. In ZEOS, there are around 100 companies included. It covers about 80 percent of the WEEE market, which means approximately 80% of the WEEE material flow. Experiences from some other countries indicate there is a large quantity of material to process and ZEOS's expectations are very similar. *Those quantities demand optimal and clearly defined handling of all WEEE treatment processes*.

The aim of the WEEE Treatment Decision Support project is to create a decision support system [1] in order to help decision makers of the WEEE treatment system in ZEOS. A case study, relevant to the WEEE treatment system in Slovenia, is presented in this paper.

2 WEEE TREATMENT DECISIONS IN GENERAL

There are many decisions involved in the WEEE treatment system, so they need to be structured first. The main groups of decisions are related to:

Information technology: Almost every business today depends on information technology. There are decisions about software and information infrastructure.

Partners: A proper selection of various partners means long term cooperation and stable operations. There will be partners for collection sites, recyclers, logistics partners and partners for material disposal.

Recycling: A very important decision to be made is whether to build our own recycling center or not. In the case that we decide to build our own recycling center, we must also select its location. Besides, we need to decide about and select locations for the warehouses and disassembling plants.

Technology: For almost every task we need to decide which technology to use and what kind of machines to buy. Another decision is whether to use machines or people for some kind of jobs, e.g. disassembling, where both are possible.

Materials: Materials are the core of the whole recycling business. We need to decide how to recycle each type of materials, when to stop processing it, how to use it or bring it to the market.

Economy: There are many decisions concerning finances and economy. They are hidden in the various other buying or renting decisions. But the most important ones are decisions about prices to be set for WEEE treatment services and for recycled materials on the market.

Logistics: Logistics has an important role in the WEEE treatment business. There are many locations included in the transport network all over Slovenia and everything will be transported among them all the time. Section 3 focuses on decision support in logistics.

Environment: We should constantly assess our environmental burdening. Besides, there are various partners' environmental evaluations and decisions about their acceptability concerning environmental impact.

Energy: There are decisions about acceptable energy consumption of the system or each part of it.

Human resources: Human resources management has to take several decisions. All of them are extremely sensitive, because they concern people: decisions about new employment needs, employee selection and decisions about wages.

Knowledge transfer to the production process: There is a decision about whether it is necessary or reasonable to transfer knowledge gained during the WEEE treatment to production. Better knowledge of the recycling process and business overall can lead towards constant research and development of household appliances in the whole life cycle. Knowledge gained in the recycle business will be used in the R&D and production of new appliances in Gorenje.

3 WEEE DECISIONS IN LOGISTICS

The whole WEEE treatment system includes several different types of locations. At the beginning there are *collection centers*, where WEEE materials are collected from the users and WEEE material producers and importers. Then we can find *warehouses*, where WEEE material is temporarily stored, and *disassembling plants*, where it is partially disassembled. And at the end there are *recycling plants* or *recycling centers*, which recycle all of the WEEE material. Logistics has an important role in this business because all WEEE material must be transported between the numerous locations, more than 100 are expected, which are located all over Slovenia. It means that each location is like a node in a big network and must be continuously connected to the others and especially to the recycling center.

In WEEE logistics, there are three levels of decisions: *strategic, tactical and operational [3]*.

3.1 STRATEGIC DECISIONS

Decision about recycling center need: At the beginning there is no recycling center; material is recycled in various small recycling plants, which can be found elsewhere. This means that the majority of recycling part of the WEEE treatment business will be outsourced. At the moment, we can only predict the annual material flow. But in the future, when the quantity of material recycled per year is known, adequate and certain, the *decision about the recycling center need* will take place.

Decisions about the storage capacity and recycling capacity of the recycling center: When the decision for the location center has been accepted, a decision about its capacity would become necessary. In fact, there are two decisions. First, there is a *decision about the storage capacity*, which is about the dimensions of the building that can be used for storage, internal logistics and recycling processes. The second one is a *decision about the recycling capacity*. Recycling capacity means how much material can be recycled over a given period of time, e.g., one day. It must be sufficient to cover recycling needs in the near future.

Decisions about supported types of recycling: Supported recycling types means specific types of material or types of recycling, which can be handled by the recycling center. It depends on the market; firstly what kind of materials there are in the majority of the electrical appliances; and secondly, what kind of materials are needed on the market. But the most important attribute is the profitability of the particular material or type of recycling.

Decision about the location of the recycling center: This decision is very sensitive. It's true that it depends on business parameters, like the optimal distance from the other locations in the WEEE treatment system, proximity of the recycling materials' consumers and availability of appropriate experts in the region. But there is also the very important social aspect of the problem, which means how society in the region will accept the recycling center. The possible motivation for the community to accept the recycling center is an expected rise of employment and potential development of the region. The reason against is the potential environmental risk to the region.

Decisions about the need for disassemble plants and warehouses: There will be no recycling center at the beginning and therefore some other facilities might be used for partial disassembling and warehousing. This decision will certainly take place very soon. Even when a recycling center is built, it will still be desired to have some more warehouses and disassembling plants.

Decisions about the locations of the disassembling plants, warehouses: As soon as the decision for a disassembling plant or warehouse is taken, some new decisions are needed. Those are *decisions about the location of the disassembling plant or warehouse*. Those kinds of facilities should be at the locations where they fit perfectly in the whole distribution network. The decisions depend on the geographical characteristics, social and environmental parameters.

Decision about the capacity of disassembling plants and warehouses: For all the facilities, mentioned above, a decision about the capacity is also important. For disassembling plants, there is also a disassembling capacity decision.

3.2 TACTICAL DECISIONS

Decision about the logistic partner selection (or evaluation): Before the first transport, a proper transport partner should be found. Therefore, *the selection of the logistic partner* is one of the earliest decisions. A proper partner can substantially influence the business success. The partner should be reliable, flexible, but what is the most important is the quality of its service. The decision parameters used for this decision can also be used for periodical evaluation purposes, but including some additional attributes. We could evaluate and compare partners annually or more frequently.

Decision about own vehicles need: When the quantities of material per time unit become stable, we should *decide whether to use our vehicles or even fleet*. We can expect a lot of locations and very frequent transports and our own vehicles and drivers could be the cheapest solution when used properly and frequently.

Decision about our own vehicles selection or even fleet: It is important what kind of vehicles we should use. The *decision about the vehicles characteristics* depends on their consumption and pollution, but also on the capacity and ability to load and unload the cargo.

Decision about the transport units or caissons selection: One of the fundamental decisions is the *decision about the transport units*. They must be big enough to contain a sufficient amount of material but not too big, because then they are seldom full and they are hard to transport. They should also be durable and easy to handle.

3.3 OPERATIONAL DECISIONS

Decision about the transport need: Before any transport is made, a *decision about the transport need* must be taken. There are a lot of locations and all of them should be monitored to find if there are units ready for transport. On the other hand, there is recycling, which can also be called production, with its needs, for recycling or for disposal. The decision about the transport need means constant optimization between those two demands.

Decision about the transport provider: Transport provider must be selected for each transport separately. Every transport is different and not all the transport providers are good for all the transports. It depends on trucks suitability as well as availability at a particular time.

Optimal path selection: One of the attributes for transport provider selection is also a previously *selected optimal path*. This selection can substantially contribute to the optimization of costs of the transport. The optimal path also depends on the locations of the vehicles.

There are four of the listed decisions, which will be made continuously. First, there is logistic partner selection, which will be used for annual partner evaluation as well, but with some additional group of attributes. The other three are all operational decisions, transport need decision and transport provider selection combined with optimal path selection. Decision models for two of them are presented in the following two sections.

4 DECISION SUPPORT FOR THE LOGISTICS PARTNER SELECTION AND EVALUATIONS

At the beginning of the WEEE project, proper transport partners should be selected. This selection will take place every time a new partner is needed. The management will decide which partner to contract and which not, but on the basis of a decision support system [5]. For this purpose, we have designed a multi-attribute model (Figure 1) using the DEXi decision modelling software [4]. Figure 2 shows an example of evaluating four potential transport providers.

The success of the project will pretty much depend on those partners as well. That is why annual partner evaluation is also planned. Almost the same decision support model could be used for that task as well: only history data should be added to the model.

Partner	Partner evaluation, suitability
├ **Company**	Company of the logistics partner
├├ **Market position**	Position and recognition on the market
├├├ Tradition	Company's presence on the market
├├├ Number of clients - References	Number of clients and market share
├├└ Income	Annual income of the company
├└ **Employees properties**	Parameters that concern employees
├ ├ Human resources care	Human resources treatment and possibilities
├ └ Number of employees	Number of employees in the company
├ **Service & Environment**	Services and their impact on environment
├├ **Vehicles**	Description of the vehicle
├├├ Number of vehicles	Number of suitable vehicles in the company
├├├ Average Age	Average age of the fleet
├├└ Vehicles tracking system	Use of Vehicles tracking and controlling system
├├ **Operation**	Area of operations
├├├ Operational area	Range of operations in Slovenia
├├└ WEEE treatment services	Possibilities for other WEEE treatment services
├└ **Environmental Evaluation**	Environmental value of the company
├ ├ Vehicle Fleet Environm. Value	Environmental value of the vehicle fleet
├ ├ Environmental influence	Environmental value of the entire company
├ └ Environmental certificates	Environmental certificates?
└ **Costs**	Expected costs for the service
├ Contract costs	Costs by the contract
└ Costs Sensitivity	Potential costs rise

Figure 1: Logistics partner DEXi model

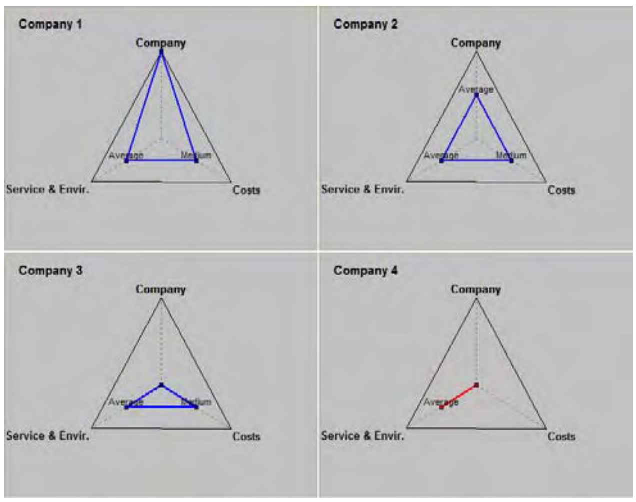


Figure 2: Logistics partner evaluation

5 DECISION SUPPORT IN THE TRANSPORT PROVIDER SELECTION

When the decision about the transport need is taken, a decision about the transport provider is needed immediately. That is why the transport provider selection is an operational decision which will take place very frequently, which means practically every day. The person responsible for this decision is the operator in the Call center. This model (Figure 3) has been developed to help this person to decide optimally. It is a combined decision about an optimal path selection and an optimal partner or even a vehicle for the particular transport. An example evaluation is shown in Figure 4.

Transport provider	Transport provider evaluation
├Vehicles adequacy	Proper vehicle attributes and its position.
│ ├Truck suitability	Proper vehicles dimensions and load capabilities
│ └Vehicle position - path length	Position of the truck concerning selected locations
├Costs	Expected costs of the transport
│ ├Contract costs	These are planned costs, e.g.regarding the contract.
│ └Additional costs - costs sensitivity	Additional costs probability
├Availability	Availability of the truck in the near future
└History - Flexibility	Our general impression about its previous jobs

Figure 3: Transport provider DEXi model

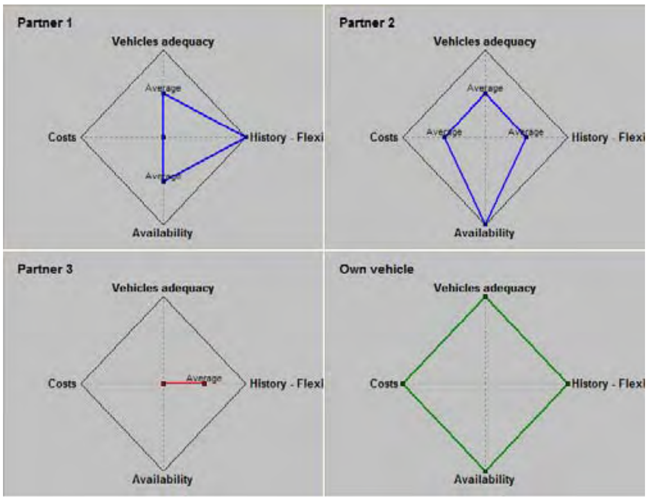


Figure 4: Transport provider evaluation

6 MANAGEMENT OF THE DECISION SUPPORT SYSTEM

Constant evaluation and improvement of the decision model can be very helpful in business improvement. The first requirement is that decisions as well as performance of the decided options are closely monitored. We should keep track of decisions being made as well as their performance after being implemented. Thus, we can group monitoring and logging into two groups:

- Monitoring and logging of the decision process, which includes all the possible alternatives, their attributes, utility functions and the results.
- The most important data are data gathered from the performance of the selected option in the decision process. We should measure time, costs, service quality, quantity of transported material, number of transports, its frequency, distances, number of kilometres covered, etc.

These data may be analysed by using data mining algorithms [2] to extract useful information, which are the basis for the management of the decision support system [1]. The plan is to be carried out using the Plan-Do-Check-Act (PDCA) cycle [6], which is becoming a standard mechanism in management systems.

7 CONCLUSION

The WEEE directive requires that providers and importers are responsible for the waste of electrical and electronic equipment. Large quantities demand optimal and clearly defined WEEE treatment. We have presented the current results of the Decision Support project, relevant to the WEEE treatment system in Slovenia.

So far, the identification of the decision processes has been made and two of the models in logistics, which are presented in Section 4 and Section 5, have been developed. Also, we have designed the management of the decision support system.

The implementation of the WEEE Treatment Decision Support System in Logistics is expected in 2007, followed by the extension and adaptation of the decision support system into other fields (Section 2) of WEEE treatment.

8 REFERENCES

[1] Mladenić, D., Lavrač, N., Bohanec, M., Moyle, S. (eds.): *Data mining and decision support: Integration and collaboration*. Kluwer Academic Publishers, 2003.

[2] S. Džeroski. Data mining in a nutshell. In S. Džeroski, N. Lavrač, editors, Relational Data Mining, pages 3-27. Springer, Berlin, 2001.

[3] E. Mallach: Understanding decision support systems and expert systems, 32-36. Richard D. Irwin, Inc., 1994

[4] E. Jereb, M. Bohanec, V. Rajkovič: DEXi - Računalniški program za večparametrsko odločanje. Moderna organizacija, Kranj, 2003.

[5] A.H. Simon: The New Science of Management Decision. Prentice-Hall, 1977.

[6] PDCA cycle description by HCi (Information development organization), 2006. <http://www.hci.com.au/hcisite3/toolkit/pdcacycl.htm>

[7] Official WEEE site, European Commission, Last update: 2006/09/14. <http://europa.eu.int/comm/environment/waste/weee_index.htm>

[8] Directive of the European Parliament on the restriction of the use of certain hazardous substances in electrical and electronic equipment, 2003/01/27. <http://europa.eu.int/eur-lex/pri/en/oj/dat/_2003/l_037/l_03720030213en00190023.pdf>

ERP SYSTEM AND SELECTION METHODOLOGIES

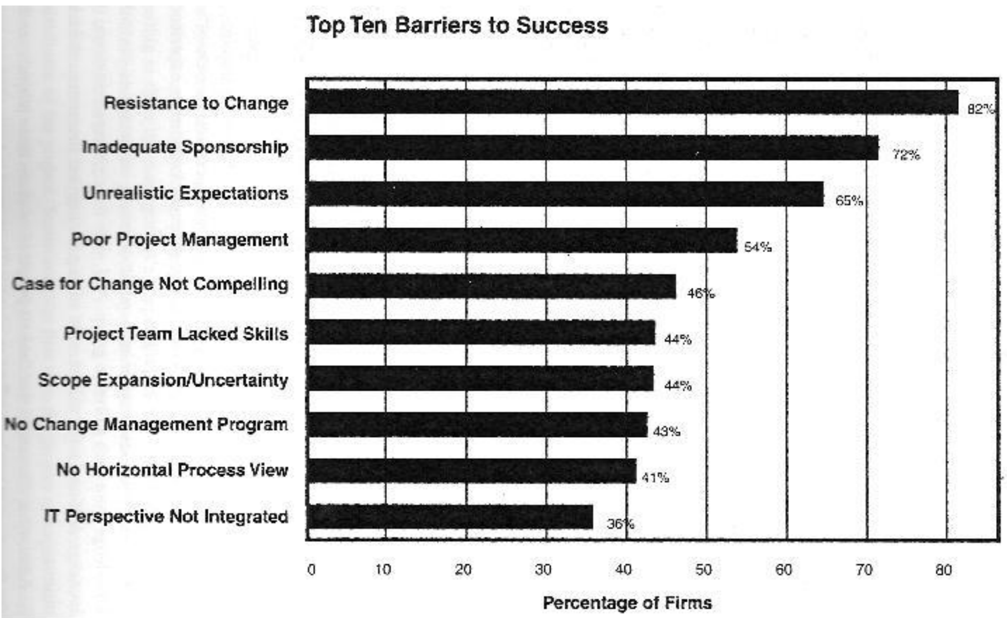
Primož Vreček, Miha Volovšek

Aggregata d.o.o.
management consulting
Gerbičeva 57, 1000 Ljubljana
Tel: +386 1 280 88 06

1. Introduction

The main purpose of this paper is to present and define ERP Moreover, for a successful selection and implementation of an ERP system, a right approach has to be selected, which will in process deliver the optimal results with the chosen ERP system. It will be discussed, which the main methodologies for selection process, their main advantages and disadvantages. In the past there were many failed selection and implementation projects, which make this particular topic very relevant, also with the increasing level of information technology development and needs of organizations.

In the past 30 years, a majority of the selection and implementation projects have been failures. Most of the projects have taken much more time, than originally planned and had much higher costs than originally planned and finally, they did not deliver the required results. Many of these projects were also aborted after some years of effort and high costs (1). There are also other reasons why such projects have failed in the past, apart from selection of inadequate ERP system, as shown on a picture below.

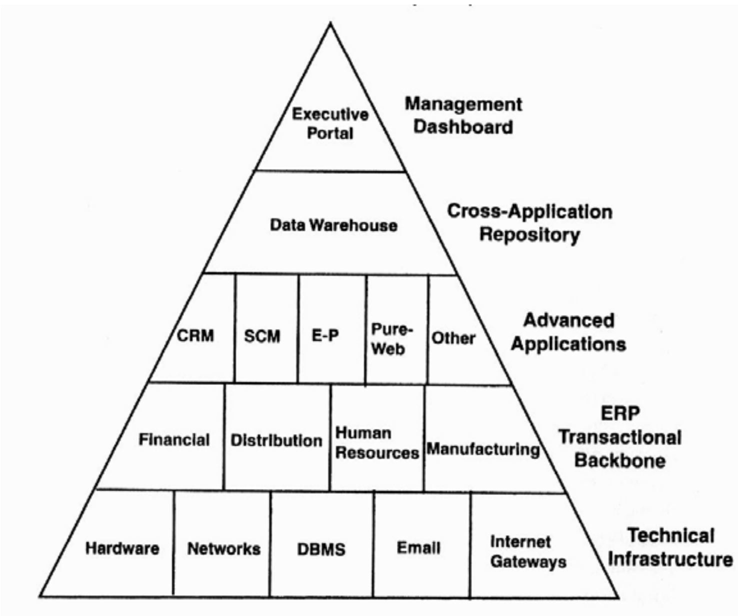


Source: (1), Deloitte & Touche 1998 CIO survey

2. ERP system

ERP or resource planning system is a set of applications with a structured approach to optimizing an organization’s internal and external value chain. It is fully installed across an entire organization and connects different components of the system with transmission of common data into one integrated ERP system. When a change of data occurs in one part of the system, the change is made and processed in the whole integrated system, thus allowing better coordination of the processes. A change in one component affects all other components of the integrated system. The system standardizes and organizes organization`s business processes and data. The data is transformed into useful information, which can be analyzed to support decision making. ERP system is an enabling technology, a set of integrated modules that make up the core engine of internal transaction processing. Selecting and implementing ERP requires major changes to organizational, cultural and business processes. As a result, in an ERP-empowered organization, new technologies and processes force individuals to upgrade their skill set as well their working pattern. (2)

There are many different sets of application modules that make up an ERP system. Sometimes there are also some terminology problems regarding what particular sets of application modules are included in an ERP system. The system has already been referred to as ERP, e-business, CRM, e-stores, e-procurement, SCM, data warehousing, etc… How all these different types of application modules fit together in a system is shown in a graph below.



Extended Enterprise System Framework

Source: (1)

The term used is XES or eXtended Enterprise System (1) and represents a system, with all sets of up-to-date application modules. This system framework is commonly and most widely called an ERP system.

3. Selection methodologies

Selecting the right ERP system to enable business process improvements is an important decision for an organization. Selecting the wrong ERP system can lead to a project failure even with a good implementation approach. There are no ERP systems, which would satisfy 100% of all requirements, but there are systems, which could satisfy 80% to 90% of necessary requirements of an organization. (1)

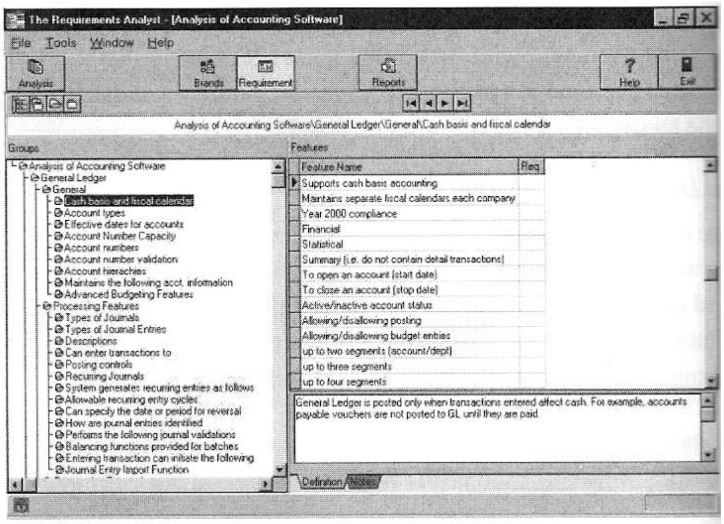
There are two main selection methodologies:

- Requirements analysis,
- Gap analysis: comparing “As is” and “To be”

Requirements analysis

Requirements analysis is a review of system requirements for organizational models, artefacts and processes (MAPs). (3). Requirements are catalogued by their importance and necessity. Requirements are then summarized in a requirements document called request for proposal or RFP, which is then send to different vendors. RFP document is then used for the organizations to evaluate, which different part of the software meets their needs.

Requirements analysis (example)



Source: (3)

Advantages of requirements analysis are:

- list of requirements can be used to benchmark different software packages,
- provides basis for communication and discussion of different MAPs,
- better understanding of the limitation of existing MAPs,
- ensures, that specific needs are met.

Disadvantages:

- requirements can be very time-consuming
- requirements analysis can be very costly
- if RFP is too large, vendors may be too busy to reply in an appropriate time
- requirements analysis may lock organizations into old working patterns

Gap analysis: comparing “as is” and “To be”

Second selection methodology deals with developing an “as is” analysis and a “to be” analysis and then compare these two by a gap analysis. “As is” refers to current system functionality. The organization must then decide and research the “to be” model. If the “to be” analysis is clean slate, then it becomes the requirements analysis, however more often “to be” is based on a specific ERP package and may also be called “best practice” analysis. (3)

Gap analysis is then used to see, what gap exists currently between what an organization has and what an organization needs, it enables the organization to determine what modifications are necessary for a software to meet their needs. (3)

Advantages:

- provides better practical insight into new system
- all functions and modifications of the new system can be directly tested
- it offers better cooperation with the vendors (3)

Disadvantages:

- how is a gap defined?
- can the gap be calculated by requirements?
- should only the critical requirements be considered?(3)

Alternative approach

Increasingly organizations are doing only “to be” analysis and no “as is” analysis. In this case ERP technology is seen as true technology enabled reengineering.

Arguments are for such approach are:

- each ERP package is assumed to meet organizational needs,
- organizations should rather reengineer existing business processes using ERP technology,
- best practice analysis should take place only within context of the specific ERP software chosen,
- implementation costs are minimized by making few changes in the software, only best practice within specific ERP system. (3)

There are also some extra information, that have to be included in the process:

- are there any similar organizations, that have implemented an ERP system,

- ERP system recommended by the consultant, who has specific knowledge of some ERP systems. (3)

4. Conclusion

There are advantages as well as disadvantages of all methodologies. For each particular selection process, there is one of these methodologies, that is best suited for the selection process. There are also The question, whether ERP system will actually fulfil all the needs will never remain entirely answered, for technology is constantly improving, but the needs of organizations are also constantly changing. It is vital however to critically consider all possible approaches to a selection process, truly evaluate all needs and try to gather as much possible information regarding different potential ERP systems.

5. References

(1) Murrel G. Schields, E-business and ERP, Rapid implementation and project planning, John Wiley & Sons, Inc. 2001

(2) Grant Norris, James R. Hurley, Kenneth M, Hartley, John R. Dunleavy, John D. Balls, E-Business and ERP, Transforming the Enterprise, , John Wiley & Sons, Inc. 2000

(3) Daniel E. O`Leary, Enterprise resource planning systems, systems, life cycle, electronic commerce and risk, Cambridge university press 2002

DESIGNING ONTOLOGY FOR THE OPEN TRAVEL ALLIANCE AIRLINE MESSAGING SPECIFICATION

Mladenka Vukmirovic
Industry Development Department, Montenegro Airlines
Beogradska 10, 81000 Podgorica, Montenegro
e-mail: mladenka.vukmirovic@mgx.cg.yu

Marcin Paprzycki
Computer Science Institute, SWPS
Chodakowska 19/31, 03-815 Warsaw, Poland
and
Systems Research Institute, Polish Academy of Science
Newelska 6, 01-447 Warsaw, Poland
e-mail: marcin.paprzycki@ibspan.waw.pl

Michał Szymczak
Department of Mathematics and Computer Science
Adam Mickiewicz University
Umultowska 87, 61-614 Poznań, Poland
e-mail: wildmike@interia.pl

ABSTRACT

Advancement of usage of ontologies requires not only creation of new ontologies (e.g. in a top-down manner), but also ontological support for existing domain-specific real-world standards. One of such standards that gains popularity is the Open Travel Alliance (OTA) messaging system that defines, among others, the way that entities should communicate about air travel related issues. The aim of this note is to outline our efforts leading toward creating an air-travel ontology that would match the OTA messaging specification as well as satisfy procedures described in IATA manuals.

1 INTRODUCTION

Recently we have proposed an airline ticket auctioning system that could be used as a part of an agent-based Travel Support System (TSS) [4, 14, 15]. In the TSS, travelers find complete support of their needs including, among others, items like restaurant information, historical points of interest, local weather etc. It is important to emphasize that the ticket auctioning system and the Travel Support System were developed separately. The ticket auctioning system was conceived in the context of a model agent-based e-commerce system (see [1, 2] and references to our earlier work contained there). During its creation we were aware that we should interface our agents with the Global Distribution System (GDS) used by airlines to sell their inventory, but we did not pursue this problem further [14, 15]. Meanwhile, in the TSS we made ontologically demarcated data the centerpiece of our system and have developed ontologies of a *hotel* and a *restaurant* [3]. When attempting at merging the two systems, we have realized that, on the one hand we have to deal with data representation used in airline distribution systems, which is regulated by IATA and which has nothing to do with ontologies, and with RDF demarcated instances of our travel ontology on the other. The natural way of solving this problem was to find or develop a suitable ontology to represent airline travel data. After an in-depth research of existing air-travel ontologies we have concluded that none of them is capable of addressing issues that arise when real-life IATA rules come to play [4, 6, 7, 8, 9, 10, 11]. Therefore we decided to develop a new ontology that would reuse as much as possible from the ontology used in the TSS, as well as existing air-travel ontologies (initial results of our work have been summarized in [14, 15]). Meanwhile we have found that changes take place in data representation used in airlines' proprietary systems. They are spearheaded by IATA's movement to utilize new technologies such as XML (and lately there is even talk about ontologies). Furthermore, as we have studied existing air-travel related ontologies, we became interested in the Open Travel Alliance (OTA) messaging specification. It needs to be stressed that this messaging standard was developed with intent to model the process (and not persist) data. Therefore this is not an ontology per se. However, it proved to be very suitable for data exchange; even to the extent that some GDSs already offer interfaces based on it. Therefore, we have decided to modify our air-travel ontology in such a way that it would be able to persist data defined by the OTA messaging system. Ontology with these features would enable us to exchange data between the TSS and the GDSs that offer an OTA-based interface.

2 OTA AND OTA AIR-MESSAGES

The Open Travel Alliance (OTA) is a non-profit organization working to establish a common electronic vocabulary for exchange of travel information. It defines messages using the eXtensible Markup Language (XML). Its specifications have been designed to serve: (a) as a common language for travel-related terminology, and (b) as a mechanism for exchange of information between travel industry members [5]. The OTA Air Messages standard specifies structure and elements of different scenarios involved in selling air travel tickets. Let us note that since this is a specification of messaging, it does not cover any other operations involved in selling air-tickets (e.g. airfare calculations). These operations have to be treated separately. OTA messages have been proposed as pairs of request and response messages (RQ / RS below). Let us summarize their main features (their complete description can be found in [12]).

OTA_AirAvailRQ/RS – establishes airline flight availability for a city pair, specific date, specific number and type of passengers. The request can also be narrowed to a specific airline, flight or booking class. Optional requested information can include: time / time window, connecting cities, client preferences (airlines, cabin, flight types etc.). The response message (*RS*) contains flight availability. Furthermore, a set of origin and destination options is returned, each of which contains one or more (connecting) flights that serve that city pair. For each flight information about: origin and destination airports, departure and arrival date/times, booking class availability, equipment, meal information and code-share information is returned.

OTA_AirBookRQ/RS – requests to book a specific itinerary for one or more identified passengers. The message contains optional pricing information, allowing the booking class availability and pricing to be rechecked as part of the booking process. Optional requested information can include: seat and meal requests, Special Service Requests (SSR), Other Service Information (OSI), remarks, fulfillment information – payment, delivery details, type of ticket desired. If booking is successful, the RS message contains the itinerary (including the directional indicator, status of booking, and number of passengers), passenger and pricing information sent in the request, along with a booking reference number (PNR Locator) and the ticketing information. The RS echoes back received information with additional information – booking reference from the GDS through which reservation was created.

OTA_AirFareDisplayRQ/RS – allows a client to request information on fares, which exist between a city pair for a particular date or date range. No inventory check for available seats on flights is performed by the server before the RS is send back. The request can optionally contain information indicating that a more specific response (e.g. passenger information, specific flight information and information on the types of fares that the client is interested in) is required. The RS message repeats *FareDisplayInfo* elements, each of which contains information on a specific fare contract including airline, travel dates, restrictions and pricing. It can also return information on other types of fares that exist, but have not been included in the response.

OTA_AirFlifoRQ/RS – requests updated information on the operation of a specific flight (it requires the airline, flight number and departure date; the departure and arrival airport locations can be also be included). The RS includes real-time flight departure and arrival information. It also includes: departure airport, arrival airport, marketing and operating airline names; when applicable, flight number, type of equipment, status of current operation, reason for delay or cancellation, airport location for diversion of flight, current departure and arrival date and time, scheduled departure and arrival date and time, duration of flight, flight mileage, baggage claim location.

OTA_AirLowFareSearchRQ/RS – requests priced itinerary options for flights between specific city pairs on certain dates for a specific number and types of passengers. Optional requested information can include: time / time window, connection points, client preferences (airlines, cabin, flight types etc.), flight type (nonstop or direct), number of itinerary options desired. The RS contains a number of *Priced Itinerary* options. Each includes: a set of available flights matching the client's request, pricing information including taxes and full fare breakdown for each passenger type, ticketing information – ticket advisory information and ticketing time limits, fare basis codes and the information necessary to make a rules entry.

OTA_AirPriceRQ/RS – requests pricing information for specific flights on certain dates for a specific number and type of passengers. The message allows for optional information such as fare restriction preferences and negotiated fare contract codes to be included. The pricing request contains information necessary to perform an availability / sell from availability / price series of entries for an airline CRS or GDS. The RS contains a *Priced Itinerary* that includes: set of flights, pricing information including taxes and full fare breakdown for each passenger type, ticketing information, fare basis codes and the information necessary to make a fare rules entry.

OTA_AirRulesRQ/RS – requests text rules for a specific fare basis code for an airline and a city pair for a specific date. Negotiated fare contract codes can be included in the request. The RS contains a set of, human readable, rules, identified by their codes.

OTA_AirSchedulesRQ/RS – provides customer, or a third party, with ability to view flight schedules. It requires specification of the departure and arrival cities and a specific date. It offers flight information on airlines that provide service between requested cities and could be used when customer: (1) wants to determine what airlines offer service to/from specific destinations, (2) is looking for a specific flight number – by entering the arrival and departure cities, and the approximate arrival or departure time, specific flight number can be found, (3) needs to determine the days of the week that service is scheduled to and from requested destinations, (4) wants to determine aircraft type used to fly that route. Message may request other information that customers are interested in: meal service, duration of flight, on-time statistics and if smoking is allowed. In addition, these messages provide foundation for electronic timetables.

OTA_AirSeatMapRQ/RS – displays seats available on a given flight, as well as their location within the aircraft. It is used o make seat assignments as it identifies all information necessary to request and return an available seat map for a particular flight. Types of information for the seat map request include: airline, flight number, date of travel, class of service and frequent flier status. The RS includes: flight, aircraft and seat description information.

OTA_AirBookModifyRQ/OTA_AirBookRS – requests to modify an existing booking file. It contains all elements of the *OTA_AirBookRQ* plus a general type of modification, i.e. name change, split, cancel or other; as indicated with the attribute *ModificationType*. The modification operation on different elements is either indicated with the existing attribute *Status* (for air segments, SSR's and seat requests) or with attribute *Operation* of type *ActionType* for other elements (i.e. other service information, remarks or *AirTraveler* elements). In the *AirBookModifyRQ*, all data to be changed is submitted and in the *AirReservation* element all existing data may be submitted. This allows the receiving system to perform a consistency check before updating the booking file (but to keep the message small, this part can be omitted). Changes to a booking (1) may result in required updates of the ticket (e.g. revalidation), (2) may imply charges for the change, (3) the pricing may change, and/or (4) some fees may need to be collected. Pricing and fulfillment details required to achieve results of *AirBookModify* ticketing, are out of scope and are omitted. The RS confirms changes in the itinerary.

3 PROPOSED ONTOLOGY

As indicated above, in our research [14, 15] we have established that existing air-travel ontologies have been designed as "academic" demonstrator systems – rather than with the goal of actually working within the context of real-life airline reservation systems – and this explains lack of important features when it comes to dealing with genuine air travel data. According to our best knowledge, the only project that actually involves airline industry is the OTA specification (which, as stated above, is only a messaging specification). Therefore, we decided to create new ontology that would: (1) utilize IATA mandated data descriptions and recommended practices; (2) utilize as much as possible from existing travel ontologies – as long as they follow IATA practices, (3) match features included in the OTA specification, and (4) be synchronized with our existing travel ontology. To achieve this goal we have applied a bottom-up approach and our initial goal was to model reservations occurring in the AMADEUS global distribution system.

IN the proposed ontology we have divided main classes into following groups: *AirInfrastructureCodes, AirTravel, AirInfrastructure* and *AirtravelCodes*. *AirInfrastructure* group encloses most basic terms related to air travel industry such as *Airline*, *Airplane* and *Airport*. While all three are defined in line with specifications presented in [6, 7, 11], the latest (*Airport*) is a subclass of our *OutdoorLocation* class that was designed for the TSS [4]. In this way it is possible for the traveler to obtain more data regarding the airport then the city name, which usually is the only information that can be obtained from other airline travel related ontologies. *AirInfrastructureCodes* group contains, used in other classes, codes for airports and countries. Included classes are *ISOCountryCode* and *AirportCode*. *AirTravelCodes* group comprises industry codes used in GDSs and CRSs for itinerary reservation and ticket issuance: *IATATicketIndicator*, *IATAStatusCode*, *CabinClass*, *BookingClass*, *IATAFareBasis*, *MealCode*, *SSRCode*, *SSRMealCode*, *TicketDestignator* (details can be found in [6, 7 , 8, 9, 10, 11]). Finally, the *AirTravel* group takes care of upper-level terms that define more complex objects used in air travel systems. Following classes are included in this group: *OfficeID*, *TerminalID*, *AgentCredentials* – that define credentials of the GDS/CRS user, *AvailabilityDisplay* – that defines available flight options for a certain route, *Flight* - with usual properties together with status statistics, *IATAItinerary* – that defines itinerary for the passenger, *PNR* – Passenger Name Record or, simply described, a reservation with all details of the passenger, the itinerary, special requests and the GDS/CRS locator code, *Pricing* – that describes available prices for a certain route with or without taxes included, *SeatMapPlan* – for a certain flight, *Tariff* - with *Category* properties that are coded as in the *ATPCO*'s (Airline Tariff Publishing Company) recommendation, and *TimetableDisplay* – with timetable of different airlines for a certain route.

As stated above some classes were inherited or used as upper level classes from the TSS. These classes are: *OutdoorLocation*, *IATADiscountCodes**, *MeanOfPayment*, *FareTax*, *Discounts*, *DiscountCodes*, *IATATaxCodes**, *NameRecord*, and *PersonTitle*. Marked with * are classes that were sub classed from classes inherited from the TSS.

One additional, very important, concept in traveling is currency. At first we designed a very simple class that contained only the currency code. Promptly this showed to be insufficient as air travel currency application involved some complicated restrictions. As in the case of air travel ontology, we made an effort to find an already existing ontology of currency, and inject it into our project. We studied several currency ontologies (more details can be found in [13]) and found out that ontology used in Cambia webservice [3] was the most appropriate one. Unfortunately, it was rather broad, and furthermore we had to modify it so that it could be used for currency conversion guided by the IATA conversion rules [9].

Let us stress that since the OTA was defined as a messaging system used for information exchange, while the proposed ontology was created with intention to describe persistent data in our system, therefore quite often more then one class from our ontology has to be used in association with a single OTA message. As request (RQ) messages contains only data used to make a query, let us illustrate how the RS message matches with the proposed ontology in the case of the *OTA_AirAvailRS*. In our ontology an equivalent class is *AvailabilityDisplay*. Both are used with regard to available flight information and contain flight numbers, arrival/departure details as well as available seats etc. In Table 1 we depict how elements of the message match elements in our ontology.

OTA message	*OTA message element*	*Related classes from our ontology*
`OTA_AirAvailRS`	OriginDestinationOption	
	FlightSegment atributes *DepartureDateTime* *ArrivalDateTime* *FlightNumber* *JourneyDuration* *SmokingAllowed* *OnTimeRate* *Ticket*	Flight class properties *departureTime* *arrivalTime* *flightNo* *journeyduration* *smokingAlowed* *onTime* *etkt*
	DepartureAirport LocationCode	Flight class property *origin*
	ArrivalAirport LocationCode	Flight class property *destination*
	Equipment *AirEquipType, ChangeofGauge*	Flight class property *aircraft* with range airplane with further details of equipment
	MarketingAirline	Relates to *CodeShare* class that contains data regarding marketing carrier
	BookingClassAvail *ResBookDesigCode,* *ResBookDesigQuantity*	*AvailableClassElement, AvailableClasses, AvailableFlightElement* and *AvailableFlights* all used to show hierarchy for connecting flights and classes available in plane. First relates to *class* of *AvailableClassElement* and later relates to *noAvailableSeats* property of the same class
	Meal *MealCode*	*MealCode* class

Table 1. *Matching the OTA message with the air-travel ontology*

6 CONCLUSION

In this note we have discussed crucial aspects of design of complete air-travel ontology. Proposed ontology goes beyond what is proposed thus far in existing air-travel ontologies, as it is based on IATA manuals and OTA messaging system. Therefore, when completed (currently the proposed merged travel ontology it is available for comments at: http://agentlab.swps.edu.pl) can be used to interface our travel support system with an actual GDS, which is one of goals of our project. Specifically, we will develop a subsystem that will parse OTA RQ messages originating from the GDS into SPARQL queries to be executed in the TSS. Obtained responses (in form of RDF triples) will be parsed back to OTA RS messages.

References

[1] Bădică, C., Bădită, A., Ganzha, M., Paprzycki, M., Developing a Model Agent-based E-commerce System, in: Jie Lu et. al. (eds.) E-Service Intelligence - Methodologies, Technologies and Applications (to appear)

[2] Bădică C., Ganzha M., Paprzycki M., UML Models of Agents in a Multi-Agent Ecommerce System. In: Proceedings of the ICEBE 2005 Conference, IEEE Press, Los Alamitos, CA, 56-61

[3] Cambia Service, http://zurich.agentcities.whitestein.ch/Services/Cambia.html

[4] Gordon M., Paprzycki M., Designing Agent Based Travel Support System. In: Proceedings of the ISPDC 2005 conference, IEEE Computer Society Press, Los Alamitos, CA, 2005, 207-214

[5] http://www.opentravel.org/about.cfm

[6] IATA Airline Coding Directory – Airline Designators, 70th Edition

[7] IATA City Code Directory, 43rd Edition, Effective 9 December 2005 – 31 December 2006

[8] IATA Passenger Services Conference Resolutions Manual, 24th Edition, Effective 1 June 2005 – 31 May 2006

[9] IATA Passenger Tariff Coordination Conferences Manual, Composite, Dec 9, 2005 until Dec 31, 2006

[10] IATA Reservation Service Manual, 23rd Edition

[11] IATA Standard Schedules Information Manual, Mar 1, 2006 until Sep 30, 2006

[12] OpenTravelTM Alliance, Message Users Guide. 2005B Version 1.0, 2 December 2005

[13] Szymczak M., Gawinecki M., Vukmirovic M., Paprzycki M., Ontological reusability in state-of-the-art semantic languages, Proceedings of the XVIII Summer School of PIPS (to appear)

[14] Vukmirovic M., Ganzha M., Paprzycki M.: Developing a Model Agent-based Airline Ticket Auctioning System. In: Proceedings for the IIPWM Conference, LNAI

[15] Vukmirovic M., Szymczak M., Ganzha M., Paprzycki M.: Utilizing Ontologies in an Agent-based Airline Ticket Auctioning System. In: Proceedings of the 28th ITI Conference, IEEE Computer Society Press, Cavtat, Croatia, 385-390

POSNEMANJE OPAZOVANEGA VEČAGENTNEGA SISTEMA Z UPORABO MASDA V DOMENI 3VS2 KEEPAWAY

Andraž Bežek, Matjaž Gams
Odsek za inteligentne sisteme
Institut "Jožef Stefan"
andraz.bezek@ijs.si, matjaz.gams@ijs.si

Ivan Bratko
Fakulteta za računalništvo in informatiko
Univerza v Ljubljani
ivan.bratko@fri.uni-lj.si

POVZETEK

V članku obravnavamo problem posnemanja delovanja večagentnega sistema. Na kratko predstavimo algoritem za odkrivanje strategije večagentnega sistema (MASDA) in njegovo aplikacijo na domeni robotskega nogometa 3vs2 Keepaway. MASDA uporabimo za generiranje opisov agentnega delovanja referenčne skupine agentov s poznano strategijo, ki jih nato neposredno uporabimo pri implementaciji agentov. S takim postopkom aktivno posnemamo delovanje referenčne skupine agentov. V članku ocenimo kvaliteto posnemanja z različnimi meritvami in načini vrednotenja podobnosti obnašanja referenčne in naučene skupine agentov.

1 UVOD

Večagentni sistemi (angl. *multi-agent systems*, krajše MAS) so dinamična okolja, v katerem deluje množica avtonomnih agentov. V kooperativnih MAS deluje skupina agentov z namenom, da zadovolji skupne cilje, ki jih zgolj z delovanjem posameznih agentov ne bi mogli doseči. Njihovo delovanje je običajno opisano z nekim skupnim planom oz. strategijo, ki opisuje vloge in določa ciljno usmerjeno obnašanje posameznih agentov znotraj skupine. Cilj modeliranja večagentnih sistemov je torej zaznati obnašanje, ki je posledica izvrševanja skupne strategije in ločiti od obnašanja, ki je zgolj posledica agentnega odziva na lokalne spremembe okolja.

Naš cilj je bil razviti domensko neodvisen algoritem, ki odkrije in opiše strateško večagentno obnašanje in s tem omogoči ljudem, da razumejo principe delovanja opazovanega MAS. Zato smo razvili algoritem za odkrivanje strategije večagentnega sistema (angl. *Multi-Agent Strategy Discovering Algorithm*, krajše MASDA) [1][2]. Algoritem za vhod uporablja sled izvajanja akcij agentov in časovne spremembe stanja MAS. S pomočjo iterativnega procesa abstrakcije lahko algoritem določi, kateri vzorci agentnega obnašanja so dejansko del strategije in kateri le posledica lokalnega delovanja agentov. Rezultat algoritma je opis strateškega obnašanja agentov, ki je predstavljen v grafični in simbolni obliki. Grafično obliko predstavlja usmerjen graf, ki ustreza poteku zaporedja izvajanih akcij, imenovanih makro akcij, simbolni opis pa sestavljajo pravila, ki opisujejo stanje sistema v začetku izvajanja posameznih agentnih akcij.

Algoritem MASDA smo uporabili na domeni RoboCup Simulated League [4], ki je večagentna domena, kjer dve ekipi z 11 agenti odigrata simulirano igro nogometa. Domena fizikalno natančno simulira 2D igro nogometa, kjer pri izračunih poti igralcev in žoge upošteva umetno dodan šum, ki igro naredi bolj nepredvidljivo. Agenti delujejo neodvisno drug od drugega, domena pa omogoča vidno in slušno zaznavanje, ki pa je omejeno z oddaljenostjo. RoboCup je kompleksna večagentna domena, ki je zaradi jasno zastavljenih pravil in popularnosti nogometa postala referenčna večagentna domena.

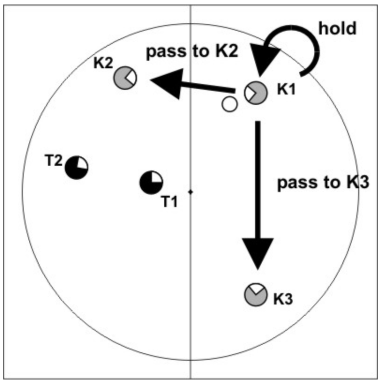
Z uporabo MASDA na domeni RoboCup smo uspeli določiti nekaj značilnih napadov na gol. Ustreznost dobljenih opisov so preverili tudi nogometni strokovnjaki, ki so potrdili vsebinsko primernost opisov. Vendar pa dobljeni vzorci obnašanja opisujejo le strateško dejavnost agentov. Ker ne opisujejo tudi nižjenivojskega obnašanja, kot je na primer veščina preigravanja, ne omogočajo neposredne uporabe kot napotkov za igranje nogometa. Zato smo želeli MASDA preizkusiti tudi na domeni, ki omogoča, da izhod iz MASDA uporabimo kot neposredne napotke za izvajanje agentov. Če naučeni agenti igrajo (merljivo) podobno kot originalni agenti smo nedvoumno potrdili uspešnost MASDA za modeliranja MAS. V ta namen, smo preizkusili posnemanje delovanja večagentnega sistema na domeni 3v2 Keepaway, ki je dovolj preprosta, da omogoča neposredno izvajanje naučenih strategij.

V poglavju 2 predstavimo domeno 3vs2 Keepaway in uporabo MASDA na novi domeni. V poglavju 3 predstavimo meritve in rezultate meritev. Zaključke podamo v poglavju 4.

2 DOMENA 3VS2 KEEPAWAY

Zaradi relativne kompleksnosti učnih problemov v domeni RoboCup so raziskovalci [7] začeli razmišljati o učenju v omejeni RoboCup domeni, ki bi vključevala manjše število igralcev. Določili so nalogo zadrževanja žoge pred napadalci (angl. *keep away*) [6] kot podproblem RoboCup domene, kjer ekipa branilcev (angl. *keepers*) poskuša obdržati posest žoge v omejenem prostoru, medtem ko ekipa napadalcev (angl. *takers*) poskuša pridobiti posest nad žogo. Cilj igre je maksimirati povprečno trajanje epizode, ki je določena kot igra, v kateri imajo posest nad žogo branilci. Če se žoge polastijo napadalci ali pa zapusti igralno polje, se epizoda konča in igra ponovno požene. Domena lahko vsebuje različno število napadalcev in branilcev ter različno veliko igralno polje. V naših poskusih smo uporabili domeno *3vs2 Keepaway* [8], ki jo določa kvadratno igralno polje velikosti 20x20m, 3 branilci in 2 napadalca. Številčne oznake branilcev oz. oznake njihovih vlog (označeni s K1, K2 in K3) in

napadalcev (označena s T1 in T2) so urejene po naraščajoči oddaljenosti do žoge, kot je to prikazano na sliki 1. Branilec z žogo ima tako vedno oznako K1.
Domena je poenostavljena tudi v smislu agentih akcij, saj so te le visokonivojske. Akcije lahko izvaja le branilec, ki ima v posesti žogo (K1). Branilec K1 lahko žogo zadrži (akcija: **hold**) ali pa jo poda enemu od soigralcev (akciji: **pass to K2** in **pass to K3**). Slika 1 shematsko predstavlja vse tri možne akcije. Trajanje akcije **hold** je en časovni korak, medtem ko je trajanje podaje lahko daljše, saj je odvisno od usmerjenosti agenta K1 in poravnanosti žoge glede na smer podaje. Izvajanje akcij je popolnoma avtomatsko, saj sistem sam pretvori izvajanje visokonivojskih akcij v odgovarjajoče zaporedje osnovnih agentih akcij.



Slika 1. Možne akcije agenta z žogo K1 v 3vs2 Keepaway domeni (*hold*, *pass to K2* in *pass to K3*).

Poenostavitev je vpeljana tudi v agentnem zaznavanju okolja, saj vsi agenti "vidijo" prostor z enakim naborom spremenljivk. Če je *dist(a, b)* razdalja med agentoma *a* in *b* in če je *ang(a, b, c)* kot med agenti *a* in *c* s krajiščem v agentu *b* in je *C* oznaka za središče igrišča, potem je domenski prostor opisan z naslednjimi 13 spremenljivkami[61]:

- *dist(K1, C), dist(K2, C), dist(K3, C),*
- *dist(T1, C), dist(T2, C),*
- *dist(K1, K2), dist(K1, K3), dist(K1, T1), dist(K1, T2),*
- *min(dist(K2, T1), dist(K2, T2)), min(dist(K3, T1), dist(K3, T2)),*
- *min(ang(K2, K1, T1), ang(K2, K1, T2)), min(ang(K3, K1, T1), ang(K3, K1, T2)).*

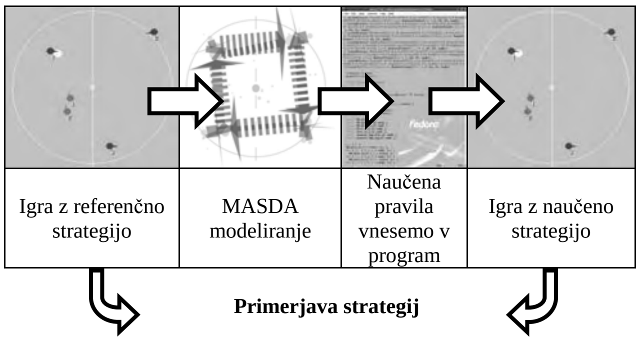
3vs2 Keepaway okolje [3] je prosto dostopno v obliki izvorne kode za okolje Linux in omogoča preprosto vključitev agentov z različnimi strategijami delovanja. V okolju so že pripravljene naslednje tri referenčne agentne strategije:

- Vedno zadrži žogo (oznaka: **allwayshold**): agent vedno izbere akcijo **hold**.
- Naključna (oznaka: **rand**): agent naključno izbere eno akcijo.
- Ročno zgrajena (oznaka: **hand**): je preprosta, toda zelo učinkovita strategija. Če je T1 od K1 oddaljen več kot 5m (dist(K1, T1) > 5m), potem izbere akcijo **hold**. Sicer oceni kot in razdaljo med soigralci in napadalci in, če je soigralec dovolj odkrit, poda najbolj odkritemu. Če noben soigralec ni dovolj odkrit, izbere akcijo **hold**.

Omenjene agentne strategije imenujemo referenčne in služijo raziskovalcem za merodajno primerjavo z njihovimi rezultati. Prednosti 3vs2 Keepaway domene glede na RoboCup domeno so predvsem v enostavnejši implementaciji različnih agentnih strategij, v lažji primerjavi kvalitete agentnih strategij ter v lažji interpretaciji dobljenih rezultatov. Domena kljub poenostavitvam ohranja vse pomembne lastnosti večagentnih domen, saj posamezni agent nima možnosti, da sam reši problem, ni centralnega nadzora in izvajanje je asinhrono.

3 MERITVE NA DOMENI 3VS2 KEEPAWAY

Ker deluje okolje Keepaway v okolju RoboCup, je postopek zaznave osnovnih agentnih akcij in postopek zaznave agentnih akcij v obeh primerih enak. Razlika je v podanemu domenskemu znanju, ki je v tem primeru prilagojen novi domeni.
Ker je bil naš cilj posnemanje poznanih strategij, smo testiranje izvedli na sledeči način. Za poznano strategijo smo generirali ustrezne igre. Vhod v MASDA je predstavljalo zaporedje akcij iger s poznano strategijo. Z MASDA smo nato generirali opise konceptov makroakcij. Nato smo dobljena pravila in zaporedja akcijskih konceptov ustrezno vgradili v program, ki krmili agente v 3vs2 Keepaway okolju. Nato smo pognali igro z našimi agenti in dobili posnetek igre z naučeno strategijo. Opisani postopek je prikazan na sliki 2.



Slika 2. Postopek generiranja strategije, ki posnema referenčno.

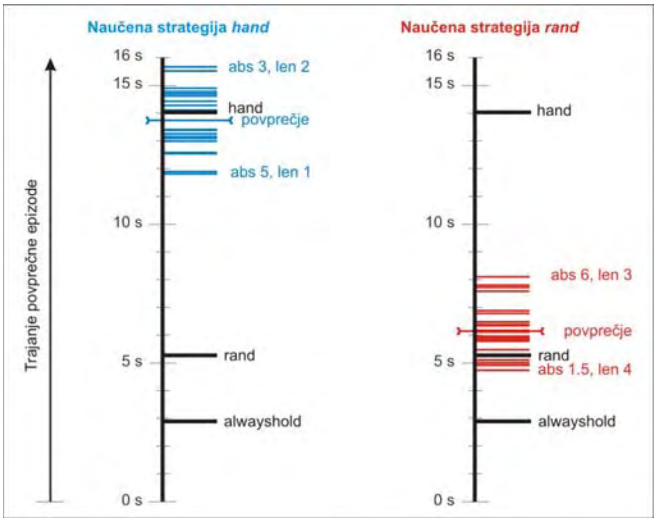
Pri tem smo testirali naslednje strategije:

- dve referenčni strategiji, ki sta priloženi okolju 3vs2 Keepaway: *hand* in *rand*,
- strategijo *hand3-6-9*, ki določa različno strategijo za vsakega igralca posebej.

Ker imamo v Keepaway okolju na voljo referenčne strategije, smo si za prvi cilj zadali modeliranje teh strategij. Poznavanje referenčnih strategij nam namreč omogoča, da s primerjavo naučenih in poznanih strategij ocenimo uspešnosti našega pristopa modeliranja večagentnih sistemov. Primerjavo naučenih in referenčnih strategij smo nato izvedli na naslednje načine:

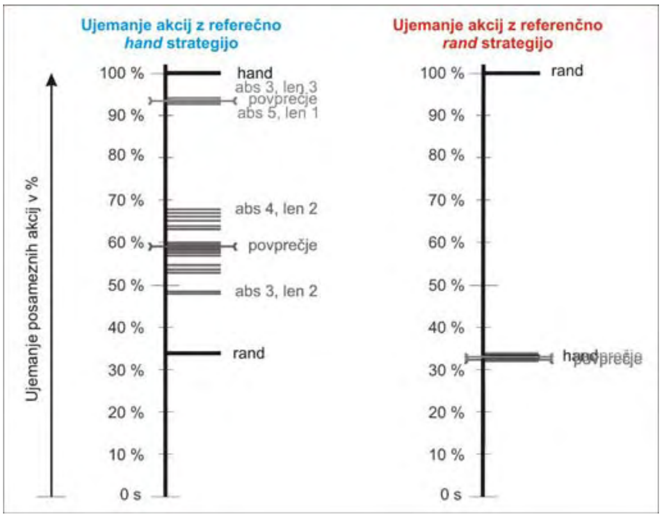
- Z merjenjem povprečnega trajanja epizode, ki omogoča numerično primerjavo uspešnosti referenčnih in naučenih strategij.
- Z merjenjem ujemanja akcij, ki so jih izbrale referenčne in naučene strategije. Tako merjenje pove v kolikšni meri se izvajanje naučene strategije dejansko ujema z referenčno.
- Z vizualno oceno poteka igre kot pomožna oceno, ki upošteva človeško zaznavo pri oceni podobnosti dveh strategij igre.

S postopkom opisanim na sliki 2 smo zgenerirali strategije, ki posnemajo referenčni strategiji *hand* in *rand*. Pri tem smo spreminjali vrednost parametra abstrakcije (1.5, 2, 3, 4 in 5) ter dolžino generiranih konceptov makroakcij (od 1 do 4). Poskuse smo ponovili za vse kombinacije parametra abstrakcije in dolžine konceptov makroakcij. Vsak poskus smo označili z "abs X, len Y", kjer X predstavlja vrednost parametra abstrakcije, Y pa dolžino konceptov makroakcij.



Slika 3. Trajanje povprečne epizode, kjer levi stolpec prikazuje rezultate naučenih *hand* strategij, desni stolpec pa rezultate naučenih *rand* strategij.

Za vsak poskus smo v agentni program vgradili dobljen opis agentne strategije in pognali igro za 30 minut ter izmerili povprečno trajanje epizode. Izmerjeno trajanje povprečnih epizod za naučene in referenčni strategij je predstavljeno na sliki 3, kjer levi stolpec prikazuje rezultate naučenih strategij, ki posnemajo *hand* strategijo, desni stolpec pa rezultate naučenih strategij, ki posnemajo *rand* strategijo. Višina vodoravnih črt ustreza trajanju povprečne epizode naučenih strategij pri različnih parametrih. Črne črte v obeh stolpcih prikazujejo trajanje povprečne epizode referenčnih strategij.
Pri izvajanju poskusov smo izmerili tudi ujemanje odigranih akcij z akcijami, ki bi jih izbrali referenčni strategiji. Vsako akcijo, ki jo je izbral agent na podlagi pravil naučenih strategij, smo preverili, ali ustreza izbrani akciji referenčnih strategij *hand* in *rand*. Rezultati teh meritev so podani na sliki 4, kjer zgornje svetlo sive vodoravne črte ustrezajo primerom naučenih *hand* strategij, spodnje temno sive pa primerom naučenih *rand* strategij.



Slika 4. Odstotek ujemanja odigranih akcij naučenih strategij z referenčnimi.

Vizualno oceno podobnosti naučenih in referenčnih strategij lahko preverimo z gledanjem posnetih iger. V naslednjih alinejah so podani internetni naslovi posnetkov iger za različne referenčne in naučene strategije:

- referenčna strategija *Hand*: http://dis.ijs.si/andraz/phd/3vs2-hand.avi
- naučena strategija *Hand* http://dis.ijs.si/andraz/phd/hand-learn.avi
- referenčna strategija *Rand*: http://dis.ijs.si/andraz/phd/3vs2-rand.avi
- naučena strategija *Rand*: http://dis.ijs.si/andraz/phd/rand-learn.avi

Ogled posnetkov pokaže vizualno podobnost igre med referenčno igro in igro z naučeno strategijo. Ujemanje je mogoče zaznati za igre naučenih strategij obeh referenčnih strategij. Če primerjamo igri naučenih *hand* in *rand* strategij med seboj, se ponovno zazna jasna razlika v načinu igre različnih strategij.
Za potrebe preverjanja pristopa MASDA smo v okolju Keepaway implementirali novo strategijo imenovano *hand3-6-9*, ki določa različno strategijo za vsakega igralca posebej. Ker v osnovi okolje Keepaway naključno premeša agente in ne omogoča enoličnega oštevilčenja igralcev, smo to možnost dodali v okolje. Za namenom, da določimo strategije za vsakega agenta posebej, smo vloge agentov ustrezno spremenili v fiksne vloge, ki ustrezajo številki igralca.
Nova strategija je podobna strategiji *hand*, pri tem da na novo določi najmanjšo bližino napadalcev, pri kateri branilec K1 poda žogo najbolj odkritemu soigralcu. Branilec številka 1 ima najmanjšo bližino napadalcev pred podajo nastavljeno na 3m, branilec številka 2 na 6m in

branilec številka 3 na 9m. Psevdo koda, ki opisuje delovanje strategije *hand3-6-9*, je predstavljena na sliki 5.

```
if (playerNum == 1) { // igralec št. 1
  if (DistK1T1 > 3) return Hold
}
else if (playerNum == 2) { // igralec št. 2
  if (DistK1T1 > 6) return Hold
}
else { // igralec št. 3
  if (DistK1T1 > 9) return Hold
}
// sicer podaj najbolj odprtemu branilcu
if (MinAngK2K1T1T2 > MinAngK3K1T1T2) {
  return PassK2
}
return PassK3
```

Slika 5. Psevdo koda, ki opisuje delovanje strategije *hand3-6-9*.

LTeam.1:Pass-K2	MinAngK2K1T1T2.30-350 ∧ DistK1T1.0-4 ∧ MinDistK2T1T2.3-20 ∧ DistK3C.4-15 ∧ DistT2C.0-10 ∧ MinAngK3K1T1T2.0-90 ∧ DistK1T2.1-10
	↓
LTeam.2:Hold	DistK1T1.7-50 ∧ MinAngK2K1T1T2.0-20 ∧ MinAngK3K1T1T2.5-350 ∧ DistK1K2.6-20 ∧ DistK3C.4-15
	↓
LTeam.2:Pass-K3	DistK1T1.3-6 ∧ MinAngK3K1T1T2.30-350 ∧ MinAngK2K1T1T2.0-60 ∧ DistK1T2.0-7 ∧ DistK1C.2-9 ∧ DistT1C.1-20 ∧ DistK3C.4-15 ∧ DistK2C.1-10
	↓
LTeam.3:Hold	DistK1T1.9-20 ∧ MinAngK2K1T1T2.0-30 ∧ DistT1C.3-7 ∧ DistK2C.2-15 ∧ DistK1K3.8-50

Preglednica 1. Primer pravil za naučeno strategijo *hand3-6-9*, ki opisujejo en koncept makroakcije.

Namen testiranja je bil pokazati, da koncepti makroakcij resnično prikazujejo del večagentne strategije. Ker ima v strategiji *hand3-6-9* vsak branilec različno lokalno strategijo, bi se to moralo odražati v pravilih, ki opisujejo koncepte makroakcij. Če bi odkriti koncepti makroakcij opisovali več različnih agentnih strategij, potem lahko sklepamo, da res predstavljajo del večagentne strategije. V ta namen smo v okolju Keepaway implementirali strategijo *hand3-6-9* in iz posnetka igre generirali pravila, ki opisujejo naučeno strategijo *hand3-6-9*.
V preglednici 1 so predstavljena pravila, ki smo jih pridobili iz iger agentov s strategijo *hand3-6-9* in predstavljajo eno naučeno makroakcijo. S krepkim tiskom so označeni pogoji, ki neposredno nastopajo v definiciji strategije. Analiza pogojev pokaže, da v veliki meri ustrezajo pogojem zapisanih v izvorni kodi strategije *hand3-6-9* (glej sliko 5).

4 ZAKLJUČEK

Predstavili smo modeliranje na domeni 3vs2 Keepaway z uporabo MASDA. Pristop smo uporabili za aktivno posnemanje opazovanih strategij. Z meritvami povprečne dolžine epizode, z merjenjem ujemanja posameznih akcij, z vizualno primerjavo in primerjavo generiranih pravil z izvorno kodo strategij smo pokazali, da je MASDA na preprostejših večagentnih domenah sposoben odkriti in reproducirati celotno strategijo opazovanega MAS.

VIRI

[1] Bežek, A., M. Gams in I. Bratko. Multi-Agent Strategic Modeling in a Robotic Soccer Domain. V zborniku Fifth International Joint Conference on Autonomous Agents and Multiagent Systems (AAMAS'06). 2006. Hakodate, Japan.
[2] Bežek, A.: *Discovering Strategic Multi-Agent Behavior in a Robotic Soccer Domain*, Proceedings of AAMAS 05, 2005.
[3] Learning to Play Keepaway Home Page. Dostopno na: http://www.cs.utexas.edu/~AustinVilla/sim/keepaway/.
[4] Noda, I. et. al: *Overview of RoboCup-97*. In Hiroaki Kitano, editor, RoboCup-97: Robot Soccer World Cup I, pp. 20-41. Springer Verlag, 1997.
[5] RoboCup 2004: *RoboCup Simulation League.* RoboCup04 world cup game repository, http://carol.science.uva.nl/~jellekok/robocup/rc04/, 2004.
[6] Stone, P. in R. S. Sutton. Keepaway soccer: a machine learning testbed. V zborniku RoboCup-2001: Robot Soccer World Cup V. 2002: Springer Verlag, Berlin.
[7] Stone, P. in R.S. Sutton. Scaling Reinforcement Learning Toward RoboCup soccer. V zborniku The Eighteenth International Conference on Machine Learning (ICML). 2001: Morgan Kaufmann, San Francisco, CA.
[8] Stone, P., in ostali. Keepaway Soccer: From Machine Learning Testbed to Benchmark. V zborniku RoboCup-2005: Robot Soccer World Cup IX. 2006: Springer Verlag, Berlin.

PREGLED INTELIGENTNIH DOMOV

Robert Blatnik, Matjaž Gams
Department of Intelligent Systems
Jozef Stefan Institute
Jamova 39, 1000 Ljubljana, Slovenia
Tel: +386 1 4773269; fax: +386 1 4251038
e-mail: robert.blatnik@ijs.si, matjaz.gams@ijs.si

ABSTRACT

In this paper we present an owerview of methods, services and solutions of intelligent homes. The emphasis is on world-wide solutions supported by links to the most relevant sites.

V množici aktualnih tržnih rešitev in standardizacijskih aktivnosti na področju vgrajevanja inteligence v zgradbe in domove ter na področju telematskih storitev osnovanih na dodani inteligenci doma in na sodobnih komunikacijskih storitvah, se pojavlja potreba po celovitem vpogledu v (1) sedanje stanje na področjih standardizacije informacijsko-komunikacijskih tehnologij, automatizacije, inteligentnih hišnih naprav, varnostnih sistemov in uporabniških vmesnikov; (2) ponudbo in perspektivo storitev s pogleda potreb uporabnikov in glavnih smernic razvoja tehnologije in (3) aktualno ponudbo opreme in sistemov.

V tem članku podajamo pregled stanja sistemov in storitev na področju inteligentnih domov.

1 UVOD

Digitalna konvergenca računalništva, komunikacij in vsebin postavlja informacijsko-komunikacijske tehnologije (IKT) v novo perspektivo medsebojno povezanih, do sedaj ločenih idustrijskih vej in storitvenih dejavnosti.
Vedno bolj dostopne tehnologije žičnih in brezžičnih širokopasovnih omrežij, mobilne, prilagodljive, varne in prijazne IKT rešitve, omogočajo komunikacije kjerkoli in kadarkoli. Storitve so vedno bolj nezaznavno vključene v vsakdanje inteligentne in personalizirane naprave, temelječe na autonomnih senzorskih in odločitvenih podsistemih, agentnih tehnologijah in semantičnem spletu. Integracija videa, zvoka in podatkov preko konvergence fiksnih in mobilnih omrežji v enotne sisteme odpira možnosti za razvoj novih storitev in prodor inteligence v bivalna okolja [1].
Inteligentni dom je množica medsebojno povezanih storitev, aplikacij, naprav, sistemov in omrežij, ki zagotavljajo varnost in nadzor, komunikacije, višjo kakovost življenja in okoljsko sprejemljivost. Vse te komponente inteligentnih domov pa zagotavlja množica ponudnikov, standardizacijskih teles, raziskovalcev in interesnih združenj, kar povečuje kompleksnost pri zagotavljanju optimalnih rešitev.
V poglavju št. 2 podajamo pregled storitev pomembnejših telekomunikacijskih (TK) operaterjev v Evropi, ponudba ostalih podjetij je omejena na aktualna problemska področja, ki se tematsko navezujejo na inteligentne domove: telemedicina, telematsko upravljanje naprav in varovanje. Hišni residenčni prehod, kot ključni element v povezovanju hišnih omrežij in naprav, je predstavljen v poglavju št. 3. Obširno področje standardizacije, s pregledom najpomembnejših iniciativ ter interesnih združenj na področju uvajanja širokopasovnih storitev, hišnih omrežij in razvoja inteligentnih domov, je podano v poglavju 4.

2 PONUDBA STORITEV

Ko govorimo o naboru storitev na področju inteligentnih hiš, lahko problemska področja razdelimo v tri osnovne skupine: (1) zagotavljanje varnosti in zdravstvenega varstva; (2) zagotavljanje boljše kakovosti življenja, večjega bivalnega udobja in zabave oz. večje delovne učinkovitosti, kadar gre za delovna okolja; (3) omogočanje prihrankov v energiji, v času za posamezna opravila, v investicijah za vzdrževanje ter nadgrajevanje obstoječih sistemov in manjših okoljskih obremenitvah.
Med tržno aktualnimi storitvami, ki jih lahko pokrivajo sistemi inteligentnih zgradb in domov so [2]:

- distribucija vsebin (video na zahtevo, glasba, tv programi);
- komunikacije (telefonija, fax, e-pošta, videotelefonija, VoIP);
- izobraževanje oziroma učenje na daljavo;
- zabava (interaktivne omrežne igre, igralništvo na daljavo, večpredstavnostne klepetalnice idr.);
- nadzorovanje porabe komunalno-energetskih storitev (električna energija, plin, voda, daljinsko ogrevanje);
- tehnično varovanje in videonadzor;
- nadzorovanje hišne avtomatizacije in nadzornih sistemov;
- zdravstveni nadzor in medicinska pomoč ali reševanje;
- vzdrževalni nadzor sistemov inteligentnega doma;
- daljinski nadzor nad vsemi napravami in konfiguracijo avtomatizacije;

- upravljanje z različnimi hišnimi energijskimi porabniki (kuhalniki, pečice, ogrevanje, pralni stroji);
- daljinsko diagnosticiranje avtomatiziranih sistemov s predvidenimi vzdrževalnimi postopki in uporabniško podporo;
- spremljanje zdravja in počutja ljudi (npr. ljudje s posebnimi potrebami, ostareli);
- storitve na daljavo (izobrazevanje, daljinsko delo, socialne storitve).

V nadaljevanju podajamo pregled storitev telekom (TK) operaterjev, ki obvladujejo največji tržni delež pri zagotavljanju storitev za residenčne uporabnike, določeni segmenti ponudbe pa že zajemajo elemente inteligentnih domov. Podajamo tudi vpogled v storitve zagotavljanja zdravstvene nege in varnosti, ki na lestvici življenjskih potreb zavzemata vedno pomembnejši delež.

2.1 Širokopasovne storitve TK operaterjev

TK operaterji se s pospešenim uvajanjem novih tehnologij za širokopasovni dostop in širjenje mrežne infrastrukture vedno bolj usmerjajo k storitvam za končne uporabnike, ki presegajo tradicionalne govorne komunikacije. Distribucija vsebin preko tako imenovanih triple play rešitev v povezavi z distributerskimi podjetji pokriva visok delež ponudbe. Nabor storitev previloma obsega različne pakete širokopasovnega dostopa, digitalne IP televizije in videa na zahtevo (VoD), konvergenco IP in mobilne telefonije, ki v povezavi s spletnimi portali dopolnjujejo ponudbo z mrežnimi igrami, fotoservisi za tiskanje fotografij, distribucijo glasbe in osnovnimi funkcijami video nadzora.
Hišni residenčni prehod (gateway), kot osrednja točka dostopa in povezave hišnih naprav, postaja blagovna znamka TK operaterjev. Dober primer je uspeh rešitve Livebox v France Telecom (http://www.francetelecom.com/en/our_solutions/home/livebox/).

2.2 Telenega

Področje telematskih zdravstvenih storitev postaja z razvojem informacijsko-komunikacijskih tehnologij v zadnjih letih samostojna veja IKT industrije, ki jo spodbuja potreba po zmanjševanju stroškov zdravstvenega varstva, širjenje kroničnih bolezni med ostarelimi in potreba po čim daljšem samostojnem bivanju ostarelih.
Zdravstvena informatika, kot samostojna znanstvena veja interdisciplinarno združuje področje tehnologije in medicine. Nove tehnologije širijo možnosti razvoja in spreminjajo organizacijske in poslovne modele v zdravstvu in socialnem skrbstvu.
Področje telematskih zdravstvenih storitev je razpredeno med množico področij v sistemu zdravstvenega varstva. Telemedicina uporablja informacijsko in telekomunikacijsko tehnologijo za prenos medicinskih informacij v diagnostične, terapevtske in izobraževalne namene. Telezdravstvo (Telehealth) je uporaba informacijske in telekomunikacijske tehnologije za prenos zdravstvenih informacij v klinične, administrativne in izobraževalne namene. Telenega (Telecare) uporablja informacijsko in telekomunikacijsko tehnologijo za prenos medicinskih informacij, potrebnih za diagnostiko in terapijo pacientov na njihovem domu. Napredne senzorske tehnologije zagotavljajo zajem informacij o zdravstvenem stanju ljudi, izvajanju terapij in njihovih dnevnih aktivnostih.
Storitve patronažne oskrbe na domu so prisotne že nekaj destletij. Trendi staranja prebivalstva, zmanjševanje sredstev za zdravstvo in spremnjenih življenjskih navad, še povečujejo potrebo po tovrstnih storitvah. Samo v Veliki Britaniji je poldrugi milijon uporabnikov tovrstnih storitev. Pri vzpostavljanju telemedicinskih storitev pa se pojavljajo tudi vprašanja etične upravičenosti poseganja v zasebnost posameznika v odnosu do varnosti in zdravstvenega varstva [3].
Telematski nadzor nad zdravjem ljudi v domačem okolju je v osnovi mogoče zagotoviti na tri načine: (1) preko zajemanja podatkov o vitalnih funkcijah preko mobilnih senzorskih naprav (tipično v obliki zapestnice ali obeska); (2) preko nezaznavnega zajemanja podatkov o aktivnostih posameznika preko senzorjev vgrajenih v domače okolje ali (3) preko kombinacije obeh [4].
Kljub temu, da je mreža patronažne oskrbe v Sloveniji dokaj razvejana je ponudba storitev telematskega nadzora nad zdravjem in počutjem ljudi relativno omejena. Večinoma je zagotovljena telefonska povezava z oskrbovalnim centrom preko prilagojenih brezžičnih telefonskih pozivnikov v obliki obeskov s preprosto tipko za poziv na izbrano telefonsko številko.
V ZDA, Veliki Britaniji in delno v Evropi že obstaja množica ponudnikov sistemov, ki zajemajo podatke o vitalnih življenjskih funkcijah in jih preko hišnih omrežij in širokopasovnih komunikacijskih poti prenašajo v specializirane zdravstvene in negovalne centre.
V nadaljevanju podajamo pregled nekaterih ponudnikov opreme in neodvisnih raziskovalnih organizacij in združenj s področja telenege.
Ricability (http://www.ricability.org.uk) je neodvisna raziskovalna organizacija na področju opreme in storitev za starejše in osebe s posebnimi potrebami. TSA (http://www.asap-uk.org/) je neodvisno britansko združenje ponudnikov storitev s področja telenege. TUNSTALL (http://www.tunstall.co.uk/) je vodilni ponudnik opreme in storitev s področja telenege v Veliki Britaniji. Philipsov program Medical Systems (http://www.medical.philips.com), poleg medicinskih radioloških in kardioloških naprav, pokriva zdravstvene informacijske sisteme in naprave za nadziranje zdravstvenega stanja preko zajemanja podatkov o vitalnih življenjskih funkcijah ljudi. Sistem Motiva je osnovan na interaktivni digitalni televiziji, ki preko uporabniško prijaznega televizijskega vmesnika in za starejše prilagojenega daljinskega upravljalnika omogoča dostop do zbranih podatkov na zaslonu domačega TV

sprejemnika in sprotno daljinsko osveževanje zdravstvene kartoteke pri ponudniku zdravstvene nege.

2.4. Telematsko upravljanje naprav

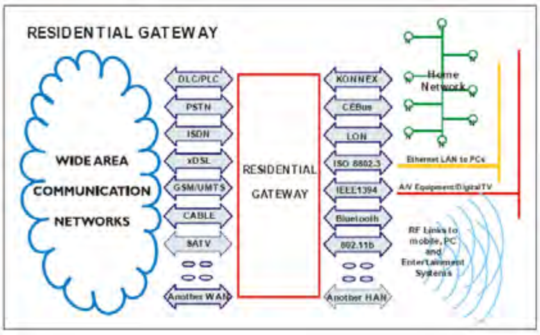
Področje hišne avtomatizacije in telematskega nadzora je bilo v zadnjih desetletjih predvsem ozko specializirano področje za zahtevnejše uporabnike in tehnološko izobražene samograditelje. Nestandardizirani, ozkonamenski sistemi, ki jih je bilo praviloma težko nadgrajevati in integrirati v okolje, so zahtevali celovito izvedbo, praviloma z obsežnimi strojnimi in kabelskimi instalacijami in dograditvami obstoječih hišnih naprav. Praviloma so se za take rešitve odločali pri novogradnjah ali obsežnejših adaptacijah. S porastom novih komunikacijskih, predvsem brezžičnih, tehnologij (Z-Wave, ZigBee idr.) pa se odpira prostor za razvoj novih interoperabilnih proizvodov, ki jih je mogoče relativno hitro nadgrajevati. Tržišče že zasedajo močnejši igralci v industriji telekomunikacij, multimedijskih naprav, zabavne elektronike in bele tehnike. Proizvajalci bele tehnike že ponujajo omrežene aparate v višjih cenovnih razredih, ki omogočajo serviserjem oddaljeni nadzor in diagnostiko na lokacijah končnih uporabnikov. V Sloveniji lahko omenimo strateško preusmerjanje Gorenja iz strogo industrijskega podjetja v storitveno naravnano podjetje. Sodelovanje Gorenja z IBM pri implementaciji brezžičnih arhitektur na osnovi usmeritev OSGi (http://www.osgi.org/) bo omogočilo uvajanje celovitih storitev na področju daljinskega nadzora gospodinjskih aparatov.

2.5 Varnost

Področje varnosti, ki ga pokriva širok spekter specializiranih podjetij, npr. ameriški ADT (http://www.adt.com/adt/), lahko v grobem razdelimo na varovanje velike stopnje varnosti (večji objekti, poslovni sklopi, tovarne itd.) in varovanje nižje stopnje varnosti (stanovanja, hiše, vikendi idr.).
Za storitve IDT je zanimivo področje varovanja nižje stopnje varnosti. Manj zahtevni brezžični sistemi za video nadzor, protivlomni in požarni sistemi so lahko integrirani v inteligentni dom brez večjih instalacijskih posegov. Npr. Motorola ima v programu domačih omrežnih naprav družino brezžičnih naprav za hišni nadzor, ki jih je mogoče brez obsežnejših instalacij hitro integrirati v domače okolje. Podobne rešitve že ponujajo nekateri TK operaterji, npr. British Telecom (http://www.bt.com/homemonitoring/). Skupina Redcare, (http://www.redcare.bt.com) v okviru British Telecom, pokriva področje zahtevnejšega daljinskega nadzora za poslovne uporabnike in državni sektor. Redcare predstavlja zgleden primer vključevanja javnega sektorja pri zagotavljanju storitev za javno dobro.

3 HIŠNI RESIDENČNI PREHOD

Hišni residenčni prehodi že predstavljajo uveljavljen način telekom operaterjev pri uvajanju novih storitev. Uvajanje novih storitev kot so VoIP, IPTV, tehnično varovanje idr. preko hišnih prehodov predstavlja vir vzpona v prihodkih in zmanjševanja fluktuacije naročnikov [5]. Vsi pomembnejši operaterji že ponujajo triple play storitve, pri tem pa je pomebna dolgoročna strategija uvajanja dodatnih storitev. S pravilno zasnovo hišnih residenčnih prehodov bo mogoče praviloma relativno enostavno, hitro in brez dodatnih investicij za uporabnike dodajati nove storitve. Študija [6] napoveduje v obdobju do leta 2009 znatno povečevanje deleža večnamenskih residenčnih prehodov glede na enonamenske „single service“ residenčne prehode.
Konec leta 2004 je devet velikih operaterjev ustanovilo združenje Home Gateway Inititive (http://www.homegatewayinitiative.org/) z namenom zbiranja fukcionalnih zahtev in specificiranja nizkocenovnih residenčnih prehodov, ki bodo podpirali nove storitve. Prvenstveni namen tovrstnih hišnih prehodov je zagotavljanje vmesnika med dostopovnim omrežjem in storitveno platformo na eni strani in hišnim omrežjem pri uporabniku. Na sliki 1 je predstavljen hišni residenčni prehod, ki omogoča dostop do širokopasovnih storitev preko različnih mrežnih vmesnikov.



Slika 1: *Domače omrežje s hišnim residenčnim prehodom [7]*

Ključne funkcije hišnega residenčnega prehoda so:

- simultana povezava z množico različnih hišnih omrežij;
- dostop do vsebin, neodvisno od strojne opreme na nižjih nivojih (različne naprave in komunikacijske poti);
- naročanje storitev, kot komercialni odnos med stranko in ponudnikom storitev;
- personalizacija uporabniških profilov glede na življenjske navade in potrebe ljudi;
- mobilnost in prenosljivost.

4. STANDARDIZACIJA

Inteligenente domove z novo generacijo odprtih hišnih omrežij pokriva množica industrijskih segmentov, interesnih združenj in standardizacijskih organov. Standardizacija zagotavlja medsebojno povezljivost, upravljanje, varnost, interoperabilnost naprav in kakovost storitev (QoS) za množico hišnih aplikacij, do katerih dostopamo preko hišnega omrežja. V nadaljevanju podajamo pregled pomembnejših standardov, priporočil in interesnih združenj.

4.1 Standardizacijski organi

European Committee for Electrotechnical Standardization (CENELEC: http://www.cenelec.org/) izvaja projekt SmartHouse, ki spodbuja konvergenco in interoperabilnost sistemov, naprav in storitev za inteligentne domove. V okviru projekta je bil izdan obsežen referenčni dokument [2] s priporočili razvijalcem in ponudnikom storitev inteligentnih domov. ICT Standards Board (ICSTB, http://www.ictsb.org/), ki združuje organizacije CEN, CENELEC in ETSI je ustanovil delovno skupino SmartHouse Standards Steering Group (ICTSB/SHSSG), ki preko sodelovanja z industrijo oblikuje predloge za standardizacijske organe.

ISO (http://www.iso.org/) in IEC (http://www.iec.ch/) sta v združenem tehničnem komiteju ISO/IEC JTC 1, izdala standard ISO/IEC 15045-1 [8] s priporočili za razvoj hišnih residenčnih prehodov.

4.2 Mrežni standardi

Med hišnimi mrežnimi standardi, ki si najmočneje utirajo pot na tržišče so ZigBee [9], Konnex [10] , LonWorks, X10, Z-Wave, Bluetooth in nenazadnje družina standardov IEEE 802.11 [11] .

4.3 Iniciative in interesna združenja

Poleg že omenjenih združenj OSGi in HGI so za razvoj inteligentnih domov pomembne organizacije ANEC, ISTAG, FMCA, Digital Living Network Alliance (DLNA), Consumer Electronics Association (CEA), the Internet Streaming Media Alliance (ISMA) in Home Audio/Video Interoperability (HAVi).

5. ZAKLJUČEK

Trenutno v ponudbi TK operaterjev ni videti storitev inteligentnega ali omreženega doma (networked home), ki bi širše izkoriščale potenciale novih tehnologij. Nedvomno lahko ugotovimo, da je večina bivalnih okolij, kljub pospešenemu tehnološkemu razvoju, vedno cenejši in vedno bolj dostopni visoki tehnologiji, še vedno neinteligentna. Hišne naprave in sistemi, kljub relativno veliki skupni procesorski moči, še vedno niso povezani v celovite inteligentne sisteme. Storitve so večinoma omejene na distribucijo vsebin, varovanje in komunikacije. Integracija omejenega dela hišnih naprav v enovite sisteme je sicer mogoča, vendar zahteva poglobljeno tehnološko znanje, zamenjavo določenih naprav ali delov naprav in dodajanje različnih komunikacijskih in uporabniških vmesnikov. Vgradnja tovrstnih sistemov praviloma zahteva obsežnejše kabelske in strojne instalacije. Na tak način praviloma pridobimo neko vnaprej določeno funkcionalnost, ki pa je neprilagodljiva in nezdružljiva z naknadnimi dopolnitvami. Omejena funkcionalnost, nezdružljivost, neprilagodljivost in nenazadnje visoka cena, omejuje ekonomsko učinkovitost in širjenje tovrstnih sistemov. Sistemi popolnoma avtomatiziranih inteligentnih zgradb, so tako predvsem stvar prestiža in ne toliko rezultat realnih potreb široke skupine uporabnikov in ekonomske upravičenosti, kar je tudi razlog za relativno počasno uvajanje novih storitev. Popolnoma omreženi inteligentni dom, ki omogoča prihranke v energiji, daljinski nadzor, interoperabilnost in prilagodljivost je še vedno bolj ali manj predmet demonstracijskih prototipov in raziskovalnih projektov. Kljub temu pa lahko ugotovimo, da naraščajoče število omreženih naprav, širjenje širokopasovne infrastrukture in nove storitve TK operaterjev spodbujajo razvoj inteligentnih domov prihodnosti.

Viri in literatura

[1] Sumi H., W. Mann, H. El-Zabadani, J. King, Y. Kaddoura, E. Jansen. The Gator Tech Smart House:A Programmable Pervasive Space. IEEE Computer Society. 2005.

[2] S. Pattenden, managing editor, SmartHouse Code of Practice. CENELEC Workshop Agreement. European Committee for Electrotechnical Standardization, CENELEC. 2005.

[3] J. Blanchard. Ethical Considerations of Home Monitoring Technology, Home Health Care Technology Report. Civic Research Institute. 2004.

[4] M.J. May, W. Shin, C.A. Gunter. Securing the Drop-Box Architecture for Assisted Living. FMSE. 2006.

[5] J. Buvat, D. Lim, E.B. Hovdkinn. Home Gateways: A Business Imperative in a Box. Telecom & Media Insights. Capgemini. 2005.

[6] K. Scherf, T. Parks. Home Networks and Residential Gateways: Analysis & Forecasts. Parks Associates. 2005.

[7] Home Gateway Technical Requirements: Release 1, Home Gateway Initiative. 2006.

[8] ISO/IEC JTC 1, International Standard ISO/IEC 15045-1. ISO/IEC. 2004.

[9] ZigBee Specification. v1.0. ZigBee Alliance. Internet, http://www.zigbee.org. 2004.

[10] Konnex Device Network, Volume 3: System Specifications, Part 1: Architecture”. Konnex Association. 2002.

[11] TEAHA Project IST-2004-507-029. Deliverable D7.1.4 – Market Background Document. Homega Research. 2005.

Bodočnost inteligentnih sistemov

Matjaž Gams
Odsek za inteligentne sisteme, Institut Jožef Stefan
Jamova 39, 1000 Ljubljana, Slovenija
Tel: +386 1 4773900; fax: +386 61 1251038
e-mail: matjaz.gams@ijs.si, http://ai.ijs.si/mezi/matjaz.html

Povzetek

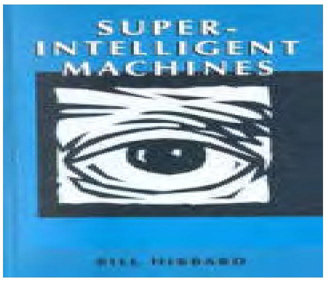
Podan je kratek pregled stanja in perspektiv inteligentnih sistemov. Ker mineva (dobrih?) 50 let od začetka umetne inteligence, se je pojavilo več člankov in specialnih številk v pomembnih svetovnih revijah. Izbranih je nekaj objav s poglobljenimi analizami avtorju najbolj zanimivih predvsem iz revije Intelligent systems.
Inteligentni sistemi doživljajo stalno nadgradnjo, čedalje uspešnejše aplikacije na raznolikih področjih in čedalje večjo potrebo po inteligentnih storitvah. Posebej pomembno je, da se pogoji za uveljavitev inteligentnih sistemov izboljšujejo – cenejša strojna oprema, več znanja, večja konkurenca. Področje je zatorej izredno atraktivno in perspektivno.

1 UVOD

Za začetek umetne inteligence zgodovinarji včasih štejejo prve nastope Alana Turinga, še pogosteje pa John McCarthyjevo konferenco z naslovom The Dartmouth Summer Research Project on Artificial Intelligence, izpeljano leta 1956 v Dartmouthu, ZDA. To je najpogosteje omenjeni rojstni datum umetne inteligence in posredno tudi inteligentnih sistemov. Morda bi se komu ta datum zdel upravičeno vprašljiv, saj je Turing že okoli leta 1950 pisal npr. o Turingovem testu kot potencialnem odgovoru na vprašanje, kaj naj se šteje kot inteligentno, in tudi avtor tega prispevka bi raje dejal, da je rojstni datum UI in IS okoli leta 1950. Kakorkoli že, kmalu je umetna inteligenca postala široko sprejeta kot oznaka nove, samostojne smeri znanstvenega raziskovanja. Termin "inteligentni sistemi" se pogosto pojavlja kot sinonim, čeprav z nekoliko bolj tehnično komponento.
Umetna inteligenca kot termin in znanstvena disciplina je nekako vezana na raziskave, saj se uveljavljeni sistemi le redko štejejo za umetno inteligentne. To paradoksalno situacijo v veliki meri delijo tudi inteligentni sistemi, saj recimo danes ne obstaja niti en sam inteligentni agent (kot primer najbolj udarnih metodologij inteligentnih sistemov) v praksi, ki bi imel večino zaželenih lastnosti. Inteligentni sistemi so v inženirskem smislu zatorej v določeni prednosti pred umetno inteligenco, saj je tudi delno inteligenten sistem lahko štet kot tak, pa čeprav ni inteligenten v človeškem smislu, npr. inteligentna miška.
Med pomembnimi podporniki zgodnje umetne inteligence je bil Alan Turing, verjetno najpomembnejši raziskovalec računalništva in informatike, ki je postavil vrsto ključnih konceptov od Turingovega stroja, Turingovega testa do Church-Turingove teze že v prvih desetletjih 19. stoletja (Einstein računalništva). Ti osnovni koncepti računalništva se ne štejejo za začetek umetne inteligence, ker se je Turing z njimi ukvarjal na akademski matematični ravni – npr. z vprašanjem, kaj je možno izračunati in česa se načeloma ne da v nekem sistemu. Najbrž pa bi bilo za pionirja umetne inteligence in inteligentnih sistemov edino korektno priznati Alana Turinga in zametke v njegovih zgodnjih desetletjih prejšnjega stoletja.
Turing (1947, 1948) je predvideval, da bo okoli leta 2000 že deloval inteligentni računalnik, ki bo pogosto prelisičil človeškega preiskovalca pri testu inteligence, tj. v Turingovem testu. Splošno priznana nezmožnost prave inteligence na računalnikih je dobro desetletje nazaj sprožila precejšnje kritike umetne inteligence, ki jih je delno pomiril uspeh računalniškega šaha, ki danes premaga tudi najboljše šahiste na navadnem osebnem računalniku. Vendar pa so taki programi inteligentni le v inženirskem smislu, nikakor pa ne v smislu prave človeške inteligence. Nasprotno – zadnja leta uspeh testiranja na Turingovih testih celo upada, ker so se ljudje navadili, kako spraševati. Čim vprašanje zadeva pomen

prejšnjega stavka, računalniki praktično vedno odpovedo.
Hibbard (2003) predvideva, da bomo ljudje priznali računalnike kot zavestne in morda celo nad-zavestne čez kakšnih 100 let. Ko bi namreč uspeli realizirati pravo inteligenco in zavest na računalnikih, naj bi bil naslednji skok do ljudem superiornih sistemov le vprašanje krajšega časovnega obdobja. Glede na empirične izkušnje, velika pričakovanja in posledična razočaranja opozarja, da so človeški možgani mnogokrat kompleksnejši kot računalniki, ki so v osnovi preproste naprave. Zato je razvoj zahtevnejši.

Hibbard ne predvideva, da bodo super-inteligentni računalniki prekosili ljudi tudi pri čustvih, saj naj bi bili neke vrste "hladna" super inteligenca. Njegovo mnenje je torej drugačno kot nekaterih drugih avtorjev, ki ravno v sklopu raznovrstnih miselnih mehanizmov vidijo tisto dodatno računsko moč (Gams 2001).

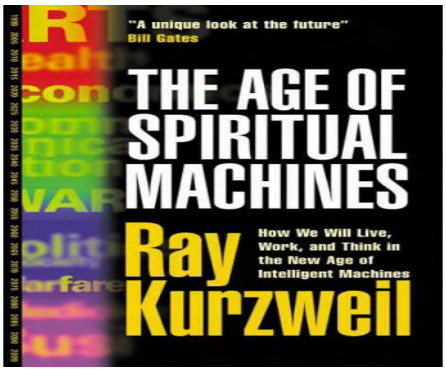


Slika 1: Bill Hibbard pričakuje, da bodo čez 100 let računalniki dosegli in presegli ljudi. Dosedaj so se vsa tovrstna pričakovanja izkazala za preoptimistična.

Kurzweil (2000) je leta 2000 napovedal, da bodo že okoli 2020 računalniške umske sposobnosi prešle človeške.
Kaj torej lahko rečemo ob pregledu prvih 50 let in ob pregledu nekaj najodmevnejših ocen preteklosti in napovedi prisotnosti?

2 OCENA NAZAJ

Kratek pregled nekaj objav kaže splošno zadovoljstvo ob pogledu nazaj. Selfridge (2006) pravi: "Umetna inteligenca je čudovita! Toliko stvari smo odkrili, toliko starih idej prevetrili na razne načine, zgradili smo tako napredna računalniška orodja za preiskovanje umetne inteligence."

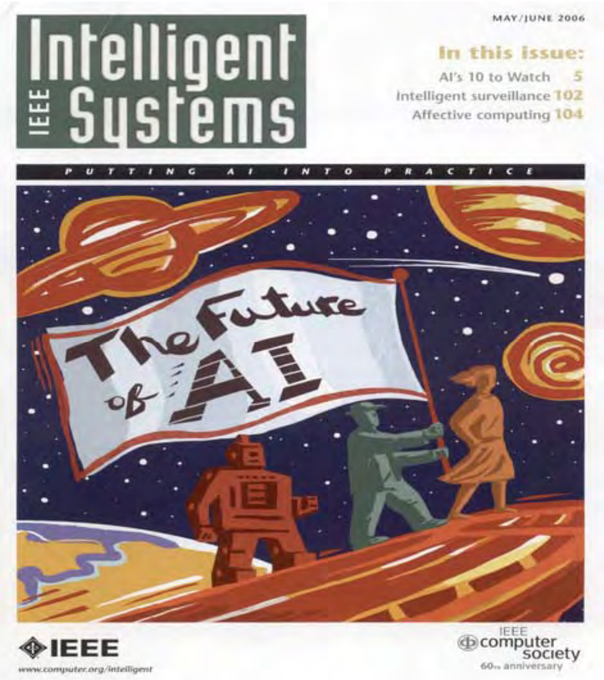


Slika 2: Ray Kurzweil napoveduje, da bodo računalniki v dobrih dveh desetletjih umsko prehiteli ljudi.

Rissland (2006) podobno ugotavlja, da "mnogo tega je v umetni inteligenci, kar smo dosegli in česar se lahko veselimo. Dosegli smo množico odličnih rezultatov na raznovrstnih področjih. Recimo na področju strojnega učenja in predstavitve znanja smo dosegli res impresivne, zanesljive in splošno uporabne aplikacije, o katerih smo nekaj desetletij ali let nazaj le sanjali." Sistemi umetne inteligence so pogosto prekašali klasične po marsikaterih ključnih lastnostih, zato se uporabljajo v praksi.
Če morda ob pisanju Kurzweila, ki predvideva skorajšnje rojstvo prave umetne inteligence in integracijo človeka s stroji tako v smislu hardvera kot umskih sposobnosti, včasih zamahnemo z roko, se ob množici utemeljenih pohval dosežkov umetne inteligence v najkvalitetnejših revijah pač moramo strinjati s splošno oceno stanja. Je pa potrebno takoj omeniti, da je tu govora o inženirski umetni inteligenci, o aplikacijah metod in tehnik umetne inteligence. Primer uspešnega paketa je Weka, kjer je preko interneta dostopnih okoli 50 odprtokodnih sistemov za strojno učenje in rudarjenje podatkov (Mitchell 1997), ki jih lahko uporabljamo na istih podatkih oz. si jih ogledujemo z istimi orodji za vizualizacijo. Lahko pa jih preprogramiramo ali dodatno razvijamo za kakšno posebno uporabo.
Tudi na področjih kot inteligentna robotika je bil narejen ogromen napredek v dveh smereh. Kot prvo imamo čedalje naprednejše robote v vsakdanji uporabi, tako industrijski kot doma. Kot drugo so inteligentni razvojni roboti, ki znajo igrati nogomet ali plesati, samostojno opravljati zahtevne naloge itd. Ti roboti so v zadnjih desetletjih naredili neverjeten napreden in vprašanje let ali kvečjemu

desetletij je, kdaj jih bomo srečali pri vrsti novih tržnih nalog.

3 BODOČNOST IN OCENA STANJA IS



Slika 2: Tudi revija IEEE Intelligent Systems je v 2006 namenila posebno številko debatam o AI.

Izmed specialnih številk si bomo podrobneje ogledali The Future of AI revije (2006) IEEE Intelligent systems (slika 2).
Med drugimi specialnimi številkami omenimo še dve izdaji revije AI Magazine (2005 in 2006). Obe prinašata veliko zanimivih misli in analiz. Morda je že najbolj izstopala ocena Patricka Winstona (Stone idr. 2005), da je AI dosegla izjemen uspeh v smislu razvoja računalniških metod in sistemov umetne inteligence, ki se masovno uporabljajo in so uspešnejše kot klasične. Po drugi strani pa je potrebno priznati, da človeške inteligence še nismo dosegli, niti se ji nismo bistveno približali. Nekaj bistvenega manjka računalniškim sistemom, saj bi ob siceršnji neverjetni rasti sposobnosti morali že zdavnaj kazati vsaj osnovne lastnosti človeške inteligence, npr. inteligenco otrok.
Hiter prikaz poglavitnih člankov iz Future of AI pokaže osrednja področja:

- učenje in vzgoja
- roboti in inteligentni sistemi v podporo/pomoč družbi
- dinamika utelešenih agentov
- geografsko porazdeljeni sodelujoči agenti
- razmišljanje na osnovi podobnosti
- brezumna inteligenca.

Omenjena številka poleg poglavitnih prispevkov kratko opisuje 10 udarnih mlajših posameznikov. Njihova področja so:

- človeška inteligenca (združevanje učenja s predstavitvami znanja, prilagoditev logičnega in verjetnostnega sklepanja na probleme realnega sveta, razvoj teorij človeku podobne AI)
- AI in lingvistika (modeliranje lingvističnih procesov, semantika)
- socialna omrežja in AI
- človeška kognicija (kako se iz AI učiti o človeški inteligenci)
- kreativno genetsko programiranje
- opisna logika v AI
- koodrinacija multiagentnih sistemov (npr. uporaba v policijskih akcijah)
- AI in semantični splet (kot idealno domensko področje za testiranje metod AI na spletu)
- algoritmična biologija (kako razviti teorije, veljavne tako za biološke kot računalniške sisteme).

Selfridge (2006) opisuje učenje in vzgojo kot eno najpomembnejših človeških lastnosti. Opisuje primere človeškega učenja predvsem v primerjavi z živalmi in primeri učenja pri otrocih. Zakaj so nekatere naloge preproste in druge zapletene? Posebej obravnava nekaj področij učenja in trenutno stanje strojnega učenja. Za učenje je koristno, če učenec gradi mentalni model, če se je že naučil podobnih oz. predhodnih nalog in samo nadgrajuje.
Reddy (2006) najprej opozarja na eksponentni razvoj računalniških sposobnosti, tako gostot elektronskih komponent kot kapacitet magnetnih diskov in kapacitet prenosa. Čeprav poznamo predvsem prvo zakonitost kot Moorov zakon, pa se podvojitev tu zgodi v 15 do 24 mesecih, medtem ko se pri kapacitetah diska v 12 mesecih in pri prenosu podatkov po kablih v 9, torej bistveno hitreje. To pomeni, da bomo kmalu lahko prenašali vse telefonske pogovore na enem samem kablu oz. se odpirajo ogromne možnosti nadaljnjega prenosa večjih količin podatkov, npr. multimedijskih vsebin.
Drugo pomembno področje je uporaba robotov. Reddy vidi posebno motivacijo v skrbi za starejše ljudi, saj se njihov delež v razvitem svetu dramatično povečuje in enostavno ni druge možnosti kot pomoč z roboti in ITK storitvami. Roboti so tudi zelo uporabni pri raznovrstnih reševalnih akcijah, npr. pri odkrivanju min ali reševanju ob požarih. Med področji, ki bodo kmalu

dosegla komercialno uspešnost, je računalniško prepoznavanje govora. Na področju računalniškega vida in zmožnosti samostojne vožnje je potrebno omeniti, da več prototipov s kamerami in računalniki opremljenih avtomobilov dosega skoraj človeške sposobnosti pri vožnji na npr. kolovozih.
Na področju interakcije človek-stroj Reddy navaja primer prototipnega PVTC, računalnika, ki je predelan v TV, oz. multimedijsko napravo. Lahko se uporablja kot TV, kot DVR, kot telefon, kot IP telefon, kot PC itd. Sistem je izredno preprost in prijazen. Uporabnik samo klika ikone na zaslonu, izbira osnovni način delovanja (npr. kot TV), nato s klikanjem na okence kanala izbere primeren kanal itd.
Pollack (2006) opisuje brezumno inteligenco. Po njegovem mnenju se AI preveč ukvarja z najtežjo nalogo – kako narediti inteligenco na človeškem nivoju, namesto da bi gradila najprej preprostejše modele inteligence, npr. preprostih in nato čedalje bolj zapletenih živali. Odtod pride tudi ime podpodročja. Opozarja, da večina živih bitij živi brez uporabe formalne simbolne logike. Recimo severni medved ima gotovo veliko znanja in modelov o snegu, čeprav tega ne on ne ljudje ne znamo formalizirati in niti ne vemo, ali obstaja v obliki formalnega modela, ali pa kakšni drugi obliki.

4 ZAKLJUČKI

Večina modernih sistemov ima nekaj lastnosti inteligentnih sistemov, čeprav večini med njimi ne rečemo, da so inteligentni sistemi.
Trendi razvoja storitev in sistemov računalnikov in informacijske družbe gredo nesporno, relativno počasi in stanovitno v smeri inteligentnih sistemov. Večinsko mnenje strokovnjakov, tako raziskovalcev kot razvojnikov, je, da bo pomen inteligentnih sistemov bistveno porasel v bodočih desetletjih.
Ne glede na inženirsko, raziskovalno in razvojno uspešnost inteligentnih sistemov ostaja nejasno vprašanje, kdaj se bodo pojavili resnično inteligentni sistemi na vsaj delno človeškem nivoju – ocene nihajo med nekaj desetletij do stoletja.

Literatura

Achieveing Human-Level Intelligence through Integrated Systems and Research, AI Magazine, vol. 27, no. 2, summer 2006.

AI past, present, and future, AI Magazine, vol. 29, no. 4, pp. 53-97, 2005.

B. Hibbard, Super Intelligent Machines, Kluwer Academic Publishers, 2003.

M. Gams, Weak intelligence: Through the principle and paradox of multiple knowledge, Advances in computation: Theory and practice, Vol. 6, Nova science publishers, inc., NY, 2001.

B. Hibbard, Super Intelligent Machines, Kluwer Academic Publishers, 2003.

R. Kurzweil, The Age of Spiritual Machines: How We Will Live, Work, and Think in the New Age of Intelligent Machines, Penguin books 2000.

T. Mitchell, Machine Learning, McGraw, 1997.
J.B. Pollak, Mindless Intelligence, Intelligent Systems, pp. 50-56, May/June 2006.

R. Reddy, Robotics and Intelligent Systems in Support of Society, Intelligent Systems, pp. 24-31, May/June 2006.

E.L. Rissland, AI and Similarity, Intelligent Systems, pp. 39-49, May/June 2006.

M. Stone, H. Hirsh, Artificial intelligence: The next twenty-five years, AI Magazine, vol. 26, no. 4, pp. 85-97, 2005.

O.G. Selfridge, Learning and Education: A Continuing Frontier for AI, Intelligent Systems, pp. 16-23, May/June 2006.

The Future of AI, Intelligent Systems, May/June 2006.

A.M. Turing, Lecture to the London Mathematical Society on 20 February 1947, in Carpenter, Doran (eds.) A.M. Turing's ACE Report of 1946 and other papers, MIT Press, 1947.

A.M. Turing, Intelligent Machinery, in B. Meltzer, D. Michie (Eds.), Machine Intelligence 5, Edinburgh University Press, 1948.

TOWARDS AN INTELLIGENT BIOMETRIC SYSTEM FOR ACCESS CONTROL

Mitja Kolbe, Matjaž Gams
Department of Intelligent Systems
Jozef Stefan Institute
Jamova 39, 1000 Ljubljana, Slovenia
tel: +386 1 568 08 48, fax: +386 1 568 08 88
e-mail: mitja.kolbe@spica.si, matjaz.gams@ijs.si

ABSTRACT

The paper presents an intelligent multi-modal biometric system for access control. In the first part it discusses and compares various biometric technologies, according to their robustness, acceptance, commodity of use, reliability and price. It also includes recommendations and conclusions about further application of different biometric technologies. Next the paper presents the possibilities of using computer vision to perform fuzzy access control serving as additional information for granting access. The paper follows by presenting an intelligent behaviour recognition module, that is capable of learning profile-typical behaviour and provides real-time warning of possible unusual behaviour that might lead to security crisis. At the end the whole access control systems layout is presented.

1 INTRODUCTION

In a world in which security is ever more significant, access control systems are of increasing importance to guarantee safety of people and access to resources by their intended users, and not by other possibly malicious intruders. Access control systems are used to regulate access to various resources (such as files, database entries, printers, web pages, etc.). This article focuses on systems that control access of individuals to physical places such as buildings, offices, server rooms, etc.

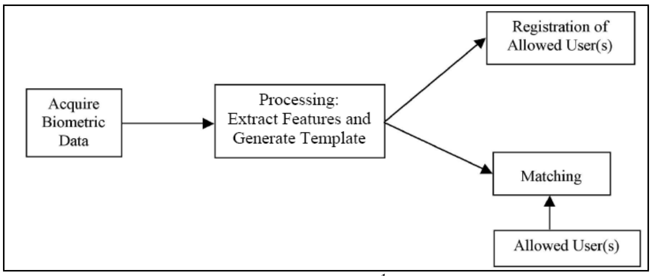
Many different technologies are available for person recognition and identity authentication and some examples include biometric measures based on information from handwriting (especially signatures), fingerprint, face, voice, retina, iris, hand geometry and vein patterns. However, recognition based on any one of these modalities may not be sufficiently robust or else may not be acceptable to a particular user group or in a particular situation or instance.

Current approaches in applications of access control are mostly taking use RFID or single biometrics in personal identity authentication. Single biometrics is limited, principally because no single biometric (except fingerprint) is generally considered both sufficiently accurate and user-acceptable for universal application. Multi-modal biometrics can provide a more balanced solution to the security and convenience requirements of many applications. The paper presents the model of an intelligent multi-modal biometric system for access control. One of the scientific problems addressed by this article is decision fusion from various biometric sensors.

The intelligent part of the system not only manages the combination of available biometric measure to grant access (decision fusion), but also learns a profile-typical behaviour and warns about unusual behaviour in real time. Hence a more prompt and effective reaction to a possible system abuse could be performed.

2 BIOMETRIC TECHNOLOGIES

Essentially, biometrics is the automated approach to authenticate the identity of a person using the individual's unique physiological or behavioural characteristics. Compared to traditional knowledge-based (e.g. passwords or PIN) and token-based (e.g. ID cards and smart cards) security systems, biometrics is generally regarded as a stronger form of authentication [4], [5]. Since it is unique to each person, it is more difficult for others to copy, duplicate, and steal it or users forgetting it. Thus in general, biometrics offers a more secure and friendly way of identity authentication. Unfortunately, a biometric attribute is not necessarily unambiguously permanent, so all biometric schemes are probabilistic [5].



Picture 1. *Common Biometric Process Flow*[1]

A sensor is required to acquire the biometric data that is then processed by a processor (embedded system or PC). The processing involves enhancing the data, removing noise, segmenting out the crucial data, extracting unique features (minutiae) and generation of a template to represent the biometric data. This template is the basis from which the uniqueness of the data is associated with the identity of the user. User access to the system involves comparing the currently generated template against the reference template of allowed user(s). Matching against a

[1] Y. W. Yun, The '123' of Biometric Technology, 2003.

claimed identity is called verification process (one-to-one comparison), while matching against a list of legitimate users is called identification (one-to-many comparison).

There are several biometric technologies that can be used for identification and/or verification of individuals. The advantages of using biometric measures are their universality, uniqueness, invariability, simplicity and speed of capture [1].

Biometrics	Universality	Uniqueness	Permanence	Collectability	Performance	Acceptability	Circumvention
Face	H	L	M	H	L	H	L
Fingerprint	M	H	H	M	H	M	H
Hand Geometry	M	M	M	H	M	M	M
Keystroke Dynamics	L	L	L	M	L	M	M
Hand vein	M	M	M	M	M	M	H
Iris	H	H	H	M	H	L	H
Retina	H	H	M	L	H	L	H
Signature	L	L	L	H	L	H	L
Voice	M	L	L	M	L	H	L
Facial Thermogram	H	H	L	H	M	H	H
DNA	H	H	H	L	H	L	L

H=High, M=Medium, L=Low

Picture 2. *Comparison of biometric technologies*[2]

2.1 Fingerprint

The fingertips have corrugated skin with line like ridges flowing from one side of the finger to another. The discontinuity in the ridge flow give rise to feature points, called minutiae, while the pattern of flow give rise to classification pattern such as arches, whorls and loops. There are two main technical approaches for fingerprint recognition: minutia matching and pattern matching. The pattern matching approach typically requires a 2-3 times larger template than in minutia approach.

There are a few variants of image capture technology available for such commercially oriented fingerprint sensor, including optical, silicon, ultrasound, thermal and hybrid. The data that is extracted from fingerprints is dense which explains why fingerprints are an extremely reliable means of personal identification [6].

In general, fingerprint recognition can achieve good accuracy sufficient for both verification and identification. It is low cost, compact and is getting popular as consumer products. [2]

2.2 Face recognition / Facial thermogram

A face image can be acquired using a normal camera such as an off-the-shelf desktop camera. Two main approaches are used to perform face recognition: holistic approach and feature-based approach. Feature-based approach assures robustness to position variations in the image, but the automatic detection of the features is not accurate and consistent enough to yield a high recognition accuracy rate. Holistic approach processes the entire face and does not destroy any information by exclusively processing only certain points. This generally yields more accurate recognition results. However, such technique is sensitive to variations in position and scale, and thus requires large training data sets. [2]

A facial thermogram works much like face recognition except that the image is captured by way of an infrared camera, and the heat signature of the face is used to create the biometric template used for matching. This is more reliable than simple imaging and is less affected by variation in face due to aging, make-up, hairstyle, glasses, pose and lighting condition.

Face recognition is generally accepted by the public, easy to use, a covert process, compact and the cost is rather low [2]. The disadvantage is that the accuracy achievable it is only suitable for verification, but is still insufficient for identification.

2.3 Iris / Retina

Iris, the coloured part of the eye, is composed of a type of tissue, which gives the appearance of layered radial lines or mesh when examined closely. The visible mesh consists of characteristics such as striations, rings, crypts, furrows etc. giving the iris a unique pattern. The iris image is usually acquired using a monochrome camera with visible and near infra red light. Based on an efficient processing algorithm the iris is divided into rims. For each rim, wavelets filter are applied sequentially throughout the rim to extract the iris feature into numerical data [2].

Iris recognition is very accurate with very low false acceptance rate and can be applied to both verification and identification. The identification speed is also very fast and it is relatively easy to verify whether the iris is from a living subject. However, the cost of the system is somewhat high and not compact. It also suffers from poor lighting, reflection and possibly glasses. In addition, some imaging system will require the user to be motionless for a while.

Retinal recognition creates an "eye signature" from the vascular configuration of the retina, an extremely consistent and reliable attribute with the advantage of being protected inside the eye itself. Retina scanning requires a laser to be shined onto the back of the eye, with obvious potential risks to health, what is unattractive to users.

Diseases or injuries that would interfere with the retina are comparatively rare in the general population, so the attribute normally remains both consistent and consistently available.

2.4 Hand geometry / Hand vein

The hand image is obtained using a camera looking from the top or from the side when the user placed his or her hand at a specified surface. From the hand image, the fingers are located and the length, width, thickness, curvatures and their relative geometry measured. The hand geometry template size can be very small. It has acceptable accuracy for verification but not sufficient for identification [2]. The major advantage is that most people can use it and as such, the acceptance rate is good.

[2] Y. W. Yun, The '123' of Biometric Technology, 2003.

However, the system is rather bulky and may have problems with aging and health condition.

Hand vein recognition attempts to distinguish individuals by measuring the differences in subcutaneous features of the hand using infrared imaging. Like face recognition, it must deal with the extra issues of three-dimensional space and the orientation of the hand. Like retinal scanning, it relies on the pattern of the veins in the hand to build a template. The use of infrared imaging offers some of the same advantages as hand geometry over fingerprint recognition in manufacturing applications where hands may not be clean enough to scan properly using a conventional video or capacitance technique.

2.5 Voice

Voice authentication or speaker recognition uses a microphone to record the voice of a person. The recorded voice is digitized and then used for authentication. The speech can be acquired from the user enunciating a known text (text dependent) or speaking (text independent). In the former case, the text can be fixed or prompted by the system. The captured speech is then enhanced and unique features extracted to form a voice template. There are two types of templates: stochastic templates and model templates.

The cost of voice authentication can be very low and compact. Furthermore, it is relatively easy to use [2]. However, voice varies with age and there can be drastic change from childhood to adolescence. Also illness and emotion may affect the voice as well as changes in volume, speed and quality of voice, room acoustics and environmental noise.

2.6 Computer vision for behaviour recognition

Besides the presented market-ready biometric technologies, other biometric parameters could be extracted by existing hardware. In video surveillance technologies such as computer vision could bring additional information for identification / verification, thus increasing the degree of confidence that the input biometric data is from the same person as the registered data.

The video sequence is obtained using a surveillance camera, which is triggered by a motion detector or trial to access surveyed places. Efficient processing of video sequence extracts typical features of individuals when accessing secured rooms. For example, in a certain sensor configuration one would always come from the left side of the camera, taking the proximity card with the right hand (identification) and putting the left forefinger on the fingerprint sensor (verification). A suitable and efficient image sequence transformation transforms the image information to numerical data. Generation of registered templates has to include machine learning techniques on training data sets. Like face recognition, the collect-ability and acceptability of this biometric measure are high, while the permanency, circumvention and efficiency have still to be tested.

By including computer vision supported behaviour recognition and other retrieved information it is possible to recognize a situation, where more users are passing gates where only one person identifies and trigger an alarm.

Computer vision is not invasive or harmful and can be implemented with existing surveillance cameras. It cannot be used as the only biometric measure to access the system, since this technology is very environment dependent and thus needs to be adaptive, what is difficult to assure. We see computer vision as a fuzzy sensor with perspective for automated system warning generation, but usability in real applications has still to be tested.

2.7 Multi-modal biometric systems

Instead of relying on only one biometric measure, a multi-modal system which combines several biometrics to increase the likelihood of finding a match will be increasingly feasible as hardware and system cost decreases [4]. Besides not every biometric measure is suitable for all application scenarios. In this new multi-modal context, it is thus becoming important to be able to combine different modalities (identification or verification sensors) and merge their outcomes (usually a scalar number representing the degree of confidence that the input biometric data is from the same person as the registered data) to come up with the proper binary decision *accept* or *reject* user. Multi-modal biometrics assures system flexibility and adoptability to different environmental requirements, better verification results (FRR, FAR) than single biometrics, which results in a user-friendly access control point [3], [7].

A popular approach to combining multiple classifiers in biometric recognition is to treat the combination stage as a second-level pattern recognition problem on the matching scores that are to be fused [8], and then use standard learning paradigms in order to obtain combining functions. The similarity score output of each system is seen as a different feature, and the two classes correspond to impostor and genuine attempts, respectively. Comparative studies in this field show that the support vector machine-based fusion approach outperforms the others [3], [8].

Real multi-modal systems including face and fingerprint recognition have proved to work with satisfactory response time [9], but multi-modal systems are only as successful as the biometrics that they are comprised of. All single biometrics have their weaknesses, therefore the biometrics used in multimodal systems should be used on rank of their failure rate [9].

3 INTELLIGENT LEARNING OF BEHAVIOUR PATTERNS

Biometrics is not only about new methods and technologies to collect the biometrical data. Existing sensors already collect much of the data and it can be used for a higher-level biometric matching.

Additional information about individual’s typical behaviour can be extracted from the events’ database or other sensor-level available data. In applications of high security this information could be useful to produce real-time warnings of unusual behaviour. Therefore we propose an intelligent module for typical behaviour recognition, which considers existing knowledge of individuals' behaviour and is able to learn user behaviour patterns. Deviations from the standard patterns might result as a system warning or furthermore contribute to the decision fusion when granting access.

We propose a two-level behaviour recognition system:

- micro-behaviour,
- macro-behaviour.

3.1 Micro-behaviour

Micro-behaviour consists of typical individual's behaviour in a short time frame around the identification process at the point of access control, i.e. at the sensor sight. At this point the relative time of the day or sequence of registrations at different points are not considered.

Different parameters are evaluated in the identification and verification process such as time difference between usage of sensors, keystroke dynamics when typing the pin number, finger used for particular event (forefinger for entrance, thumb for exit), combination and sequence of modalities used, number of faulty trials, time of open doors, etc. Rules for registration are previously appointed to each user profile, which represent the knowledge base of the system. Additional behaviour patterns of individuals and user profiles are learned by the system through system usage by machine learning methods. The output of the micro-behaviour intelligent module is a scalar number, which represents the degree of confidence that the claimed identity is a registered user, based on his typical way of registering.

The micro-behaviour module acts as a biometric measure, which does not have a sensor on its own, but combines information from other sensors in an intelligent way. Thus we see micro-behaviour module as an additional sensor that contributes to the overall matching to the claimed identity.

3.2 Macro-behaviour

Macro-behaviour includes typical individual's daily behaviour, which is partially built in the system knowledge by the rules of registration (for example, someone is allowed to enter or exit the premises in certain hours, minimum & maximum time difference for accessing two remote gates etc.). However, there are other individual-typical daily behaviour characteristics that can be extracted from the system database of registered events with machine learning methods. For example: by clustering users in two clusters regarding number of short exits (let's suppose less than 10 minutes), it is possible to deduce which users are smokers. A very non-typical behaviour for a non-smoking person would be to exit every hour for a five-minute break and that might be a warning for the system. Furthermore the system would recognize that some individuals always register together at some hours (for example, they travel to work together or they cheat time registering at the end of the day).

While rules-based-access, which represent the system knowledge base, can be used for binary decision to accept or reject the user, the knowledge acquired with machine learning is more suitable to produce warnings and for database queries. Macro-behaviour knowledge can be used also for a more friendly access control point, which is able to facilitate the communication with the user with (interactive) messages like: "Enjoy your meal today, Mr. XY", "You are really an early bird!" or "Would you like to compensate your exit with existing extra hours?"

4 SYSTEM INTEGRATION

4.1 Sensors

When selecting a specific biometric technology for a particular use, the following should be considered [2]:

a. Size of user group.
b. Place of use and the nature of use
c. Ease of use and user training required.
d. Error incidence such as due to age, environment and health condition.
e. Security and accuracy requirement needed.
f. User acceptance level, privacy and anonymity.
g. Long-term stability including technology maturity, standard, interoperability and technical support.

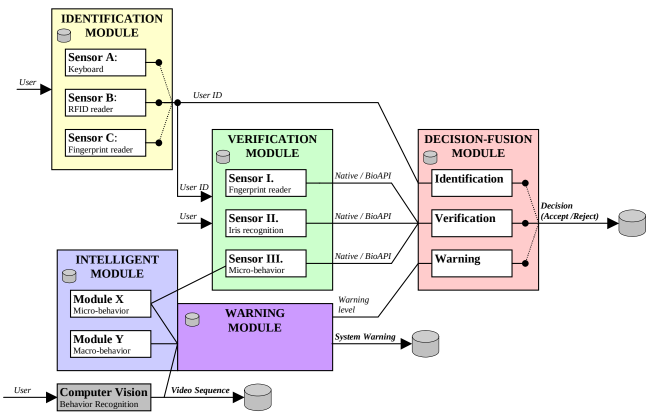
Based on facts presented in the paragraph 2 we consider the following technologies to be the most suitable for a robust, reliable and commercially viable intelligent biometric access control system:

- *identification*: PIN, RFID cards and fingerprint;
- *verification*: fingerprint, iris scan, micro-behaviour intelligent module;
- *warning system*: computer vision behaviour recognition, micro-behaviour intelligent module, macro-behaviour intelligent module;

Selecting sensors and building solutions that comply with standards bring various advantages. The only industry standard in the field of biometric applications that is publicly available is BioAPI.

4.2 System Layout

The International Biometric Group (IBG) [5] proposes a framework for multi-modal biometric applications named AMOLD (Acquisition, Matching, Output, Logic, Decision), where multi-modal verification and identification models are presented. We use the IBG verification model framework to build an intelligent multi-modal biometric access control system layout.



Picture 3. *Conceptual scheme of the proposed system.*

The system is comprised of a (near) deterministic *identification module*, a probalistic *verification module* with high degree of confidence (fingerprint, iris recognition). The *intelligent module for behaviour learning* and the *computer vision behaviour recognition module* produce system warnings and other outputs (warning level). Identification, verification and warning results are entered in the decision-fusion module, which outputs the binary decision to accept or reject the user. Besides the system tracks system warnings and video sequences for later analysis. All the modules have connection to the central database.

4.3 Future work

Future work is focused on the novel biometrics introduced like computer vision for behaviour recognition, micro- and macro-behaviour recognition. Proposed methods have to be tested and evaluated in real applications to prove applicability and usability.

Using intelligent access control gives plenty of opportunities for integration with other systems and applications that could improve security and commodity of use. The classic access control point is therefore transformed in a friendly interactive point of communication with the user. Imagine the system could warn you that you have forgotten to lock your computer or asking you to turn the Out-Of-Office function on when leaving the building, or when coming back from lunch asking you for coffee.

5 CONCLUSION

Biometrics has proved satisfactory results for automatic authentication of identity in different environments. However, all biometric technologies are not market-ready (yet) and some of them are suitable in limited cases. Fingerprint and iris scan biometrics are still the most robust and reliable technologies to be used for access to secure systems or applications. Additional information to secure access could be obtained by applying computer vision methods to video surveillance, but the permanency, circumvention and efficiency of this approach have still to be tested. Machine learning methods could be applied also to retrieve micro and macro-behaviour characteristics of users. This information is mostly useful to generate system warnings or to bias the decision, which is handled by a decision-fusion module.

An intelligent biometric access control system needs reliable compounds to work efficiently. A very valuable part for proper integration is sensor selection process, where adequate technologies have to be used. We propose deterministic identification and probalistic verification with high degree of confidence. Furthermore we present a system layout for successful integration of intelligent biometrics for an efficient, user-friendly and reliable access control system.

In the future the emphasis of the work is on novel biometrics, intelligent module for behaviour learning and decision-fusion.

References

[1] J. Ashbourn. *Practical Biometrics, From Aspiration to Implementation.* Springer, 2004.

[2] Yun, Yau Wei. *The 123 of biometric technology*. QSTC, 2002.

[3] A. Lumini, L. Nanni. *An advanced multi-modal method for human authentication featuring biometrics data and tokenised random numbers*. Neurocomputing vol. 69, p. 1706 – 1710. Springer, 2006.

[4] D. T. Toledano, R. F. Pozo, A. H. Trapote, L. H. Gomez. *Usability evaluation of multi-modal biometric verification systems*. Interacting with Computers vol. xx, p. 1 – 22. Elsevier B.V., 2006.

[5] International Biometric Group. http://www.biometricgroup.com

[6] Digital Persona. *Biometric Solutions to Personal Identification*. http://www.digitalpersona.com

[7] P. Verlinde, G. Chollet, M. Acheroy. *Multi-Modal Identity Verification Using Expert Fusion*. Information fusion vol. 1, p. 17 – 31. Elsevier B.V., 2000.

[8] B. Gutschoven, P. Verlinde, *Multi-modal identity verification using support vector machines*. Third International Conference on Information Fusion, Paris, France, 10 – 13 July 2000, p. 3–8.

[9] M. K. Khan. *Multimodal Biometrics: A more secure way against Intruders.* http://www.multimedia.ece.uic.edu/FIT03/Day-2/S11/p3.pdf

OPTIMALNA GLOBINA PREISKOVANJA PRI LRTA*

Mitja Luštrek
Odsek za inteligentne sisteme
Institut Jožef Stefan
Jamova 39, 1000 Ljubljana, Slovenija
Telefon: +386 1 4773380; telefaks: +386 1 4773131
E-pošta: mitja.lustrek@ijs.si

POVZETEK

Za preiskovalne algoritme z takojšnjim odzivom, kakršen je LRTA*, velja, da najdejo boljše rešitve, če uporabljajo večjo globino preiskovanja. To pa ne drži vedno in tudi kadar drži, je večja globina od najmanjše potrebne časovno potratna. Zaradi tega v tem prispevku preučimo dve metodi za vnaprejšnje določanje optimalne globine preiskovanja. Eno od metod dopolnimo z uporabo abstraktnih stanj, kar omogoči, da število stanj, za katere je optimalno globino preiskovanja treba določiti, zmanjšamo. Dopolnjeno metodo smo preizkusili na problemu iskanja poti po zemljevidih iz komercialnih računalniških iger. Po nekajurnem določanje optimalnih globin je uporaba teh globin pri iskanju poti dala okrog desetkraten prihranek časa in dosegala dolžine poti primerljive z uporabo nespremenljive globine.

1 UVOD

Najbolj znan algoritem za enoagentno hevristično preiskovanje je prav gotovo A* [6]. Ob uporabi popolne (optimistične) hevristične funkcije A* vedno najde optimalno pot do cilja. Žal pa je pri nekaterih problemih prostor preiskovanja prevelik, da bi mu bil A* (dovolj hitro) kos. V takih primerih se uporabljajo preiskovalni algoritmi s takojšnjim odzivom (*real-time*). Klasičen tovrsten algoritem je learning real-time A* ali LRTA* [7], ki se mu bomo posvetili v tem prispevku.

LRTA* in sorodni algoritmi preiščejo del prostora okrog trenutnega stanja in nato naredijo korak v najbolj obetavni smeri proti cilju. Postopek ponavljajo, dokler cilja ne doseže jo. Vprašanje, ki se ob rabi tovrstnih algoritmov zastavi, je, do kakšne globine naj algoritem v vsakem koraku prostor preišče. Razširjeno je prepričanje, da je najdena pot do cilja boljša, če je globina preiskovanja večja. Nedavne ugotovitve [1, 3, 8, 9] pa kažejo, da to ne drži vedno, da včasih prihaja do tako imenovane patologije, kar pomeni, da se manjše globine preiskovanja obnesejo bolje. Ker poleg tega plitvejše preiskovanje terja tudi manj procesorskega časa, bi bilo zaželeno za vsako stanje poznati optimalno globino preiskovanja.

Optimalno globino preiskovanja v nekem stanju bi si želeli določiti kar neposredno iz topologije dela prostora, v katerem stanje leži. Žal pa kaka splošno uporabna metoda za to ni znana. Tako si lahko pomagamo z vnaprejšnjim določanjem optimalnih globin s pomočjo preiskovanja. Tak postopek je časovno zelo zahteven, vendar si ga pri nekaterih problemih lahko privoščimo. Npr. v računalniški igri, kjer mora biti množica enot zmožna hitrega hkratnega iskanja poti po zemljevidu, izdelovalec igre, preden igro pošlje v trgovine, zlahka nameni nekaj ur ali dni procesiranja določanju optimalnih globin preiskovanja.

Prispevek je razdeljen na šest poglavij. Poglavje 2 opredeli problem in predstavi algoritem LRTA*. Poglavje 3 obravnava naivno in časovno zahtevno metodo za določanje optimalne globine, v poglavju 4 pa je opisana učinkovitejša metoda. V poglavju 5 to metodo dopolnimo z uporabo abstraktnih stanj, kar omogoči, da število stanj, za katere je optimalno globino preiskovanja treba izračunati, zmanjšamo. Poglavje 6 prispevek sklene in poda nekaj smernic za nadaljnje delo.

2 PROBLEM

Problem, s katerim se ukvarja ta prispevek, je iskanje poti iz začetnega stanja v končno stanje po zemljevidu razdeljenem v kvadratna polja, od katerih so nekatera neprehodna. Agent, ki išče pot, se iz vsakega polja lahko premakne v katerokoli prehodno sosednje polje – cena premika naravnost je 1, cena diagonalnega premika pa $\sqrt{2}$. Prosta polja tvorijo množico stanj *S*. Preiskovalni problem določajo zemljevid, začetno stanje s_0 in končno stanje s_g.

Za načrtovanje poti agent uporablja algoritem LRTS [2] nastavljen tako, da ustreza LRTA*. Algoritem preišče vsa stanja do *d* premikov oddaljena od trenutnega stanja $s_c \in S$. Stanja na robu preiskanega področja oceni s hevristično funkcijo *h*, ki ocenjuje oddaljenost stanja od s_g. Agent nato naredi prvi premik po najkrajši poti do najobetavnejšega stanja na robu preiskanega prostora. To je stanje $s_{f\ opt} \in S$, ki leži na najcenejši poti do s_g. Cena poti $f(s_{f\ opt}) = g(s_{f\ opt}) + h(s_{f\ opt})$, pri čemer je $g(s_{f\ opt})$ cena poti od s_c do $s_{f\ opt}$, $h(s_{f\ opt})$ pa hevristična ocena cene poti od $s_{f\ opt}$ do s_g. Na začetku so hevristične ocene enake cenam poti po povsem prehodnem zemljevidu. Po opravljenem premiku pa $h(s_c)$ dobi vrednost $f(s_{f\ opt})$, s čimer algoritem popravi hevristične vrednosti na področjih, kjer so bile na začetku preveč optimistične, tako da agent lahko najde pot okrog ovir tudi takrat, kadar tega ne more doseči s preiskovanjem do globine *d*.

V poizkusih opisanih v tem prispevku smo uporabili šest zemljevidov iz komercialnih računalniških iger: tri iz Baldur's Gate in tri iz Warcraft III. Zemljevidi imajo od 5.672 do 18.841 prehodnih stanj. Na vsakem zemljevidu smo naključno izbrali končno stanje, nato pa smo iz vseh drugih stanj iskali pot do njega. Uporabljali smo globine preiskovanja od 1 do 10.

3 OPTIMIZACIJA DOLŽIN CELIH POTI

Najprej smo izmerili, kakšno povprečno dolžino poti dosegajo nespremenljive globine preiskovanja. Rezultati so zbrani v tabeli 1. Poleg dolžine poti smo izmerili tudi število preiskanih stanj na premik, ki je dobra ocena za porabljen procesorski čas.

d	Dolžina poti	Št. stanj / premik
1	2074,6	7,9
2	999,6	60,8
3	631,8	158,6
4	474,2	295,6
5	518,7	493,9
6	450,5	702,4
7	425,4	952,4
8	400,4	1.262,4
9	341,6	1.544,3
10	350,7	1.890,5

Tabela 1. *Povprečna dolžina poti in povprečno število preiskanih stanj na premik pri nespremenljivi globini preiskovanja.*

Rezultati v tabeli 1 so v skladu s pričakovanji: s povečano globino preiskovanja se najdene poti krajšajo. Blago patološko obnašanje je opaziti pri $d = 5$ in $d = 10$, kjer se v primerjavi s plitvejšim preiskovanjem poti podaljšajo, vendar so razlike majhne.

Najenostavnejši način določanja optimalne globine preiskovanja je prav gotovo izračun dolžine poti med vsakima dvema stanjema z vsemi možnimi globinami (pri nas od 1 do 10). Če pri iskanju poti uporabimo najboljše preizkušene globine, je povprečna dolžina najdenih poti 310,7 (11,4 % manj kot pri $d = 10$), število preiskanih stanj na premik pa 1.316,6 (30,3 % manj kot pri $d = 10$). Na tak način korist od vnaprejšnjega določanja optimalne globine preiskovanja očitno ni velika.

Če poznamo optimalno globino preiskovanja za vsako stanje, lahko pri iskanju poti globino spremenimo tudi vsak premik: ko je agent v stanju s_c, uporabi globino preiskovanja, ki bi bila optimalna, če bi v stanju s_c iskanje začel. Povprečna dolžina poti se na ta način skrajša na 178,3 (49,1 % manj kot pri $d = 10$), število preiskanih stanj na premik pa na 1.192,2 (36,9 % manj kot pri $d = 10$). Ti rezultati so precej bolj spodbudni in kažejo, da bi bilo poznavanje optimalne globine preiskovanja lahko dokaj koristno. Žal pa je izračun dolžine poti za vsaj usmerjen par stanj z vsako globino časovno izjemno zahteven, saj imajo naši zemljevidi v povprečju $8{,}1 \cdot 10^7$ takih parov stanj.

4 OPTIMIZACIJA POSAMIČNIH PREMIKOV

Metoda določanja optimalne globine preiskovanja iz prejšnjega poglavja je neučinkovita, ker mora agent mnoge dele poti prepotovati večkrat. Naj bo $P_{s\,d}$ množica stanj, ki ležijo na poti od stanja $s \in S$ do s_g pri globini preiskovanja d. V tem primeru je najverjetneje pri tej globini preiskovanja znana tudi pot do s_g iz vsakega od stanj $s_{s\,d} \in P_{s\,d}$. (gotovo to ni zato, ker bi bile hevristične vrednosti drugačne, če bi se preiskovanje začelo v stanju $s_{s\,d}$), metoda iz prejšnjega poglavja pa te poti izračuna ponovno. Metodo bi bilo mogoče dopolniti, da bi opisano pomanjkljivost odpravili, vendar ta pomanjkljivost ni edina.

Druga pomanjkljivost je, da se v stanju $s \in S$ uporabi globina preiskovanja, ki je morda potrebna le na majhnem delu poti od s do s_g, na večjem pa bi se lahko uporabilo plitvejše preiskovanje, ki bi prihranilo procesorski čas. Še več, zaradi določanja optimalne globine v stanju s na podlagi cele poti od s do s_g se lahko zgodi, da je najdena pot daljša, kot če bi bila izbrana le na podlagi prvega premika iz s.

Preden predstavimo algoritem, ki odpravlja opisani pomanjkljivosti, uvedimo nekaj definicij. Naj bo A množica premikov, ki jih lahko naredi agent. Preslikava δ: $S \times A \rightarrow S$ določa stanje, v katero agent pride iz danega stanja z danim premikom. LRTA* v stanju $s \in S$ pri globini preiskovanja d izbere premik $a\,(s, d)$. Pri optimalnem premiku $a^*\,(s)$ leži stanje $s' = \delta\,(s, a^*\,(s))$ na najkrajši poti od s do s_g. Optimalna globina preiskovanja $d^*\,(s)$ je globina, pri kateri LRTA* v stanju s izbere premik $a^*\,(s)$. Če imamo na voljo le globine preiskovanja do d_{max}, je d_{max}-optimalna globina $d_{d\,max}^*\,(s)$ enaka $d^*\,(s)$, če $d^*\,(s) \leq d_{max}$, sicer pa je enaka $1 \leq d \leq d_{max}$, pri čemer je pot od stanja s do s_g, na kateri leži $s' = \delta\,(s, a\,(s, d))$, najkrajša.

Naslednji algoritem učinkovito določi d_{max}-optimalne globine preiskovanja za vsa stanja $s \in S$.

for vsako stanje $s \in S$ **do**
  if d_{max}-optimalna globina $d_{d\,max}^*\,(s)$ ni določena **then**
    s' **:=** s
    repeat
      najdi $d_{d\,max}^*\,(s')$ s preiskovanjem z $d = 1 \ldots d_{max}$
      s' **:=** $\delta\,(s', a\,(s', d_{d\,max}^*\,(s')))$
    until $d_{d\,max}^*\,(s')$ določena v prejšnjem preiskovanju
      (takem, ki se ni začelo v s)
  end if
end for

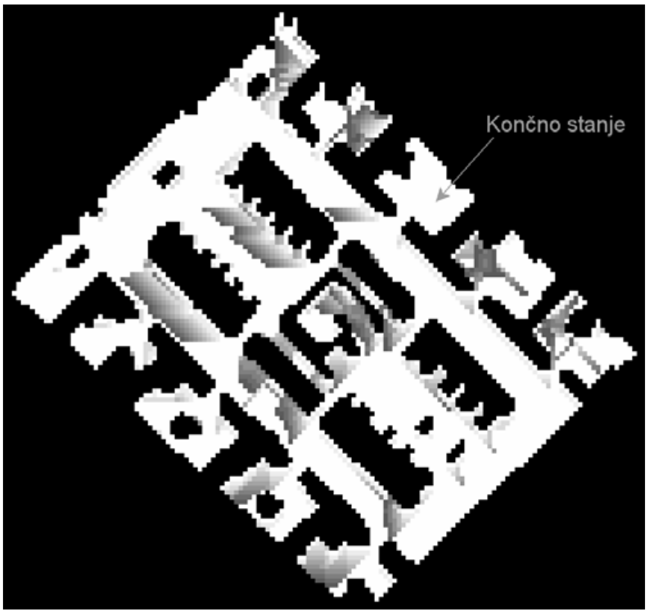
Problematična točka algoritma je določanje d_{max}-optimalne globine za neko stanje s. Izvede se s preiskovanjem z globinami $d = 1 \ldots d_{max}$, za katere se predlagani premik $a\,(s, d)$ primerja z $a^*\,(s)$. Seveda pa je za to $a^*\,(s)$ treba poznati. Določi se lahko z Dijkstrovim algoritmom [5], ki učinkovito izračuna dolžino poti iz vsakega stanja $s \in S$ do s_g. Vendar pa se ob tem zastavi vprašanje, zakaj sploh določati optimalno globino preiskovanja, če poznamo optimalni premik. Prvi razlog je, da je optimalna globina preiskovanja uporabna tudi v spreminjajočem se okolju, v kakršnem optimalni premiki lahko hitro postanejo neuporabni. Drugi pa se bo pokazal kasneje, ko bomo predstavili razširitev algoritma, ki omogoča izračun optimalne globine (in posledično optimalnega premika) le za nekatera stanja.

Povprečna dolžina poti z uporabo novega algoritma na šestih zemljevidih je 114,4, povprečno število preiskanih stanj na premik pa 155,7. To je v primerjavi z nespremenljivo globino 10 bistvena izboljšava: pri dolžini poti za 67,4 %, pri preiskanih stanjih pa kar za 91,8 %. Razlog za tolikšno zmanjšanje števila preiskanih stanj vidimo, če si ogledamo, kako pogosto je bila uporabljena katera izmed globin. Rezultati so zbrani v tabeli 2.

d_{10}*	Delež stanj (%)	d_{10}*	Delež stanj (%)
1	73.0	6	1.8
2	8.0	7	1.7
3	4.7	8	1.9
4	3.3	9	1.9
5	2.4	10	2.3

Tabela 2. *Deleži stanj, kjer je naš algoritem določil posamične globine preiskovanja za 10-optimalne.*

Slika 1 ilustrira delovanje našega algoritma: na enem izmed šestih zemljevidov so z odtenki sivine ponazorjene optimalne globine preiskovanja, črna polja pa so neprehodna.

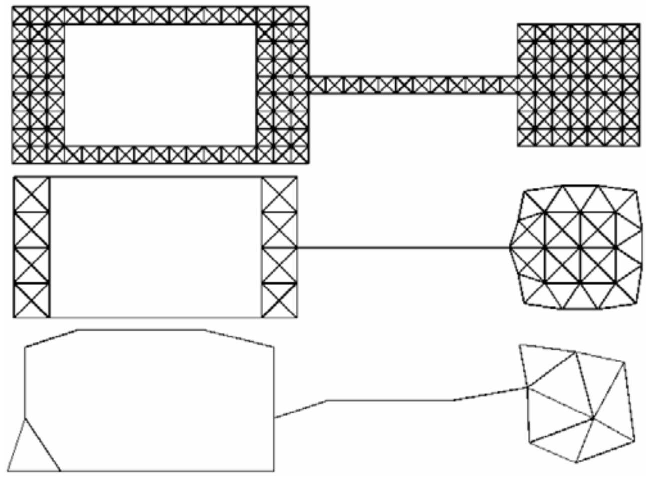


Slika 1. *Polja obarvana glede na 10-optimalno globino preiskovanja: bela ... d_{10}* = 1, najtemnejša siva ... d_{10}* = 10, črna ... neprehodno.*

5 ABSTRAKCIJA STANJ

Algoritem iz prejšnjega poglavja sicer dosega dobre rezultate in tudi omogoča bistveno hitrejše določanje optimalnih globin preiskovanja kot metoda iz poglavja 3, vendar je časovno še vedno zelo zahteven. A kot kaže slika 1, so stanja s podobno optimalno globino preiskovanja združena v skupine, iz česar je moč sklepati, da bi lahko brez prevelike izgube točnosti globino določili za le po eno stanje iz vsake skupine.

Način združevanja stanj v skupine, ki smo ga izbrali, je abstrakcija s klikami [4]. Ta metoda v prvem koraku prostor razdeli na četverice popolnoma povezanih stanj (to pomeni, da je iz vsakega z enim premikom mogoče priti v vsako drugo). Kjer zaradi topologije prostora ni mogoče najti četveric, se uporabijo manjše skupine. Vsaka četverica ustreza enemu abstraktnemu stanju nivoja 1. Abstraktna stanja nivoja 1 se na enak način združijo v abstraktna stanja nivoja 2 itd. Postopek kaže slika 2, ki je povzeta po [4]. Stanja so predstavljena kot točke, možni premiki pa kot povezave med njimi.



Slika 2. *Združevanje stanj v abstraktna stanja: na vrhu konkretna stanja, na sredini abstraktna stanja nivoja 1, na dnu pa abstraktna stanja nivoja 2.*

Naš algoritem za iskanje optimalne globine preiskovanja lahko uporabi abstraktna stanja poljubnega nivoja. Iskanje poti do s_g namesto v vsakem konkretnem stanju $s \in S$ začne v vsakem stanju $s_i \in S_i$, pri čemer je S_i množica stanj i-tega abstraktnega nivoja ($S_0 = S$). Za konkretno stanje, ki leži približno na sredini stanj pripadajočih abstraktnemu stanju s_i, poišče d_{max}-optimalno globino preiskovanja in jo pripiše vsem konkretnim stanjem, ki pripadajo s_i. Iskanje d_{max}-optimalne globine nato ponovi šele, ko agent pride v konkretno stanje, ki pripada drugemu abstraktnemu stanju. Zaradi tega se to iskanje izvede le tolikokrat, kolikor je na zemljevidu abstraktnih stanj.

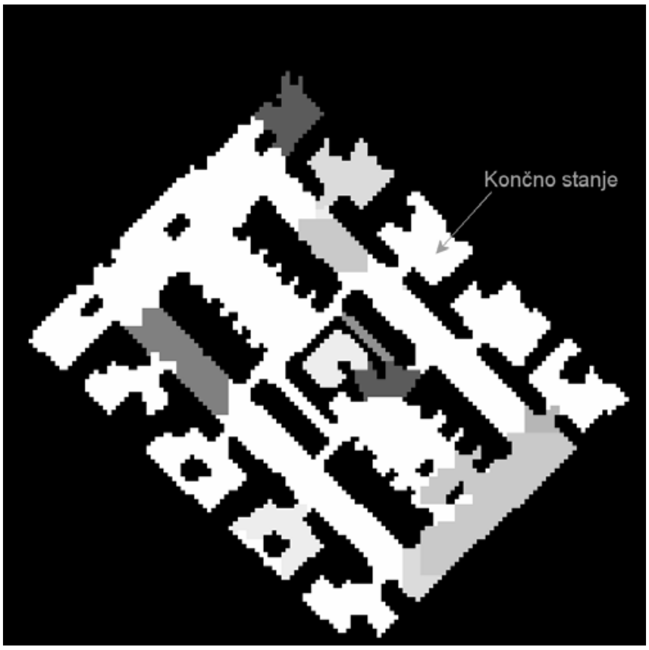
Tabela 3 kaže rezultate pri uporabi različnih nivojev abstrakcije na šestih zemljevidih. Časi za izračun 10-optimalnih globin preiskovanja za vse usmerjene pare abstraktnih stanj so ekstrapolirani iz časov izmerjenih za vsa začetna in eno končno stanje.

Nivo abs.	Št. parov abs. stanj	Čas (h)	Dolžina poti	Št. stanj / premik
0	$8{,}1 \cdot 10^7$	12.231	114,4	155,7
1	$7{,}5 \cdot 10^6$	788	130,0	158,7
2	$9{,}7 \cdot 10^5$	239	323,3	89,9
3	164.971	41	352,4	152,5
4	34.225	3,9	463,1	59,6
5	7.048	0,86	470,0	70,2
6	1.469	0,50	660,0	32,8
7	393	0,14	944,5	25,6
8	100	0,019	1004,4	13,6
9	20	0,0056	1015,3	17,0

Tabela 3. *Povprečno število usmerjenih parov stanj, čas za izračun 10-optimalnih globin preiskovanja, povprečna dolžina poti in povprečno število preiskanih stanj na premik pri uporabi različnih nivojev abstrakcije.*

Iz tabele 3 je razvidno, da sta v našem primeru uporabna abstraktna nivoja 4 in 5. Da bi z nespremenljivo globino preiskovanja dosegli v povprečju krajše poti, bi ta globina morala biti vsaj 6 (razvidno iz tabele 1). V primerjavi z nespremenljivo globino 6 pa se pri uporabi 10-optimalnih globin preišče le 10.0 % (abstraktni nivo 4) ali 8.5 % (abstraktni nivo 5) stanj na potezo, kar pomeni sorazmeren prihranek procesorskega časa.

Slika kaže 10-optimalne globine preiskovanja za zemljevid s slike 1, le da so globine določene na podlagi abstraktnih stanj nivoja 5.



Slika 3. *Polja obarvana glede na 10-optimalno globino preiskovanja določeno na podlagi abstraktnih stanj nivoja 5: bela ... $d_{10}* = 1$, najtemnejša siva ... $d_{10}* = 10$, črna ... neprehodno.*

6 ZAKLJUČEK

V tem prispevku smo opisali dve metodi za določanje optimalnih globin preiskovanja za uporabo s preiskovalnim algoritmom LRTA*. Druga dosega v povprečju krajše poti, pa tudi določanje globin je hitrejše. Kljub temu je za iskanje poti po zemljevidih iz komercialnih računalniških iger prepočasna. Uporabna pa postane, če jo združimo s tehniko za združevanje stanj v abstraktna stanja. To nam omogoči, da optimalno globino preiskovanja izračunamo za manjše število stanj, kar zmanjša potrebni procesorski čas z nekaj tisoč na nekaj ur. Povprečne dolžine poti najdenih z uporabo tako izračunanih globin so primerljive z dolžinami poti najdenih z uporabo nespremenljive globine preiskovanja, vendar je število preiskanih stanj na premik okrog desetkrat manjše.

V prihodnje je predvsem potrebno našo metodo preizkusiti na bolj reprezentativnem vzorcu parov stanj, kajti do sedaj je bile preizkušena le za eno končno stanju na vsakem zemljevidu. Poleg bi veljalo izboljšati način za izbiro konkretnega stanja, na podlagi katerega se določi optimalna globina preiskovanja za neko abstraktno stanje.

Literatura

[1] Bulitko, V. (2003). Lookahead pathologies and meta-level control in real-time heuristic search. Proceedings of 15th Euromicro Conference on Real-Time Systems, Porto, Portugal, 13-16.

[2] Bulitko, V. and Lee, G. (2006). Learning in real-time search: A unifying framework. Journal of Artificial Intelligence Research, 25, 119-157.

[3] Bulitko, V., et al. (2003). Lookahead pathologies for single agent search. Proceedings of International Joint Conference on Artificial Intelligence (IJCAI), Acapulco, Mexico, 1531-1533.

[4] Bulitko, V., Sturtevant, N., and Kazakevich, M. (2005). Speeding up learning in real-time search via automatic state abstraction. Proceedings of National Conference on Artificial Intelligence (AAAI), Pittsburgh, Pennsylvania.

[5] Dijkstra, E.W. (1959). A note on two problems in connexion with graphs. Numerische Mathematik, 1, 269-271.

[6] Hart, P.E., Nilsson, N.J., and Raphael, B. (1968). A formal basis for the heuristic determination of minimum cost paths. IEEE Transactions on Systems Science and Cybernetics, 4 (2), 100-107.

[7] Korf, R.E. (1990). Real-time heuristic search. Artificial Intelligence, 42 (2, 3), 189-211.

[8] Luštrek, M. (2005). Pathology in Single-Agent Search. Proceedings of Information Society, Ljubljana, Slovenia, 345-348.

[9] Luštrek, M. and Bulitko, V. (2006). Lookahead Pathology in Real-Time Path-Finding. Proceedings of Learning for Search workshop at American Association for Artificial Intelligence (AAAI), Boston, USA, 108-114.

ODLOČITVENI MODEL ZA LICITIRANJE PRI IGRI TAROK ZA ŠTIRI IGRALCE

Domen Marinčič, Matjaž Gams
Odsek za inteligentne sisteme
Institut "Jožef Stefan"
Jamova 39, 1000 Ljubljana, Slovenija
domen.marincic@ijs.si, matjaz.gams@ijs.si

Povzetek

V pričujočem prispevku predstavljamo odločitveni model za licitiranje pri igranju taroka za štiri igralce. Model je bil narejen na osnovi Bayesovske mreže. Razvili smo program za igranje taroka za štiri igralce Tarok 7, ki je služil kot testno okolje za ovrednotenje odločitvenega modela. Model smo nato s pomočjo programa primerjali z licitiranji treh strokovnjakov. Rezultati primerjave nakazujejo visoko ujemanje odločitev programa z odločitvami strokovnjakov.

1 Uvod

Licitacija je del nekaterih iger s kartami, kot so bridge, poker, tarok in whist. Pred dejanskim igranjem kart igralci licitirajo višje in višje igre. Tisti, ki ponudi največ vredno igro, določi tip igre, ki jo bodo igralci nadalje igrali. Ker licitacija zahteva predvidevanje končnega izida vsake od možnih iger je na nek način bolj kompleksna, kot igranje kart samo.

Med licitacijo igralci licitirajo eden za drugim; njihova licitiranja so razdeljena v runde, v vsaki rundi igralec licitira enkrat. Licitacija se zaključi, ko vsi razen enega odstopijo od nje.

V taroku za štiri igralce zmagovalec licitacije lahko igra proti vsem ostalim ali pa si izbere partnerja. Licitatorjeva strategija je izbrati najprimernejšo igro glede na njegovo moč in predvideno moč ostalih igralcev. Več je vredna igra, močnejše karte mora imeti igralec, da zmaga.

V splošnem obstajata dva pristopa, kako rešiti probleme pri licitiranju: pristop na podlagi znanja in pristop s simulacijo. Prednost pristopa z znanjem je, da odločitveni proces lahko točneje nadzorujemo, kot pri pristopu s simulacijo. Poleg tega je prvi način hitrejši; v zelo kompleksnih igrah z nepopolno informacijo simulacija porabi veliko časa. Po drugi strani pa je lažje zgraditi sistem, ki deluje na podlagi simulacije, saj ni potrebe po uporabi znanja in implementacije le-tega.

Pri našem delu smo se odločili uporabiti pristop z znanjem. Na podlagi Bayesovske mreže [3] smo razvili odločitveni model za licitiranje in ga uporabili pri taroku za štiri igralce. Izdelali smo program Tarok 7 [6], ki za igranje kart uporablja alfa-beta preiskovalni algoritem.

Bridž je verjetno najbolj poznana igra s kartami, ki vključuje licitacijo in GIB [2] eden najboljših programov za igranje te igre. GIB uporablja bazo strategij za licitiranje, vendar je najpomembnejši mehanizem za izbiro odločitev simulacija. Tudi Bridge Baron [7] je program za igranje bridža, vendar se njegovi avtorji osredotočajo predvsem na igranje kart in ne toliko na licitacijo.

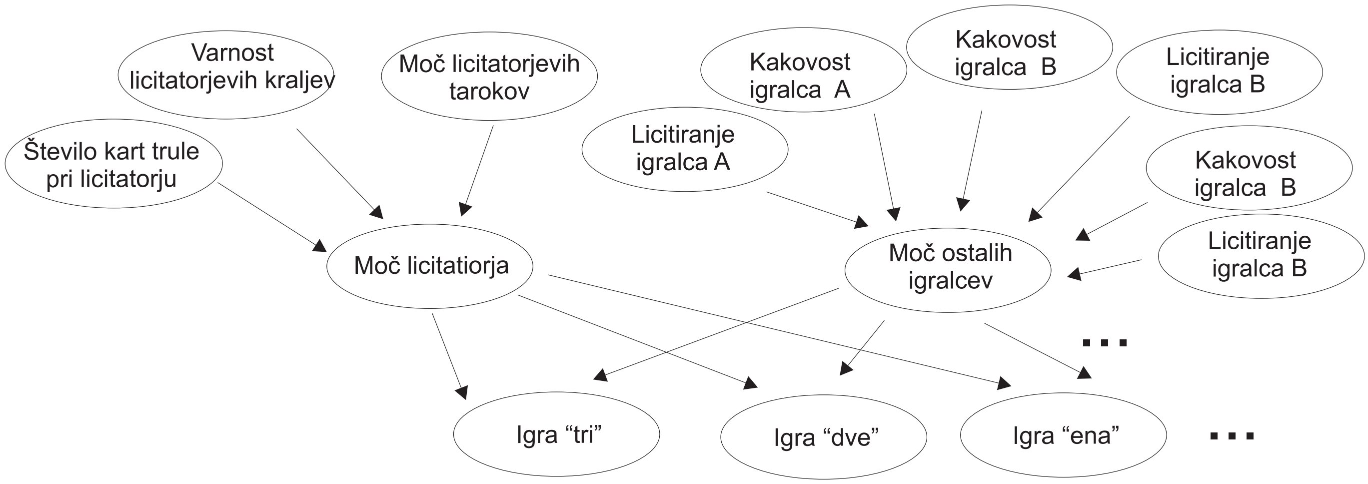
Tudi poker je primer igre z licitacijo. Poki [1], program za igranje pokra, deluje s pomočjo simulacije. Drug program, opisan v [4], uporablja Bayesovske mreže za predstavitev kart v roki licitatorja in obnašanje ostalih igralcev. S pomočjo Bayesovske mreže program izračuna verjetnost licitatorjeve zmage v igri.

Tarok za tri igralce je ravno tako igra z licitacijo. Eden od programo v za igranje te igre je Silicijev tarokist [5]. Program za odločitve pri licitiranju uporablja simulacijo.

V prispevku bomo najprej opisali strukturo odločitvenega modela. Nato bomo predstavili ovrednotenje modela s testi. Na koncu bomo podali še zaključek in predloge za prihodnje delo.

2 Opis odločitvenega modela za licitiranje

Bayesovska mreža, ki predstavlja odločitveni model za licitiranje, je predstavljena na sliki 1. Vozlišča zgornjega nivoja predstavljajo stanje igre v trenutku, ko mora igralec licitirati. Vozlišča srednjega nivoja semantično integrirajo atribute zgornjih vozlišč. Ta vozlišča niso nujno potrebna, vendar naredijo model bolj pregleden in tako lažje obvladljiv. Vsa ta vozlišča imajo simbolične vrednosti. Vsako vozlišče spodnjega nivoja predstavlja eno od možnih licitiranj in s tem igro, ki jo bodo igralci igrali nadalje, v primeru, da bo to ostalo najvišje licitiranje. Naključne spremenljivke povezane s temi vozlišči predstavljajo končen rezultat igre in lahko zavzamejo sledeče vrednosti: "visok poraz", "nizek poraz",



Slika 1: Odločitveni model za licitiranje pri taroku za štiri igralce

$$P(B = v_b) = \tag{1}$$

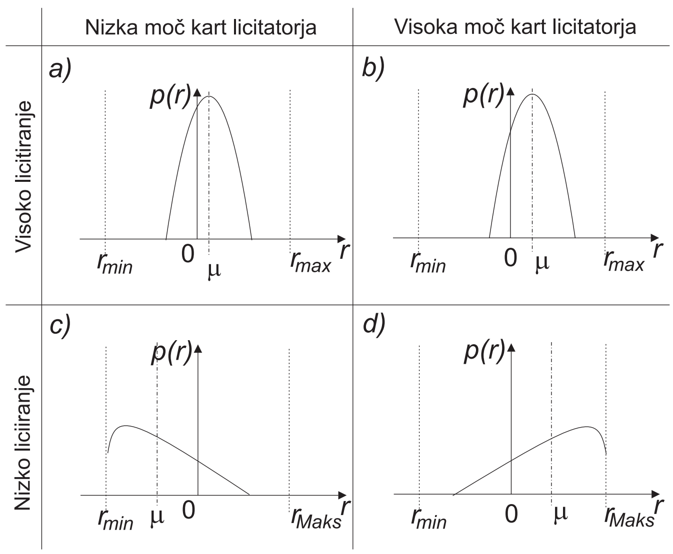
$$\sum_{j_1=1\ldots n_1,\ldots,j_k=1\ldots n_k} P(v_b|M_1 = v_{M_1}^{n_1}, \ldots, M_k = v_{M_k}^{n_k})P(M_1 = v_{M_1}^{n_1})\ldots P(M_k = v_{M_k}^{n_k})$$

"nizka zmaga" in "visoka zmaga".

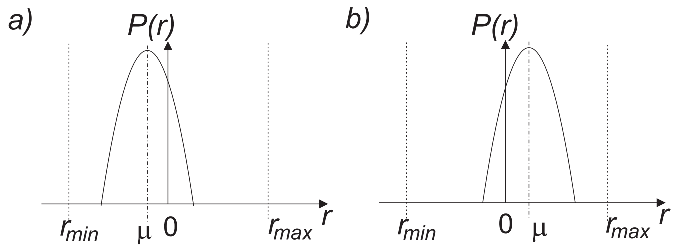
Za določitev optimalnega licitiranja najprej nastavimo verjetnosti vrednosti vseh zgornjih vozlišč glede na trenutno stanje igre. Vozlišče "Licitiranje igralca A" ima v našem primeru tri možne vrednosti: "odstop od licitacije", "nizko licitiranje" in "visoko licitiranje". Če je bilo zadnje licitatorjevo licitiranje "dve" to obravnavamo kot nizko licitranje in nastavimo verjetnost te vrednosti na 1, ostali dve verjetnosti pa postaneta 0. Podobno nastavimo vrednosti ostalih zgornjih vozlišč.

Verjetnosti vrednosti v ostalih vozliščih izračunamo s pomočjo pravil sklepanja v Bayesovskih mrežah. Zaradi posebne strukture Bayesovske mreže lahko uporabimo prirejena pravila. Recimo da je v_b vrednost vozlišča B. Naj bo $M = \{M_1, M_2, ..., M_k\}$ množica k starševskih vozlišč vozlišča B. Naj bo $V_{m_i} = \{v_{M_i}^1, ..., v_{M_i}^{n_i}\}$ množica n_i vrednosti starševskega vozlišča M_i. $P(B = v_b)$ izračunamo s pomočjo formule (1). Najprej izračunamo verjetnosti v srednjih vozliščih in nato rekurzivno še verjetnosti v spodnjih vozliščih.

Vrednostim spodnjih vozlišč nato priredimo številčne vrednosti -1, -1/3, +1/3 in +1. Rezultat pravil sklepanja so verjetnosti vrednosti naključnih spremenljivk v spodnjih vozliščih. Nato izračunamo matematično upanje za vsako licitiranje. Licitator izbere licitiranje z največjim matematičnim upanjem, v primeru, da je vsaj eno od njih pozitivno. Sicer igralec odstopi od licitacije.



Slika 2: Štirje osnovni primeri situacij odločanja pri licitiranju



Slika 3: Prilagajanje agresivnosti/tveganja pri licitiranju

3 Prilagajanje odločitvenega procesa

Model vključuje tri pomembne faktorje odločanja pri licitiranju: (i) moč igralcev (srednja vozlišča, ki združijo atribute licitatorjevih kart in pretekla licitiranja ostalih igralcev), (ii) vrednost tipov iger pridruženih določenim licitiranjem, (iii) stopnja tveganja. Drugi in tretji faktor sta vključena v verjetnostne porazdelitve naključnih spremenljivk. Slika 2 s pomočjo štirih primerov prikazuje, kako model obravnava faktorja (i) in (ii).

Primeri prikazujejo različne situacije gleda na ocenjeno moč licitatorja v primerjavi z ostalimi igralci in vrednosti igre, ki jo licitator licitira. Vsaka od verjetnostnih porazdelitev na sliki predstavlja diskretno porazdelitev v spodnjih vozliščih kot rezultat pravil sklepanja. Predstavitev z zveznimi porazdelitvami nam omogoča boljšo preglednost. Na horizontalni osi so pričakovani končni rezultati igre. Najvišja in najnižja možna vrednost sta označeni kot r_maks in r_min. Gostota verjetnostnih porazdelitev, odvisna od pričakovanih rezultatov, je prikazana na navpični osi kot $p(r)$. Matematično upanje je označeno z μ. Upoštevati je treba, da je to samo shematska predstavitev verjetnostnih porazdelitev.

Na sliki sta predstavljeni dve odločitveni situaciji. V levem stolpcu ima licitator nekoliko močnejše karte v primerjavi z ostalimi. V situacijah opisanih v desnem stolpcu ima licitator bistveno močnejše karte kot ostali. V obeh situacijah licitator lahko izbere nizko licitiranje, kjer so predvidene nizke absolutne vrednosti končnih rezultatov, visoko licitranje z visokimi absolutnimi vrednostmi predvidenih končnih rezultatov ter odstop od licitacije.

Med odločitvenim procesom najprej ugotovimo, kakšno predvideno moč ima licitator v primerjavi z ostalimi; vzemimo da je to nizka premoč. Nato izračunamo μ za nizko licitiranje (a) ter za visoko licitiranje (b). Licitator bo očitno izbral licitiranje z višjim matematičnim upanjem.

V teku večih zaporednih iger, recimo na turnirju, licitator pridobiva nove informacije o ostalih igralcih. Smiselno je, da igralec to upošteva in prilagaja strategijo licitiranja v smislu večje ali manjše agresivnosti oziroma tveganja. To lahko naredi s spremembo verjetnostnih porazdelitev v tabelah pogojnih verjetnosti v spodnjih vozliščih. Primera na sliki 3 prikazujeta manj (a) in bolj (b) agresivno licitiranje.

4 Ovrednotenje odločitvenega modela

V testu za ovrednotenje modela smo primerjali licitiranje programa Tarok 7 in treh strokovnjakov za igranje taroka za štiri igralce. V vlogi prvih treh igralcev je nastopal samo program, v vlogi četrtega igralca pa program in eden od strokovnjakov. Na ta način smo program in strokovnjaka postavili v enak položaj in opazovali njune odločitve pri licitiranju.

Strokovnjak	A	B	C
Ujemanje programa s strokovnjaki	92%	82%	80%
Odstotek licitiranj z razliko več kot ena stopnja	1%	2%	2%
Delež programovih agresivnejših licitiranj (upoštevajoč samo primere neujemanja)	35%	75%	72%

Tabela 1: Primerjava licitranja programa Tarok 7 s strokovnjaki

Tabela 1 povzema rezultate testa. Licitiranje programa Tarok 7 primerjemo s tremi strokovnjaki: A, B in C. Strokovnjak A je naredil 500 licitiranj, strokovnjaka B in C pa vsak po 100. Odstotki v drugi vrsti prikazujejo delež licitiranj, ko sta se program in strokovnjak različno odločila. Vrednost 100% bi pomenila popolno ujemanje. Tretja vrstica predstavlja delež primerov, ko sta bili licitiranji različni za več kot eno stopnjo. Obravnavajoč samo primere, ko sta program in strokovnjak licitirala različno, rezultati v četrti vrsti kažejo v kakšnem deležu primerov je program licitiral višje kot strokovnjak. Vrednost 100% bi pomenila, da je v primeru različnih licitiranj program vedno licitiral višje.

Licitranje programa Tarok 7 je bolj podobno strokovnjaku A kot ostalim strokovnjakom. To je bil pričakovan rezultat, saj je strokovnjak A avtor odločitvenega modela. Glede na rezultate v četrti vrsti je strokovnjak licitiral nekoliko agresivneje kot program Tarok 7, medtem ko sta bila ostala dva strokovnaka manj agresivna. Rezultati v drugi vrsti nakazujejo, da je bilo zelo malo primerov, ko so se odločitve programa in strokovnjakov močno razlikovale.

5 Zaključek

V prispevku smo opisal odločitveni model za licitiranje v igri tarok za štiri igralce. Model temelji na Bayesovski mreži. S testi smo ugotovili precejšnje ujemanje v primerjavi s strokovnjaki za igranje taroka. Pomembno je tudi, da odločitveni model redko izbere odločitve, ki se močno razlikujejo od strokovnjakov.

Pokazali smo, da je model na relativno enostaven način možno prilagajati spremembam v strategiji licitranja, s tem ko spreminjamo verjetnostne porazdelitve v tabelah pogojnih verjetnosti spodnjih vozlišč, ki predstavljajo možna licitiranja. Kot izhodišče za nadaljnje delo bi bilo avtomatsko učenje vrednosti v tabelah pogojnih verjetnosti. Povratni odziv za določanje teh vrednosti bi bili končni rezultati iger glede na različne odločitve med licitacijo.

Literatura

[1] D. Billings, A. Davidson, J. Schaeffer, D. Szafron, "The challenge of poker," *Artificial Intelligenc2e Journal*, Vol. 134, No. 1-2 , pp. 201-240, 2002.

[2] M. L. Ginsberg, "GIB: Imperfect information in computationally challenging game," *Journal of Artificial Intelligence Research*, Vol. 14, pp. 303-358, 2001.

[3] F. V. Jensen, "Bayesian networks and decision graphs," *Springer Verlag: New York*, 2001.

[4] K. Korb, A. Nicholson, N. Jitnah, "Bayesian poker," in *Proceedings of the 15th Conf. on Uncertainty in Artificial Intelligence Stockholm, Sweden*, Vol. , pp. 343-350, 1999.

[5] M. Luštrek, M. Gams, I. Bratko, "A program for playing tarok," *ICGA Journal*, Vol. 23 , No. 3., pp. 190-197, 2003.

[6] D. Marinčič, "Kombinacija teorije odločanja in preiskovanja pri računalniškem igranju iger," *Masters thesis, Faculty of computer and information engineering, University of Ljubljana*, 2004.

[7] S. J. J. Smith, D. Nau, T. Throop, "Computer bridge: a big win for AI planning," *AI Magazine*, Vol. 19, No. 2, pp. 93-105, 1998

Prenos znanja in znanstvenih raziskav v prakso: AMEBIS GOVOREC sintetizator govora

Tomaž Šef[1], *Matjaž Gams*[1], *Simon Rozman*[2]
[1]Institut "Jožef Stefan", Odsek za inteligentne sisteme, Jamova 39, Ljubljana, Slovenija
[2]Amebis, d.o.o., Bakovnik 3, 1241 Kamnik, Slovenija
tomaz.sef@ijs.si, matjaz.gams@ijs.si, simon.rozman@amebis.si
http://govorec.amebis.si

POVZETEK

Razvoj in raziskave so podvržene številnim spremembam, ki se odražajo v hitrem napredku in nastajanju novega znanja ter naraščanju števila novih smeri razvoja. Te spremembe se čedalje bolj odražajo tudi v slovenskem gospodarstvu, znanstveno-raziskovalnih organizacijah in univerzah. Podjetja se čedalje bolj zavedajo dejstva, da lahko preživijo in se razvijajo le, če so sposobna slediti svetovnemu razvoju. Razvoj in konkurenčnost pa ne temeljita le na nastajajočem znanju, temveč predvsem na sposobnostih podjetij, da znanje izkoristijo, uporabijo in ga čim bolje tržijo. Za to pa so potrebni ljudje, ki hkrati razumejo zakonitosti raziskovalno-razvojnega dela in pridobivanja novih znanj ter poznajo pogoje njihovega prenosa v prakso, s čimer se zagotavlja možnost ustvarjanja višje dodane vrednosti. V članku opisujemo konkreten primer prenosa znanja in znanstvenih raziskav v prakso.

AMEBIS GOVOREC je programski paket, ki pretvarja poljubno slovensko besedilo v govor. Programski paket je bil razvit kot plod sodelovanja med Institutom "Jožef Stefan" in podjetjem Amebis. Zasnovan je na trdnih in premišljenih temeljih, brez hitropoteznih kompromisov. Izdelali smo sintetizator, ki je pripravljen za svoj nadaljnji razvoj v prihodnosti.

1 UVOD

Znanje, tehnološke inovacije in izumi so temeljni vir za ohranitev, utrditev in izboljšanje konkurenčnih prednosti nacionalnih gospodarstev. Vendar pa med kakovostnim znanjem, znanstveno odličnostjo univerz in inštitutov ter ekonomsko uspešnostjo gospodarstva ni neposredne povezave. Znanstveno raziskovanje je šele prva od faz pri nastanku tehnoloških sprememb, ki ji sledijo še raziskovalni razvoj, aplikativne raziskave in komercializacija [1].

Globalizacija močno vpliva tudi na raziskovalno - razvojne dejavnosti. Brez sposobnosti za obvladovanje in prenos globalnega znanja in tehnološkega napredka, kot glavnega vira povečanja produktivnosti dela, si danes ne moremo predstavljati gradnje nacionalne konkurenčne sposobnosti in dvigovanja kakovosti življenja [2]. Veliko področij (kot npr. nanotehnologije, biotehnologija itd.) ni več možno raziskovati le v okviru ene države. Z razvojem novih telekomunikacijskih storitev je mednarodno pridobivanje in izmenjava informacij med izobraževalnimi in raziskovalnimi organizacijami ter podjetji in uporabniki izdelkov vse hitrejša in enostavnejša. S tem pridobivajo na veljavi države s poceni delovno silo (npr. Indija in Kitajska), ki postajajo vedno pomembnejši tekmovalci v svetovni inovacijski tekmi. Pojmi in pojavi, kot so nova ekonomija, družba, ki temelji na znanju in globalizacija, so nastali predvsem zaradi velikih sprememb pri pretoku informacij in znanja, zaradi katerih so se morale zakonitosti ravnanja v gospodarstvu spremeniti [3].

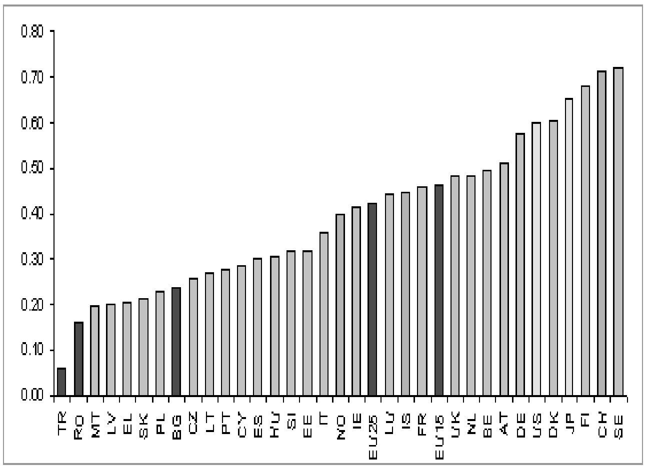
V Sloveniji se zavedamo, kako pomembna je podpora raziskovanju, znanosti in tehnologiji pri vzpostavljanju močnega gospodarstva [4]. Do težav prihaja, ker se zastavljene usmeritve ne izvajajo. Podatki kažejo, da padamo na lestvicah mednarodne konkurenčnosti, imamo nizko stopnjo sodelovanja med znanostjo in gospodarstvom, majhen delež inovativnih podjetij, izjemno majhno število visoko tehnoloških podjetij in majhno število raziskovalcev v gospodarstvu.

Glavne dileme, ki se pojavljajo v zadnjem času v Sloveniji glede strategij prihodnjega razvoja, so povezane z lizbonsko strategijo, kot so vloga znanja in znanosti, prenos in uporaba znanja iz akademskih institucij v gospodarstvo, izobraževalna politika, inovativnost ter konkurenčnost gospodarstva [3]. Večina vpletenih se strinja, da je potrebno v Sloveniji korenito izboljšati kakovost znanstvenega in razvojnega dela ter učinkovitost prenosa izsledkov v podjetja, niso pa si edini, kako doseči zastavljene cilje. Med cilji so: več aplikacij domačega in tujega znanja v gospodarstvu, več patentov in njihovega izkoriščanja ter boljše sodelovanje med znanstveno sfero in poslovnimi subjekti.

Pomena sodelovanja med znanstveno sfero in poslovnimi subjekti se zavedamo tudi na Institutu »Jožef Stefan«. V ta namen je bila ustanovljena (skupaj s partnerji iz gospodarstva) Mednarodna podiplomska šola Jožefa Štefana, organiziranih je bilo več (predstavitvenih) srečanj z gospodarstveniki itd. Rezultati vseh teh dejavnosti so že vidni in opaženi. Eden izmed rezultatov je tudi v tem članku predstavljeni **AMEBIS GOVOREC** sintetizator govora.

2 PRIMERJAVA KAZALCEV USTVARJANJA IN PRENOSA ZNANJA SLOVENIJE Z DRUGIMI DRŽAVAMI

Statistični podatki (Inovation Scoreboard 2005, http://trendchart.cordis.lu) kažejo, da Slovenija glede inovacijskega potenciala bistveno ne zaostaja za drugimi evropskimi državami, ZDA in Japonsko (Slika 1).



Slika 1: *Skupni inovacijski indeks po državah za leto 2005*

Slovenija (SI) ima v primerjavi z EU25 državami (0,41) sicer podpovprečen inovacijski indeks (0,32), vendar je z Estonijo (EE) prav na čelu novih članic (Slika 1). Zaostaja pa pri nekaterih ključnih kazalcih kot so naklonjenost okolja inovativnosti, zaščiti znanja in industrijske lastnine, podjetništvu in povečevanju znanja.

Celotna vlaganja v raziskave in razvoj podane v deležu BDP (bruto družbenega proizvoda), so v Sloveniji že približno primerljive s tistimi v EU, čeprav za skoraj trikrat zaostajamo za tistimi državami, ki v raziskave in razvoj vlagajo največji delež BDP (npr. Švedska in Finska). Povprečna letna rast vlaganj v raziskave in razvoj v Sloveniji (European Commission, Key Figures 2003–2004) glede na BDP je bila v letih 1997–2001 le 2,5 % (Finska 5,2 %, Estonija 8,8 %). Celotna vlaganja v raziskave in razvoj (ang. Gross Domestic Expenditure on R&D, GERD) lahko razdelimo na vsoto javnih vlaganj (ang. Public Expenditure on R&D, PERD) in vlaganj s strani poslovnega sektorja (ang. Business Enterprise Expenditure on R&D, BERD). Na področju javnih vlaganj v raziskave in razvoj Slovenija le rahlo zaostaja za državami EU, pri čemer je faktor zaostajanja za najboljšimi za približno dvakrat. Čeprav je znesek poslovnih vlaganj v raziskave in razvoj po absolutni vrednosti v Sloveniji višji od javnega, je relativna umeščenost Slovenije pri deležu poslovnih vlaganj za odtenek slabša kot pri javnih vlaganjih, pri čemer smo s slabim odstotkom BDP za okoli 0,4 odstotne točke slabši kot je povprečje držav EU [3]. Sklenemo lahko, da je Slovenija glede vlaganj v raziskave in razvoj le rahlo pod povprečjem EU, čeprav še daleč od 3 % BDP, na katere cilja lizbonska strategija do leta 2010.

Bolj zaskrbljujoči so statistični podatki o številu vloženih evropskih (EPO) in podeljenih ameriških (USPO) patentov. Slovenija ima v vsaki kategoriji le po nekaj patentov na milijon prebivalcev, od tega je visokotehnoloških zanemarljivo malo.

Na področju znanstvenega objavljanja je Slovenija nad povprečjem EU15 držav in le rahlo zaostaja za ZDA, kar je razveseljiv podatek. Razočara pa dejstvo, da je med objavami zelo malo visoko citiranih. Ti podatki kažejo na dobro produktivnost objavljanja slovenskih znanstvenikov in raziskovalcev, a tudi na slabo pomembnost in odmevnost objavljenih del, ki je na repu držav, ki so se primerjale [5].

Zelo nizek je tudi delež visokotehnološkega izvoza v celotnem izvozu (le slabih 5 %), kar je štirikrat nižje kot povpečje držav EU15 in šestkrat manj kot v ZDA.

Delež prebivalcev s končanim dodiplomskim in podiplomskim izobraževanjem je v Sloveniji z 18 % podoben povprečju EU25 (21 %), vendar še vedno dvakrat slabši od najboljših (ZDA 38 % in Japonska 36 %).

Slovenija s 4,6 raziskovalca na 1.000 zaposlenih lovi povprečje EU15, vendar je še daleč za najboljšimi, ki imajo do trikrat večji razpoložljiv kadrovski potencial. Ena od pomembnih prihodnjih nalog države je tako tudi spodbujanje in promocija naravoslovnih in tehniških poklicev. Delež raziskovalcev v poslovnem sektorju je v Sloveniji le 33 %, glede na lizbonske cilje pa je željeno razmerje med raziskovalci v javnem sektorju in gospodarstvu 1:3. Trenutno se raziskovalci namesto z večjimi strateškimi projekti bolj ukvarjajo z velikim številom manjših projektov, ki ne vodijo do preboja na posameznih področjih [3].

3 NAPOTKI ZA UČINKOVITO UPORABO ZNANJA

V tem poglavju povzemamo nekaj smernic, ki naj bi jih v Sloveniji čim prej uveljavili v praksi, da bomo lahko učinkoviteje izrabljali možnosti svojega znanja in sredstva, ki jih za to namenjamo. Pri procesu povečevanja učinkovitosti izrabljanja znanja bodo morali svojo nalogo opraviti vsi deležniki v procesu prenosa znanja, država, znanost in podjetja [3]:

1. **Povečanje obsega financiranja razvojno-raziskovalne dejavnosti:** država mora povečane izdatke za raziskave in razvoj učinkovito porabiti, pri čemer to velja tudi za denar iz evropskih skladov.
2. **Jasna opredelitev konkurenčnih kriterijev znanstvenega dela in njegove učinkovitosti** (znanost je potrebno postaviti na trg): kriteriji morajo biti za vse, ki prejemajo javna sredstva za raziskovanje in razvoj, enaki (sistemski) in morajo poudarjati vrednost dela, ki spodbuja prenos znanja v gospodarstvo – večji poudarek na inovacijah, patentih in uspešnih aplikativnih in ciljnih raziskovalnih projektih.
3. **Zmanjšanje togosti in zaprtosti univerz:** univerze se zapirajo vase in preprečujejo prihod svežega kadra (npr. z izgovori o pomanjkanju pedagoških izkušenj); odprtost bi vodila do prehoda iz današnjega rivalskega

odnosa za proračunski denar do boljšega sodelovanja med univerzami in inštituti.

4. **Prenova evalvacijskih procesov:** ti niso sistematski, ampak večkrat potekajo po potrebi, v zadnjem trenutku in v ozkem krogu koordinatorjev (niso opredeljene glavne smeri, ki bi jih prednostno financirali; prihaja do drobnjakarstva, ki vodi do velikega števila malih raziskovalnih skupin brez kritične mase); v prihodnje morajo na veljavi pridobiti aplikativni projekti z natančno opredeljenimi kriteriji uspešnosti.
5. **Ustvarjanje spodbudnega okolja za razvoj podjetništva:** administrativne in birokratske postopke pri ustanavljanju podjetij je potrebno skrajšati na najmanjši možni obseg (olajšati je potrebno ustanavljanje spin–off podjetij, spremeniti nenaklonjeno davčno politiko, povečati razpoložljivost tveganega kapitala itd.).
6. **Povečanje števila mladih raziskovalcev v poslovnem sektorju:** na ta način bi zagotovili pretok znanja od mentorja na univerzi ali inštitutu, na podiplomskega študenta, ki bi se ukvarjal z dejanskim problemom v gospodarstvu (tkanje vezi med obema področjema); mladi raziskovalec tehnične ali naravoslovne stroke, ki ves čas svojega podiplomskega študija preživi na javni instituciji, ne zna napisati poslovnega načrta, saj v procesu podiplomskega izobraževanja ne more pridobiti nobenega formalnega znanja s področij ekonomije in podjetništva.
7. **Omogočanje raziskovalne dejavnosti tudi v malih in srednjih podjetjih:** v številnih primerih nimajo denarja za to dejavnost, poleg tega se srečujejo s kompliciranimi postopki in zahtevnimi kriteriji za pridobivanje sredstev, ki jim lahko zadostijo le veliki.

4 SINTETIZATOR GOVORA AMEBIS GOVOREC

Amebis Govorec (http://govorec.amebis.si/) je programski paket, ki pretvarja poljubno slovensko besedilo v govor. Besedilo analizira, pretvori simbole v besede, besedilo naglasi, določi izgovarjavo in prebere. Programski paket je bil razvit v sklopu sodelovanja med Institutom »Jožef Stefan« in podjetjem Amebis, d.o.o. Uporaben je v različnih primerih, ko je govorno posredovanje sporočila primernejše od vizualnega:

- Skupaj z bralniki zaslona ali knjig je uporaben kot pomoč slepim in slabovidnim.
- Omogoča izdelavo rešitev, ki vključujejo posredovanje ne-slikovnih informacij na daljavo, kot na primer telefonskih odzivnikov.
- Primeren je za vgradnjo v programe in avtomate v proizvodnih procesih za podajanje glasovnih informacij uporabnikom, ki zaradi narave svojega dela ne morejo med delom brati zaslonov.
- Uporaben je kot dodatek v programih, ki komunicirajo z govorom, a je besedišče preveliko ali pa vnaprej neznano in ga razvijalci programov ne morejo posneti vnaprej.

Programski paket Amebis Govorec je na voljo kot modul za vgradnjo v operacijske sisteme Microsoft Windows 98 ali novejše. Uporabljajo ga lahko vsi programi, ki uporabljajo vmesnik Microsoft SAPI 5 za govor (Adobe Reader 7, AiSquared ZoomText 9, Freedom Scientific Jaws 4.5, itd.).

Poleg sintetizatorja je v programskem paketu priložen tudi enostaven programski vmesnik **Amebis Govorec Mini** (http://govorec.amebis.si/vmesniki/). Program je namenjen uporabi govornega vmesnika v vseh programih, ki omogočajo delo z odložiščem (možnost Kopiraj Ctrl+C) ali tehniko Povleci in spusti (angl. Drag & Drop). Seveda se lahko uporablja tudi samostojno. Glavno okno programa vsebuje naslednje elemente:

- orodno vrstico (Slika 2 zgoraj): vrstica z gumbi ter drsnika za glasnost in hitrost izgovarjave,
- polje za besedilo (Slika 2 levo),
- animiran obraz (Slika 2 desno),
- statusno vrstico (Slika 2 spodaj).

Slika 2: *Uporabniški vmesnik Amebis Govorec Mini*

S spletno različico sintetizatorja govora Amebis Govorec je možno preizkusiti kakovost govora trenutne verzije sistema (dostopna je na naslovu http://govorec.amebis.si/demo/).

Prav tako je na voljo tudi enomesečni brezplačni programski paket, ki ga lahko uporabnik prenese in namesti na svoj računalnik (dostopen je na naslovu http://govorec.amebis.si/prenos/).

Razvijalci programske opreme lahko v svoje programe dodajo govor s samo nekaj vrsticami kode (navodila za razvijalce so dostopna na naslovu ftp://ftp.amebis.si/Javno/Govorec/Doc/Razvoj.doc).

5 KRATKA ZGODOVINA GOVORCA

Sistem Govorec je rezultat dolgoletnega dela in raziskav s področja jezikovnih in govornih tehnologij [6]. Pomeni logično nadaljevanje in nadgradnjo poprejšnjega dela, opravljenega z razvojem Sistema za izgovarjavo izoliranih slovenskih besed (1992. leta). Sistem je deloval na osnovi uporabe pravil. Za vsak fonem je izračunal primeren čas trajanja in osnovno frekvenco F0. Za tvorjenje govora je uporabljal dva komercialna sintetizatorja (prvotno razvita za angleški jezik): LSI Phonetic Synthesizer in Covox Speech Thing. 1995. leta je bil ta sistem dopolnjen z modulom za določevanje stavčne intonacije, formantna sintetizatorja pa sta bila zamenjana s sintezo na osnovi združevanja osnovnih govornih enot (difonov), ob uporabi algoritma TD-PSOLA. Nastal je sistem STTS, ki je deloval pod operacijskim sistemom DOS [7]. Sledilo je izboljševanje posameznih modulov, ki so bili v celoti zasnovani in implementirani povsem na novo [8, 9, 10]. Sistem je postal dostopen tudi preko interneta. Leta 2000 je bil preprogramiran v skladu z industrijskim standardom Microsoft Speech API 4.0, dobil je tudi novo ime - Govorec ver. 1.0 [11, 12].

Sistem Govorec ver. 1.0 je bil najprej uporabljen v zaposlovalnem agentu EMA, ki je posredoval informacije o prostih delovnih mestih v Sloveniji [13, 14]. Uporabljajo ga tudi člani Zveze društev slepih in slabovidnih Slovenije, ki jim je bil sistem predan v brezplačno uporabo. Sistem je bil nagrajen s prvo nagrado Sklada za nagrajevanje inovacij na področju usposabljanja, življenja in dela invalidov. Med drugim je bil predstavljen v številnih revijah (Moj Mikro, Monitor, Novice IJS itd.), v dnevnem časopisju (Delo, Dnevnik itd.), na več radijskih in televizijskih postajah (TV Slovenija, POP TV, Radio Slovenija, razne lokalne radijske postaje itd.). Uporabljen je bil v razvedrilno-informativni oddaji Terminal na TV Slovenija ter v še nekaterih drugih oddajah na televiziji in radiu. Na njegovi osnovi so bili razviti prototipi govornih vmesnikov številnih podjetij.

Leta 2006 je bil Govorec ver. 1.1 uporabljen V umetniškem projektu Saše Sedlačka "Žicar, robot za socialno ogrožene". Avtor umešča delo v okvir širših družbenih sprememb, ki vnašajo v splošno sliko družbe vedno večji procent revščine. Tako opozarja na različne marginalizirane skupine kot so revni posamezniki in družine, begunci oziroma ostali prosilci za azil, ostareli, invalidi itd. Robot Žicar lahko vstopa v beračem nedosegljiva okolja, kot so nakupovalna središča in na družbene prireditve, kjer se zbira in zadržuje premožnejši del družbe, ki zmore več simpatij do marginaliziranih, če le ti komunicirajo v varni distanci s pomočjo tehnološkega vmesnika.

Med tem je podjetje Amebis prevzelo programsko kodo Govorca in jo uporabilo za osnovo pri izdelavi povsem nove verzije 2.0. Govorec je bil napisan v celoti na novo. Od starega so ostale le ideje in govorna baza. Na vhodu je bil dodan Amebisov stavčni analizator, uveden je bil slovar izgovarjav, uporabljen zanesljivejši zlogovalnik in dodano še mnogo drugih izboljšav. Govorec je bil pripravljen in preizkušen, da je stoodstotno združljiv s standardom Microsoft SAPI 5. Za bolj zanimivo ponudbo je poskrbljeno še z dodanim vmesnikom Mini, ki s pomočjo animiranega robotka v tehnologiji Direct3D bere poljubno besedilo, ki ga uporabnik vpiše ali postavi na odložišče.

6 SKLEP

Pri razvoju Govorca druge generacije smo imeli ves čas pred seboj vizijo izdelati sintetizator slovenskega govora na trdnih in premišljenih temeljih, brez hitropoteznih kompromisov. Novi temelji omogočajo tako enostavne nadaljnje raziskave, kot njihov prenos v končni izdelek. Izdelali smo sintetizator, ki je pripravljen za svoj nadaljnji razvoj v prihodnosti.

Literatura

[1] D. Pučko, *Strateško upravljanje*, Ekonomska fakulteta, Univerza v Ljubljani, 2003, 3 natis.

[2] L. Argote, P. Ingram, J. M. Levine, R. L. Moreland, Knowledge Transfer in Organizations: Learning from the Experience of Others, *Organizational behaviour and Human decision Processes*, 2000, 82 (1), str1-8.

[3] M. Polak, Povezovanje gospodarstva in znanosti pri nastajanju, prenosu in uporabi znanja, *magistrsko delo*, Ekonomska fakulteta, Univerza v Ljubljani, 2005.

[4] J. Bešter, M. Bučar, P. Raspor, Raziskave, inovacije in tehnologija, *Strokovna gradiva za pripravo Strategije razvoja Slovenije*, delovna verzija I, [URL: http://www.gov.si/umar/projekti/srs/gradiva/rit1.pdf], 22.2.2006.

[5] D. Bole Kosmač, *Kazalci za spremljanje nacionalnih raziskovalnih politik: Izračuni za Slovenijo*, Ministrstvo za šolstvo, znanost in šport, 2002.

[6] T. Šef, Analiza besedila v postopku sinteze slovenskega govora, *doktorska disertacija*, Fakulteta za računalništvo in informatiko, Univerza v Ljubljani, 2001.

[7] T. Šef, The new Slovenian text-to-speech system, *Advances in signal processing, robotics and communications, (Electrical and computer engineering series)*, WSES, str. 216-221, 2001.

[8] T. Šef, M. Gams, Data mining for creating accentuation rules, *Applied Artificial Intelligence*, vol. 17, str. 395-410, 2004.

[9] T. Šef, Avtomatsko naglaševanje nepoznanih besed pri sintezi slovenskega govora, Elektrotehniški vestnik, letn. 73, št. 2-3, str. 99-104, 2006.

[10] T. Šef, Automatic accentuation of words for highly inflected Slovenian language, WSEAS Transactions on Communications, vol. 5, str. 1188-1194, 2006.

[11] T. Šef, Sistem GOVOREC za sintezo slovenskega govora, *Elektrotehniški vestnik*, str. 165-170, 2002.

[12] T. Šef, M. Gams, Speaker (GOVOREC) : a complete Slovenian text-to speech system, *International Journal of Speech Technology*, vol. 6, str. 277-287, 2003.

[13] T. Šef, A. Dobnikar, M. Gams, An agent speech module, *International Journal of Applied Mathematics*, vol. 3, str. 267-280, 2000.

[14] M. Gams, T. Šef, A speech module in an agent system, *Engineering Intelligent Systems*, vol. 4, 2000.

ODKRIVANJE IZJEM NA PRIMERU INTELIGENTNEGA SISTEMA ZA KONTROLO PRISTOPA

Tea Tušar, Matjaž Gams
Odsek za inteligentne sisteme
Institut "Jožef Stefan"
Jamova 39, 1000 Ljubljana, Slovenija
tea.tusar@ijs.si, matjaz.gams@ijs.si

POVZETEK

Prispevek obravnava sistem za kontrolo pristopa, ki različne (biometrične) senzorje povezuje in nadgrajuje z uporabo inteligence. Ena izmed nalog takšnega inteligentnega sistema je odkrivanje izjem, tj. nenavadnih primerov obnašanja uporabnikov. V prispevku so opisani različni algoritmi za odkrivanje izjem, ki izjeme definirajo s pomočjo razdalj med primeri, na podlagi gostote ali pa z uporabo različnih klasifikatorjev. Na podlagi posebnih lastnosti podatkov sistema za kontrolo pristopa lahko ugotovimo, da so za ta namen najbolj primerne metode, kot so projekcije na prostore z manj dimenzijami, izračun lokalnega koeficienta izjemnosti in kombinacija obeh metod. Opravljena analiza bo postala še bolj informativna, ko bomo omenjene metode preizkusili na realnih podatkih o pristopih.

1 UVOD

Sistemi za kontrolo pristopa predstavljajo pomemben del celovitega zagotavljanja varnosti ljudi in premoženja. Pri kontroli pristopa ločujemo določanje identitete (tako imenovano *identifikacijo*) in preverjanje identitete (*verifikacijo*) posameznikov. V zadnjem času se za obe nalogi vedno pogosteje uporabljajo biometrični senzorji. Medtem ko se za identifikacijo poleg prstnih odtisov še vedno pogosto uporabljajo brezkontaktne kartice ali gesla oz. PIN kode, se za verifikacijo uporabnikov uporablja prepoznava biometričnih lastnosti človeka, kot so npr. šarenica, prstni odtis, geometrija dlani in podobno. Glavna prednost uporabe biometričnih metod je v tem, da so biometrične lastnosti človeka edinstvene in težko ponaredljive. Poleg tega so "sestavni del" človeka in jih zato uporabnik ne more izgubiti oz. pozabiti.

Poleg uporabe različnih (biometričnih) senzorjev, lahko sistem za kontrolo pristopa nadgradimo z uporabo inteligence. Inteligentni sistem za kontrolo pristopa lahko spremlja dve vrsti obnašanja:

– mikro obnašanje pred posamezno točko za nadzor vstopa, in

– makro obnašanje, tj. gibanje med različnimi točkami za nadzor vstopa.

Spremljanje mikro obnašanja temelji na predpostavki, da se uporabniki navadijo pristopati k preverjanju identitete na določen način, ki se v krajšem časovnem obdobju bistveno ne spreminja, je pa od uporabnika do uporabnika različen. Odvisen je od njegovih navad in motoričnih lastnosti (npr. od mesta, kjer ponavadi nosi identifikacijsko kartico, kateri prst je uporabil za prstni odtis, ali je motorično bolj ali manj spreten). S spremljanjem mikro obnašanja in kombiniranjem izhodov ostalih senzorjev, dobimo nov, "inteligentni virtualni senzor", ki lahko dodatno verificira uporabnika oz. nam pove, s kakšno verjetnostjo je človek pred senzorjem res tisti, za katerega se izdaja.

Po drugi strani *spremljanje makro obnašanja* pomeni opazovanje dnevne rutine uporabnikov. Pri tem se beleži kdaj in na katerih točkah uporabnik običajno vstopa. Tako se sistem lahko nauči značilnih vzorcev obnašanja za posamezne uporabnike in ugotovi, ko pride do izjem. Na primer, sistem bi moral opaziti, če se je namesto kadilca, ki vsako uro odhaja kadit, infiltriral nekadilec ali pa če kadilec zaradi živčnosti odhaja ven dvakrat pogosteje. Sistem spremlja tudi, kateri uporabniki prihajajo skupaj in druge časovne odvisnosti med njimi. Pravzaprav se sistem lahko nauči česarkoli, kar je opisljivo z zajetimi podatki. Naučeno znanje uporablja sproti za odkrivanje deviantnosti, hkrati pa so naučena pravila na voljo nadzornikom in morebitnim analitikom za kasnejši ročni pregled.

S spremljanjem obnašanja na obeh nivojih se inteligentni sistem za kontrolo pristopa lahko nauči prepoznavati ustaljene vzorce obnašanja za vsakega posameznega uporabnika in, kar je še pomembnejše, odkrivati izjeme, ki lahko predstavljajo poskus vstopa neavtorizirane osebe.

Za odkrivanje izjem poznamo številne algoritme, ki se uspešno uporabljajo v ta namen in jih bomo predstavili v naslednjem razdelku. V nadaljevanju se bomo posvetili tudi posebnostim podatkov inteligentnega sistema za kontrolo pristopa, ki postavljajo svoje zahteve za predstavljene algoritme. Prispevek bomo zaključili s pregledom nalog, ki nas za izvedbo takšnega sistema še čakajo.

2 ALGORITMI ZA ODKRIVANJE IZJEM

Odkrivanje izjem (primerov z nenavadnimi lastnostmi) je zelo zanimivo področje strojnega učenja, ki se uporablja pri reševanju mnogih nalog, kot so med drugim odkrivanje prevar [6], identificiranje vdorov v računalniška omrežja [13, 8] in prečiščevanje podatkov [14]. Z odkrivanjem izjem so se najprej ukvarjali v statistiki [10, 3], kjer pa so večinoma obravnavali enodimenzionalne podatke in podatke, za katere je vnaprej znana njihova distribucija. Ker za naše podatke opisani lastnosti ne veljata, v prispevku ne bomo obravnavali statističnih metod, ampak le metode, ki temeljijo na strojnem učenju.

2.1 Definicija izjeme

Ko govorimo o odkrivanju izjem, moramo najprej definirati, kaj izjema sploh je. Večina avtorjev izjemo definira s pomočjo *razdalje* do njenih najbližjih sosedov. Če torej pregledamo lokalno okolico (navadno vzamemo k najbližjih sosedov) nekega primera, je opazovani primer izjema, če se vsi sosedi iz lokalne okolice nahajajo daleč od njega. Prednost uporabe razdalje za določanje izjem je v tem, da ni potrebno poznati distribucije primerov in da lahko izjeme na ta način definiramo na vsakem prostoru, na katerem je definirana razdalja.

Tri najpogostejše definicije izjem so naslednje:

1. Izjeme so tisti primeri, za katere obstaja manj kot p drugih primerov, ki se nahajajo v razdalji manjši ali enaki d [12, 11].

2. Izjeme so tisti prvi n primeri, ki se nahajajo najdlje od k-tega najbližjega seseda [16].

3. Izjeme so tisti prvi n primeri, katerih povprečna razdalja do k najbližjih sosedov je največja [2, 8].

Med temi definicijami obstajajo manjše razlike. Prva izjem ne rangira in zahteva, da se določi mejna razdalja d, kar lahko včasih povzroča težave. Druga definicija ne upošteva informacije o primerih, bližjih od k-tega najbližjega primera. Tretja pa odpravlja pomanjkljivosti prvih dveh definicij, a je zato izvajanje metod na njeni podlagi časovno bolj zahtevno.

Vsem definicijam na podlagi razdalje je skupno, da znajo povedati le, da je primer izjemen, ne pa tudi koliko se razlikuje od ostalih primerov. To je mogoče doseči, če za definiranje izjem uporabimo *gostoto* [7, 15]. To pomeni, da je primer definiran kot izjema glede na to, kolikšna je njegova lokalna gostota glede na lokalne gostote njegovih sosedov.

Izjeme lahko poiščemo tudi na drugačen način. Z uporabo strojnega učenja se lahko na podatkih naučimo različnih pravil, ki opisujejo te podatke. Izjeme lahko potem določamo na podlagi *klasifikatorjev* tako, da je izjema vsak primer, ki ga klasifikatorji različno klasificirajo.

V nadaljevanju si bomo najprej ogledali štiri metode, ki izjeme iščejo s pomočjo razdalje, nato pa še metodo, ki temelji na gostoti.

2.2 Ugnezdene zanke

Najenostavnejši algoritem za odkrivanje izjem je *algoritem ugnezdenih zank* (angl. nested loops) [12, 11, 16]. V osnovni različici algoritem izračuna razdalje med vsakim parom primerov in to uporabi za ugotavljanje izjem po eni od zgornjih definicij. Algoritem ima kvadratno časovno zahtevnost $\mathcal{O}(N^2)$ glede na število vseh primerov N. V primeru številnih podatkov je to prevelika zahtevnost, zato so raziskovalci veliko napora namenili razvoju algoritmov z manjšo časovno zahtevnostjo.

2.3 Prostorske indeksne strukture

Izjeme lahko odkrivamo tudi s pomočjo *prostorskih indeksnih struktur*, kot so KD-drevo [4], R-drevo [9] ali X-drevo [5], s katerimi lahko poiščemo najbližjega soseda za obravnavani primer celo v času $\mathcal{O}(\log N)$ [12, 11, 16]. Odkrivanje izjem tako zahteva čas $\mathcal{O}(N \log N)$. Vendar pa to drži le za prostore z malo dimenzijami, saj drevesa hitro odpovedo, če je število dimenzij večje od pet.

2.4 Particije prostora

Zahtevnost algoritma za odkrivanje izjem se lahko zmanjša, če prostor razdelimo na predele in tako omogočimo hitrejše iskanje najbližjih sosedov. Za vsak predel si zapomnimo določene podatke, kot je npr. minimalni mejni pravokotnik. Ko iščemo najbližje sosede nekega primera, primerjamo primer z mejnim pravokotnikom in tako ugotovimo ali lahko najbližji sosed prihaja iz tistega predela. Če to ni možno, potem noben primer iz tistega predela ne more biti najbližji sosed opazovanega primera. V [12] prostor razdelijo na hiperpravokotnike, s čimer dosežejo časovno zahtevnost, ki je linearna glede na število primerov N, a eksponentna glede na število dimenzij. Zato je primerna samo za iskanje po prostorih z manj kot petimi dimenzijami. V [16, 8] prostor razdelijo na particije s pomočjo gruč. Ta algoritem se je izkazal za boljšega od algoritmov z ugnezdenimi zankami ali prostorskimi indeksnimi strukturami, a je bil preizkušen samo na prostorih z malo dimenzijami.

2.5 Projekcije

Nekateri raziskovalci uporabljajo projekcije prostora, s katerimi se skušajo izogniti problemom, ki jih prinesejo večdimenzionalni prostori. Če namreč gledamo razdalje med primeri v večdimenzionalnem prostoru, se lahko zgodi, da ne ugotovimo izjem, ki se močno razlikujejo v eni dimenziji in malo v drugih, saj se navadno razlike po posameznih dimenzijah seštevajo. Zato v [1] predlagajo, da se prostor projicira na manjdimenzionalne prostore. V [2] pa prostor večkrat projicirajo na interval $[0, 1]$ s Hilbertovimi krivuljami. Vsaka naslednja projekcija izboljša oceno "izjemnosti" primera. Njihovi rezultati kažejo, da algoritem dosega skoraj linearno časovno zahtevnost.

2.6 Lokalni koeficient izjemnosti

Lokalni koeficient izjemnosti (angl. local outlier factor, LOF) je za vsak primer definiran s pomočjo lokalne gostote primera in lokalne gostote njegovih sosedov [7]. Število sosedov, ki jih upoštevamo v tem izračunu, je parameter algoritma. Tako dobljeni koeficient vsakemu primeru določi število večje ali enako 1, ki pove, kolikšna je izjemnost primera. Primeri, ki niso izjeme, imajo LOF = 1. Večji kot je LOF, večja je izjemnost primera. Rezultati dobljeni z uporabo koeficienta izjemnosti so zelo dobri – metoda pravilno določi izjeme tudi v primerih, ko so podatki različno distribuirani. Na takšnih podatkih imajo navadno metode, ki temeljijo na razdalji, težave. V [15] so raziskovalci metodo razvili korak naprej tako, da so edini parameter metode (število sosedov) določili avtomatsko iz podatkov. Slabost uporabe lokalnega koeficienta izjemnosti pa je časovna zahtevnost metode, saj je kvadratna glede na število primerov.

3 POSEBNOSTI PODATKOV SISTEMA ZA KONTROLO PRISTOPA

Številni primeri uporabe odkrivanja izjem, kot je npr. prečiščevanje podatkov, iščejo izjeme izmed N primeri šele potem, ko so vsi primeri že znani. Pri sistemu za kontrolo pristopa pa izjema lahko pomeni poskus neavtoriziranega vstopa in zato želimo, da se izjeme odkrivajo sproti in kar se da hitro. Na ta način lahko sistem ukrepa takoj – sproži alarm ali opozorilo. Sprotno odkrivanje izjem prinaša tudi prednosti: ker želimo ugotoviti, ali je dani (zadnji dobljeni) primer izjema, naenkrat obdelujemo samo en primer. Časovna (in prostorska) zahtevnost takšnega postopka je zato manjša.

Seveda ni vseeno, koliko se novi primer razlikuje od preostalih. Vzemimo za primer uporabnika, ki navadno prihaja v službo vsak dan ob osmih. Izjemni prihod ob devetih je manj pomemben kot izjemni prihod ob dvajsetih. Algoritem za odkrivanje izjem mora torej znati razlikovati med izjemami različnih veličin, da se lahko sistem nanje ustrezno odziva. Prihod ob devetih bi tako lahko sprožil manjše opozorilo, medtem kot bi prihod ob dvajsetih lahko bil dovolj nenavaden, da bi sprožil alarm.

Ker so navade in obnašanje pri pristopih vezane na posameznega uporabnika, mora sistem iskati izjeme v okviru podatkov za vsakega uporabnika posebej. To pomeni, da ima metoda za na voljo malo primerov. Po eni strani je to dobrodošlo, saj bo tako metoda za odkrivanje izjem gotovo hitra, po drugi strani pa majhno število primerov pomeni težjo nalogo – toliko bolj, če je dimenzionalnost prostora velika. Poleg tega velja, da vsi primeri niso enako pomembni. Če npr. spremljamo podatke o makro obnašanju v obdobju več let, so starejši primeri manj pomembni od novejših, saj se človek (in s tem njegove navade) skozi čas spreminja. Primere je zato treba utežiti glede na njihovo aktualnost.

Dodatna lastnost podatkov sistema za kontrolo pristopa je obstoj nominalnih oz. poimenskih značilk. Večina metod za odkrivanje izjem (razen tistih, ki temeljijo na klasifikatorjih) potrebuje definicijo razdalje za vsako značilko. Pri nominalnih značilkah se navadno uporablja dvojiška razdalja: razdalja je enaka 1, če sta nominalni značilki različni, in 0 sicer. Vendar pa so določene značilke takšne, da bi dopuščale tudi drugačno definicijo razdalje. Sistemi za kontrolo pristopa beležijo tipe dogodkov, kot so npr. "prihod na delo", "odhod na malico", "odhod z dela" in podobni. Namesto običajne, dvojiške definicije, tu lahko razdalje določimo tako, da so si npr. prihodi med sabo bolj podobni kot prihod in odhod.

Glede na predstavljene lastnosti podatkov sistema za kontrolo pristopa lahko ugotovimo, da bi bile izmed algoritmov, ki izjeme definirajo s pomočjo razdalje, za naše potrebe še najbolj primerne projekcije. Le-te se namreč ukvarjajo z večdimenzionalnimi prostori in lahko odkrijejo tudi izjeme, ki se močno razlikujejo samo v eni dimenziji oz. značilki. Poleg tega algoritem, ki uporablja projekcije, odlikuje skoraj linearna časovna zahtevnost. Ker za obravnavani primer želimo poznati tudi stopnjo izjemnosti, velja poskusiti algoritem, ki izračuna lokalni koeficient izjemnosti. Tudi kombinacija obeh algoritmov lahko prinese zelo dobre rezultate. Kot popolnoma drugačen pristop bi bilo smiselno preizkusiti tudi kakšne izjeme lahko določimo s pomočjo klasifikatorjev.

4 ZAKLJUČEK

V prispevku smo obravnavali sistem za kontrolo pristopa, ki združuje več različnih biometričnih senzorjev in svoje delovanje nadgrajuje z uporabo inteligence. Ključna prednost takšnega sistema je zmožnost odkrivanja odstopanj od ustaljenih vzorcev obnašanja uporabnikov. Takšne izjeme lahko pomenijo nevarnost, kot je npr. poskus vstopa neavtorizirane osebe ali pa neobičajno obnašanje sicer pravega uporabnika, ki pa se giblje drugače kot navadno zaradi poškodbe ali vinjenosti.

Razvoj inteligentnega sistema je v začetni fazi in pred nami so še številne naloge. Najprej moramo iz podatkov o pristopih izluščiti tiste značilke, ki najbolje opisujejo obnašanje uporabnika. Za nominalne značilke moramo definirati razdalje, ki so lahko bodisi binarne bodisi upoštevajo znanje o značilkah in so posledično bolj informativne. Nato moramo opisane algoritme za odkrivanje izjem preizkusiti na teh podatkih. Odkrivanje izjem je oblika nenadzorovanega učenja, pri katerem poseben izziv predstavlja tudi vrednotenje kakovosti algoritmov.

Ker se lahko sistem uspešno uči šele potem, ko že vsebuje nekaj uporabnih podatkov, je treba predvideti delovanje sistema tudi, ko teh podatkov še nima. To pomeni, da mora biti v sistem vključeno domensko predznanje v obliki ontologij o značilnem obnašanju posameznikov in skupin. To znanje bo najpomembnejše pri prvih pristopih uporabnikov oz. pri zagonu sistema, vendar se bo uporabljalo tudi kasneje v povezavi z naučenim znanjem.

Literatura

[1] C. C. Aggarwal and P. S. Yu. Outlier detection for high dimensional data. In *Proceedings of the International Conference on Management of data (SIGMOD'01)*, pages 37–46, 2001.

[2] F. Angiulli and C. Pizzuti. Fast outlier detection in high dimensional spaces. In *Proceedings of the 6th European Conference on Principles of Data Mining and Knowledge Discovery (PKDD'02)*, pages 15–26, 2002.

[3] V. Barnett and T. Lewis. *Outliers in Statistical Data*. John Wiley & Sons, 1994.

[4] J. L. Bentley. Multidimensional binary search trees used for associative searching. *Communications of the ACM*, 18(9):509–517, 1975.

[5] S. Berchtold, D. A. Keim, and H.-P. Kriegel. The X-tree: An index structure for high-dimensional data. In *Proceedings of the 22th International Conference on Very Large Data Bases (VLDB'96)*, pages 28–39, 1996.

[6] R. J. Bolton and D. J. Hand. Statistical fraud detection: A review. *Statistical Science*, 17(3):235–255, 2002.

[7] M. M. Breunig, H.-P. Kriegel, R. T. Ng, and J. Sander. LOF: Identifying density-based local outliers. In *Proceedings of the International Conference on Management of Data (SIGMOD'00)*, pages 93–104, 2000.

[8] E. Eskin, A. Arnold, M. Prerau, L. Portnoy, and S. Stolfo. A geometric framework for unsupervised anomaly detection: Detecting intrusions in unlabeled data. In *Proceedings of the Data Mining for Security Applications Workshop*, 2002.

[9] A. Guttman. R-trees: A dynamic index structure for spatial searching. In *Proceedings of the International Conference on Management of data (SIGMOD'84)*, pages 47–57, 1984.

[10] D. Hawkins. *Identification of Outliers*. Chapman and Hall, 1980.

[11] E. M. Knorr, R. T. Ng, and V. Tucakov. Distance-based outliers: algorithms and applications. *The VLDB Journal*, 8(3-4):237–253, 2000.

[12] E. M. Knorr and R. T. Ng. Finding intensional knowledge of distance-based outliers. In *Proceedings of the 25th International Conference on Very Large Data Bases (VLDB'99)*, pages 211–222, 1999.

[13] T. Lane and C. E. Brodley. Temporal sequence learning and data reduction for anomaly detection. *ACM Transactions on Information System Security*, 2(3):295–331, 1999.

[14] A. Loureiro, L. Torgo, and C. Soares. Outlier detection using clustering methods: A data cleaning application. In *Proceedings of the Data Mining for Business Workshop*, 2005.

[15] S. Papadimitriou, H. Kitagawa, P. Gibbons, and C. Faloutsos. LOCI: Fast outlier detection using the local correlation integral. In *Proceedings of the 19th International Conference on Data Engineering (ICDE)*, pages 315–326, 2003.

[16] S. Ramaswamy, R. Rastogi, and K. Shim. Efficient algorithms for mining outliers from large data sets. In *Proceedings of the International Conference on Management of Data (SIGMOD'00)*, pages 427–438, 2000.

COMPARISON OF THE PERFORMANCE OF GENRE CLASSIFIERS TRAINED BY DIFFERENT MACHINE LEARNING ALGORITHMS

Vedrana Vidulin, Mitja Luštrek, Matjaž Gams
Department of Intelligent Systems
Jožef Stefan Institute
Jamova 39, 1000 Ljubljana, Slovenia
Tel: +386 1 477 3147; fax: +386 1 425 1038
e-mail: vedrana.vidulin@ijs.si

ABSTRACT

Modern search engines aim at classifying web pages not only according to topics, but also according to genres. This paper presents the results of an attempt to train a genre classifier. We present features extracted from a 20-genre corpus used for training the genre classifiers and the results of using different machine learning (ML) algorithms in the process of learning. Success of the genre classifiers was measured by accuracy, precision, recall and F-measure. Accuracy did not turn out to be a good indicator of classifier success. In the case of other measures the results show that different algorithms should be used for training purposes depending on whether the user wishes to obtain high precision or high recall.

1. INTRODUCTION

A good question to start with is why we want to classify a web page according to genre. For example, if we are interested in elephants and search for the keyword “elephant”, we can get as a result links to pages that scientifically describe the life of elephants, but we can also get links to web pages that describe movie with the title “Elephant” or a newspaper article about saving the elephants in Africa. However, if we can define that we want to search only for journalistic materials about elephants, than we can get more specific results in accordance with our interest. Classification of web pages according to genres can make our life easier, but what exactly is a genre?

In general, a genre could be described as a style of a web page [4]. A web page is used to send a message to the user. Message has a topic, for example life of the elephants, but it also tries to communicate that topic in a specific way. To a zoologist it will give a high number of objective facts about elephants. To a user wishing to be entertained, it will communicate the message about elephants in other ways, e.g. by presenting pictures and video material about elephants. In the light of the previous explanation, we chose the definition of genres as “named socio-cultural communication artifacts, linked to a society or a community, bearing standardized traits, leaving space for the creativity of the text producer, and raising expectations in the text receiver” [12].

The field of our interest is finding the set of web page features that could be used for discriminating web pages according to genre and to train the classifier that could be used as a part of a search engine. Therefore, results of searching could be presented to a user not only according to topic, but also according to genre.

For training the classifier it is important to choose a suitable ML algorithm. The selection of algorithms tested was inspired by the literature about genres [1-6, 8, 11-13]. Weka [14] as an environment for conducting data mining and ML experiments was used for the experiments.

In Section 2 is described the corpus on which the experiments were conduced, in Section 3 the features extracted from web pages, in Section 4 ML problem, in Section 5 the results of the experiments and in Section 6 the conclusion.

2. 20-GENRE COLLECTION

20-Genre Collection was compiled at Jožef Stefan Institute and consists of 1539 web pages divided into 20 genres. The genre categories are: index, childrens’, journalistic, prose fiction, faq, scientific, entertainment, official, blog, error message, informative, poetry, personal, user input, gateway, shopping, commercial/promotional, adult, community, content delivery.

The web pages were collected from the Internet using the most popular keywords like “Britney Spears”. Keywords were chosen dependent of statistics provided by Google Zeitgeist with an intention to build the classifier that will not have a problem with recognizing the most popular web pages.

The corpus was manually annotated by two independent annotators. Their labels disagreed on about a third of the pages in the data set, so a reassessment was made for those documents. The intention was to collect an approximately equal number of pages for each genre, but this task proved to be very difficult.

Important characteristic of the corpus is that it is multilabeled, what means that one page can belong to the multiple categories.

3. FEATURES

Text is more that just a set of the words and can be described by a set of various features [4]. In this case, we do not have only texts that need to be described, because web pages also have formatting and multimedia elements and other special characteristics that can be used to discriminate between different genres. All the features we used are presented in Table 1 divided into three groups.

URL Features	• URL Depth • Document Type (html, script, doc, output, mix) • Appearance of "/~" in URL • Top-level domain (com, org, edu, net, gov, other) • Appearance of the 35 most commonly used words in URL address in the corpus (e.g. index, news, faq etc.)
HTML Features	• Number of hyperlinks to the same domain / Total number of tags used in a document • Number of hyperlinks to a different domain / Total number of tags used in a document • Total number of hyperlinks / Total number of characters in a document • Number of tags / Total number of tags used in a document for 73 different tags
Token/Lexical Fetures	• Number of characters • Number of words • Average number of characters per word • Number of content words / Total number of content words used in a document for 50 most commonly used content words in a corpus (e.g. new, dvd, post etc.) • Number of function words / Total number of function words used in a document for 50 most commonly used function words in a corpus (e.g. a, he, in etc.) • Number of punctuation symbols / Total number of punctuation symbols used in a document for 26 punctuation symbols (e.g. ., ;, -, etc.)

Table 1. Features used for the description of web pages

4. ML PROBLEM

The first problem that we encountered was how to handle a multilabeled data set in the process of ML. The problem arose because Weka does not support multilabeled learning. The chosen solution was to separate ML process into 20 sub-processes, one for each genre category. Hence, we prepared 20 data sets of the same data, i.e. values of the features extracted from the web pages. The only element that was changed in each data set was the class. The class is binary, which means that the examples that belong to the class are labeled with yes, and the examples that do not belong to the class are labeled with no.

Some initial experiments were conduced using the SVM algorithm [14], but we did not get satisfactory results. The next idea was to search the literature about genres for algorithms appropriate for training the classifier using our set of features. At the end we chose the following set of algorithms and variations of their parameters:

1. Bagging in combination with REPTree [14]
2. J48 algorithm – implementation of C4.5 [10] in Weka
3. J48 with reduced error pruning option
4. REPTree algorithm
5. IBk – the k-nearest neighbor algorithm [9] with k parameter equal 1
6. IBk – the k-nearest neighbor algorithm with k parameter equal 2
7. IBk – the k-nearest neighbor algorithm with k parameter equal 3
8. IBk – the k-nearest neighbor algorithm with k parameter equal 4
9. JRip rule learner [14]
10. AdaBoostM1 algorithm [14]

Except for the mentioned changes in the parameters of the algorithms, for all other parameters the default values set in Weka were used. Experiments were run in Weka Experimenter. The algorithms were compared to bagging algorithm used in the combination with REPTree that is the default Weka combination. Main reason for comparing performance of other algorithms to a bagging algorithm lies in our aspiration to explore the application of ensemble ML methods. 10-fold cross-validation [7] was used and four performance evaluation measures were observed, i.e. accuracy, precision, recall and F-measure [4].

5. RESULTS

Table 2 presents the level of performance of a bagging algorithm used in the combination with REPTree in terms of four performance measures, and Table 3 the results of the comparisons of algorithms performance.

	Accuracy	Precision	Recall	F-Measure
Adult	97.73	0.77	0.73	0.74
Blog	96.49	0.84	0.37	0.51
Childrens'	96.17	0.97	0.46	0.59
Commercial/promotional	92.14	0.00	0.00	0.00
Community	96.56	0.97	0.37	0.50
Content delivery	92.33	0.90	0.17	0.28
Entertainment	95.32	0.37	0.09	0.15
Error message	96.95	0.85	0.53	0.64
Faq	99.22	0.97	0.86	0.91
Gateway	94.87	0.00	0.00	0.00
Index	86.42	0.62	0.19	0.29
Informative	84.99	0.28	0.03	0.05
Journalistic	90.58	0.76	0.34	0.47
Official	96.56	0.10	0.03	0.05
Personal	93.63	0.64	0.18	0.27
Poetry	97.46	0.87	0.55	0.66
Prose fiction	96.88	0.80	0.40	0.53
Scientific	96.62	0.80	0.42	0.53
Shopping	95.78	0.30	0.05	0.08
User input	95.97	0.75	0.43	0.54

Table 2. Performance of a bagging algorithm used in the combination with REPTree.

	Accuracy	Precision	Recall	F-Measure
Bagging (RepTree)	-	-	-	-
J48	0/12/8	1/11/8	4/16/0	3/17/0
J48 (Reduced Error Pruning)	0/15/5	0/18/2	0/19/1	0/17/3
REPTree	0/17/3	0/18/2	0/20/0	0/20/0
IBk (k=1)	0/6/14	1/8/11	6/12/2	4/14/2
IBk (k=2)	0/2/18	1/6/13	6/13/1	3/12/5
IBk (k=3)	0/9/11	0/14/6	3/12/5	1/14/5
IBk (k=4)	0/9/11	1/11/8	5/11/4	3/12/5
JRip	0/16/4	0/15/5	4/16/0	0/20/0
AdaBoost	0/18/2	0/18/2	0/18/2	0/18/2

Table 3. Comparisons of ML algorithms performance relative to bagging algorithm – The numbers denote: on how many genres was the algorithm better than bagging algorithm / performed equally / performed worse.

Accuracy did not turn out to be a good indicator of the classifier performance. In the cases of all genres and all algorithms, accuracy was greater than 74%. This happened because transforming the 20-class ML problem into 20 binary problems resulted in 20 unbalanced data sets with many negative examples in comparison to the number of positive examples. In this case we could very easily train the classifier that will with high accuracy recognize negative examples but could not recognize positive examples. This was the motivation for searching other more appropriate measures.

In information retrieval measures like precision and recall are often used [4]. F-measure (see Eq. 1), which is combination of these measures, is also common indicator. We were very interested in precision measure that shows us how many positive examples classifier could recognize. In comparison with the bagging algorithm in the cases of 19 genre categories other algorithms were not significantly better. Four ML algorithms did outperform bagging algorithm, but all in the case of the same category, i.e. commercial/promotional. An interesting result is that for commercial/promotional category algorithms that use reduced error pruning had a precision of 0, and all other algorithms had a low precision.

$$\frac{2 \times recall \times precision}{recall + precision} \tag{1}$$

In the case of recall measure the situation is highly dependent on the genre category. kNN algorithm was significantly better in the cases of index, journalistic, informative and shopping category. Its performance could be further improved by choosing appropriate value of k. Hence, we need to be cautious because changing the k value results in an increase of one measure and, at the same time, a decrease of other measures. The selection of an appropriate algorithm and parameters of the algorithm must therefore depend on the situation, e.g. if we want to have as a result a high precision classifier we choose one algorithm and parameters, and if we want a high recall classifier other.

An interesting result is that some of the genre categories are sensitive to reduced error pruning. This is manifested in recall equal or near zero when using ML algorithms with reduced error pruning option, whereas other algorithms showed higher level of performance (e.g. in the case of genre category entertainment).

In terms of F-Measure J48 algorithm performed significantly better than bagging algorithm in the case of three genre categories and in all other categories performed equally well. kNN algorithm also outperformed bagging algorithm in some categories but also had significantly lower results in other categories. Therefore, we can conclude that J48 algorithm without the option of reduced error pruning included could be better choice taking into account F-measure than bagging algorithm. Reduced error pruning also had a negative impact in this case.

It can be seen from the experiments that even by using different ML algorithms, performance of the classifiers in some genre categories could not be improved. Some categories like faq are well recognized and some like gateway are not. Apparently that problem lies in the set of chosen features and not in the chosen ML algorithms.

6. CONCLUSION

This paper could be described as lessons learned. From the experiments we learned that the set of features used is not adequate for describing genre categories and that it needs to be upgraded. Decision tree ML algorithms with reduced error pruning did not show as the best solution.

Accuracy did not showed as good measure because of the unbalanced data set with a high ration of negative to positive examples. In the cases of precision, recall and F-measure, which algorithm will be chosen is highly dependent on the need for the classifier that will show high precision, high recall or high values of F-measure.

In the case of a high precision classifier, the recommendation is to use bagging algorithm in combination with REPTree. A high recall classifier could be trained with kNN algorithm. If we take F-measure into account, J48 without the reduced error pruning option is the best solution. Therefore, we can finally conclude that the choice of the most suitable algorithm is highly dependant on the application.

References

[1] S. Argamon, M. Koppel, G. Avneri, *Routing Documents According to Style*, First International Workshop on Innovative Information Systems, 1998

[2] N. Dewdney, C. VanEss-Dykema, R. MacMillan, *The Form is the Substance - Classifications of Genres in Text*, 1998

[3] A. Finn, *Machine Learning for Genre Classification*, 2002

[4] J. Karlgren: *Stylistic Experiments for Information Retrieval*, 2000

[5] J. Karlgren, D. Cutting, *Recognizing Text Genres with Simple Metrics Using*, Proceedings of the 15th. International Conference on Computational Linguistics, 1994

[6] B. Kessler, G. Nunberg, H. Schütze, *Automatic Detection of Text Genre*, Proceedings of the Thirty-Fifth Annual Meeting of the Association for Computational Linguistics and Eighth Conference of the European Chapter of the Association for Computational Linguistics, 1997

[7] R. Kohavi, *A Study of Cross-Validation and Bootstrap for Accuracy Estimation and Model Selection*, IJCAI, 1995

[8] C.S. Lim, K.L. Lee, G.C. Kim, *Multiple sets of features for automatic genre classification of web documents*, Information Processing & Management, 2005

[9] T.M. Mitchell, *Machine Learning*, McGraw-Hill, 1997

[10] J.R. Quinlan, *C4.5: Programs for Machine Learning*, Morgan Kaufmann, 1993

[11] M. Santini, *A Shallow Approach to Syntactic Feature Extraction for Genre Classification*, Proceedings of the 7th Annual Colloquium for the UK Special Interest Group for Computational Linguistics, 2003

[12] M. Santini, *Common Criteria for Genre Classification: Annotation and Granularity*, Workshop on Text-based Information Retrieval (TIR-06), In Conjunction with ECAI 2006, Riva del Garda, 2006

[13] E. Stamatatos, G. Kokkinakis, N. Fakotakis, *Automatic Text Categorization in Terms of Genre and Author*, Computational Linguistics, 2000

[14] I.H. Witten, E. Frank, *Data Mining – Practical Machine Learning Tools and Techniques*, Elsevier Inc., 2005

Zbornik 9. mednarodne multikonference
Proceeding of the 9th International Multiconference

INFORMACIJSKA DRUŽBA IS 2006

INFORMATION SOCIETY IS 2006

Vzgoja in izobraževanje v informacijski družbi

Education in Information Society

Uredili / Edited by

Vladislav Rajkovič, Tanja Urbančič, Mojca Bernik

http://lopes1.fov.uni-mb.si

13. do 14. oktober 2006 / 13th - 14th October 2006
Ljubljana, Slovenia

Predgovor

Vzgoja in izobraževanje v informacijski družbi

Razvoj informacijskih in komunikacijskih tehnologij poteka tako hitro, da že petnajst- in šetnajstletni dijaki opisujejo, kako velikim spremembam so bili priča tekom svojega življenja. Hkrati poteka razvoj, ki se ga morda še ne zavedajo, ki pa bo prav tako močno zaznamoval njihovo prihodnost. Iz dneva v dan nastaja novo znanje in dopolnjuje, včasih pa tudi izpodriva dosedanjega. Že danes je v prednosti, kdor uspe temu procesu slediti čim hitreje in čim bolj učinkovito. V času, ko se bodo zaposlovali naši današnji učenci in dijaki, pa bo to postala nujnost.

Za primer navedimo, da se bliografska baza MEDLINE, ki zajema medicinske članke iz več kot 4800 revij iz 70 držav sveta, od leta 2002 naprej vsak delovni dan poveča za novih 1500 do 3500 člankov. Samo s klasičnimi metodami pregledovanja in branja je seveda popolnoma nemogoče ugotoviti, kaj vse se skriva v tej zakladnici. In ta je le ena izmed mnogih, ki so nam z novimi tehnologijami postale dosegljive kadarkoli in od koderkoli. Situacija je podobna na številih drugih področjih, kjer smo zasuti z nepregledno množico informacij, ki so nam dostopne preko različnih medijev, še zlasti preko interneta. Kako si ustvariti smiseln pregled nad njimi in kako iz njih izluščiti zanimivo, novo in uporabno znanje?

Tudi pri odgovorih na ta vprašanja nam lahko pomaga računalnik. Že pred leti so se začele razvijati metode za odkrivanje znanja iz podatkov in so se v številnih področjih uspešno uveljavile v praksi. Njihova uporabnost se je bistveno povečala, odkar je možno »rudariti« tudi po tekstovnih podatkih in po svetovnem spletu. Raziskovalci pa se lotevajo tudi že podatkov v *drugih oblikah, na primer slik. Na voljo so orodja, ki pomagajo pri gradnji ontologij, s tem pa tudi pri razumevanju strukture in hitrejšemu pregledu nad izbranimi zbirkami tekstovnih podatkov. Omogočajo tudi odkrivanje hipotez, na primer s primerjanjem velikega števila dokumentov in iskanjem, kje se dokumenti iz različnih področij morda dopolnjujejo. Prav v medicini so bile na tak način že odkrite nove hipoteze, ki so jih nato potrdili strokovnjaki. Napredek informacijskih in komunikacijskih tehnologij z novimi metodami torej spreminja tudi znanost na drugih področjih. Nastaja tako imenovana e-znanost.*

Ob številnih novih možnostih, ki jih omogoča tehnološki razvoj, se moramo vprašati, kako smo nanje pripravljeni in kako nanje pripravljemo naše otroke, ki bodo živeli z njimi in s številnim drugimi, ki jih danes niti še slutiti ne moremo. Poudarki izobraževanja se bodo morali neizogibno preseliti z učenja dejstev, ki bodo v veliki meri kmalu zastarela, na učenje za učenje. Tukaj lahko računalništvo ponudi ogromno, vendar pa bo samo računalniško opismenjevanje v ta namen bistveno premalo. Potrebno se bo naučiti računalnik učinkovito uporabljati za iskanje, uporabljanje, nenazadnje pa tudi za ustvarjanje novega znanja. Seveda bo znanje in tehnologije znanja še vedno potrebno postaviti na čvrste temelje matematike in drugih disciplin, hkrati pa ga znati dopolnjevati z novimi metodami.

Če govorimo o šoli za prihodnost, ne moremo mimo dejstva, da ne narašča le znanje, pač pa tudi kompleksnost problemov. Prepletenost in soodvisnost številnih področij zahtevata poleg novih tehnologij za obvladovanje informacij in znanja tudi vedno več sodelovanja med ljudmi različnih strok, različnih narodnosti, različnih usmeritev in interesov. Resda imamo tudi nove tehnologije, ki podpirajo skupinsko delo, komunikacijo na daljavo in podobno. A še vedno to ne rešuje problemov, če ostajamo individualisti, zaverovani v svoj prav in vzgojeni za tekmovalnost namesto za odprt dialog in spoštovanje različnih pogledov. Ni naključje, da evropska komisija med smernicami za modernizacijo evropskih univerz priporoča tudi več skupinskega dela in veščine komuniciranja. Začeti pa je seveda treba že veliko pred univerzo, da bodo rezultati takšni, kot si jih želimo.

Vladislav Rajkovič, Tanja Urbančič, Mojca Bernik

Programski odbor /Programme Committee

Adamič Alenka,
Zavod MIRK

Batagelj Vladimir,
Univerza v Ljubljani, Fakulteta za matematiko in fiziko

Bernik Igor,
Univerza v Mariboru, Fakulteta za organizacijske vede

Bernik Mojca,
Univerza v Mariboru, Fakulteta za organizacijske vede,

Bešter Janez,
Univerza v Ljubljani, Fakulteta za elektrotehniko,

Bregar Lea,
Univerza v Ljubljani, Ekonomska fakulteta

Čampelj Borut,
Ministrstvo za šolstvo in šport RS,

Černetič Metod,
Univerza v Mariboru, Fakulteta za organizacijske vede,

Divjak Saša,
Univerza v Ljubljani, Fakulteta za računalništvo in informatiko,

Dolenc Tomi,
ARNES,

Gerlič Ivan,
Univerza v Mariboru, Pedagoška fakulteta,

Györkös József,
Univerza v Mariboru, Fakulteta za elektrotehniko, računalništvo in informatiko,

Hribar Uroš,
Univerza v Mariboru, Fakulteta za organizacijske vede,

Jereb Eva,
Univerza v Mariboru, Fakulteta za organizacijske vede,

Jermol Mitja,
Institut Jožef Stefan,

Kokol Peter,
Univerza v Mariboru, Fakulteta za elektrotehniko, računalništvo in informatiko,

Krapež Alenka,
Gimnazija Vič,

Logar Tanja,
Center za poklicno izobraževanje,

Marinšek Robert,
Center za mobilnost in evropske programe izobraževanja in usposabljanja,

Orel Mojca,
Gimnazija Moste,

Rajkovič Vladislav,
Univerza v Mariboru, Fakulteta za organizacijske vede in Institut Jožef Stefan

Rugelj Jože,
Univerza v Ljubljani, Pedagoška fakulteta in Institut Jožef Stefan,

Schlamberger Niko,
Slovensko društvo Informatika,

Skulj Tomaž,
Zveza za tehnično kulturo Slovenije

Šmitek Branislav,
Univerza v Mariboru, Fakulteta za organizacijske vede,

Šušteršič Olga,
Univerza v Ljubljani, Visoka šola za zdravstvo,

Urbančič Tanja,
Politehnika Nova Gorica in Institut Jožef Stefan,

Vrtačnik Margareta,
Univerza v Ljubljani, Naravoslovno tehniška fakulteta

Wechtersbach Rado,
Zavod RS za šolstvo.

Računalniška zbirka za avtomatsko sestavo pisnega preizkusa znanja kot uporaben pripomoček in vzpodbuda učiteljem kemije za uporabo IKT

Collection of Computer-Based Tasks for Automatic Designing of Written Exams as the Useful Instrument for Encourageing ICT Use among Chemistry Teachers

Andreja Bačnik
ZRSŠ

Povzetek:

Prispevek predstavlja namen izdelave in značilnosti računalniške zbirke nalog za avtomatsko sestavo pisnega preizkusa znanja. Zbirka je bila zasnovana z namenom vzpodbujanja IKT pismenosti pri učiteljih kemije ob neposredni aplikaciji na vedno aktualno področje preverjanja in ocenjevanja znanja, posebej še na kvalitetno pripravo pisnih preizkusov znanja iz kemije.

Ključne besede: *računalniška zbirka nalog za avtomatsko sestavo pisnega preizkusa znanja, kemija, IKT pismenost, preverjanje in ocenjevanje*

Abstract

The article presents the purpose of designing and the basic characteristic of the "collection of computer-based tasks for automatic designing of written exams". The collection was designed to encourage ICT literacy among chemistry teachers in the very important field of knowledge assessment. One of the aims was designing quality exam sheets for chemistry.

Key words: *collection of computer-based tasks for automatic designing of written exams, chemistry, ICT literacy, assessment of knowledge*

Spiralni razvoj programske opreme kot stalen proces v e-zdravstvu

Software Spiral Development as the Continuing e-Health Process

Zvone Balantič
Univerza v Mariboru, Fakulteta za organizacijske vede,
e-pošta: zvone.balantic@fov.uni-mb.si

Povzetek

Ustvarjalni proces lahko pomaga oblikovati spiralni razvoj programske opreme, kjer poleg urejenega razvoja ideje nastopa velika koncentracija prebliskov in intuicije. E-učni modeli, ki upoštevajo dana dejstva sodobnega časa, vgrajujejo visoko stopnjo informacijske tehnologije (IT). Tudi na tem področju lahko govorimo, da je življenjska doba e-izdelka vse krajša in je potrebna stalnih izboljšav. Proces e-izobraževanja v medicini mora biti stalen, prilagojevan, rastoč, ter vpet med najnovejša teoretična dognanja in praktične izvedbe. Spiralni razvoj IT je zelo dinamičen pri izobraževanju v medicini

Z uporabo spiralnega modela smo strukturirali potek dela po naslednjih korakih: analiza, specifikacija, oblikovanje, izvedba, testiranje, povezovanje in vzdrževanje.

Spiralni razvoj programske opreme je predstavljen na modelu e-izobraževalnega paketa za respiratorno fiziologijo.

Konstrukcija spiralnega modela omogoča jasnejšo in bolj učinkovito uporabo IT v medicini. V končni fazi se IT razvije v zdravstveni portal za splošno javnost in v zdravstveni portal za strokovno javnost.

Ključne besede: *spiralni razvoj, programska oprema, multimedija, pljučna funkcija, izobraževanje, e-zdravje*

Abstract

The creative process can help to create software spiral development, where beside the settled development of an idea we have a large concentration of flashes of wit and intuition. E-teaching models that take into consideration given facts of present time are building in a high level of information technology (IT). It can be said that in this area as well the life expectancy of an e-product is getting shorter and needs constant improvements. The e-health process has to be constant, adjusted, growing and set in the newest theoretical happenings and practical realizations. Software spiral development is very dynamical regarding the education in medicine.

With the spiral model our work can be structured very clearly through next steps: analysis, specification, design, implementation, testing, integration and maintenance.

The software spiral development process was presented on the example of e-materials for the respiratory physiology.

The construction of the spiral model makes IT in medicine clearer and more effective. In the final phase the IT grows into the Health Life-Style Portal for general public and into Professional Health Portal for professional and expert public.

Key words: *spiral development, software, multimedia, lung function, education, e-health*

Zakaj se odrasli odločajo za e-študij?

Why do adults decide for e-learning?

Polona Baloh
DOBA,
polona.baloh@doba.si

Povzetek

Prispevek preučuje e-študij in model le tega, ki ga izvajamo v višješolskih in visokošolskem programu na Dobi. Mnenja študentov e – študija in njihove motive za vključitev v študij smo povzeli po anketnih vprašalnikih, ki jih študentje izpolnijo pred vključitvijo in po končanem e-študiju na Dobi.

V uvodu smo opredelili razvoj e-študija v Sloveniji in razvoj te oblike študija na Dobi. Opisali smo model e-študija na Dobi, Višji strokovni šoli in Visoki poslovni šoli Maribor ter razloge študentov za vključitev v e-študij ter jih podkrepili z grafičnimi prikazi. Povzeli smo uspešnost Dobinih študentov e-študija..

Kot največjo prednost so udeleženci navedli časovno fleksibilnost študija, saj jim je všeč, da lahko sami izbirajo čas študija in ga prilagajajo svojim sposobnostim in trenutnemu razpoloženju.

Rezultati se nanašajo na Dobo, Višjo strokovno šolo in Visoko poslovno šolo Maribor, kot prvo in največjo ustanovo, ki v Sloveniji v celoti izvaja e-študij.

Ključne besede: *e-študij, motive, razvoj e-študija, model e-študija na Dobi*

Učenje glasbe podprto z IKT tehnologijo

Learning Music with ICT Technology

Bogdana Borota
Univerza na Primorskem, Pedagoška fakulteta,
Bogdana.Borota@pef.upr.si

Andrej Brodnik
Univerza na Primorskem, Pedagoška fakulteta,
Andrej.Brodnik@pef.upr.si

Povzetek

Sodobna IKT tehnologija nudi učitelju možnost, da izboljšuje procese učenja in poučevanja (glasbe). Raziskave kažejo, da je uspešno vključevanje tehnologije v procese učenja in poučevanja glasbe odvisno tudi od kompetentnosti učitelja, postavljenih standardov znanj za glasbo in tehnologijo ter načrtovanih strategij oblikovanja, uvajanja, izvajanja in spremljanja. Oblikovali smo fleksibilni programski paket z aplikativno navezavo na glasbo, ki omogoča izvajanje nekaterih vidikov sodobnega poučevanja in učenja kot so: (1) diferenciacija, individualizacija ter enake možnosti; (2) oblikovanje lastne strategije učenja; (3) problemsko, smiselno in konstruktivistično učenje; (4) možnost doseganja višjih ciljev na kognitivnem in konativnem področju; (5) možnost sodelovanja učencev v virtualni skupnosti. Arhitektura, ki je bila uporabljena je bila standardna odjemalec-strežnik, kjer je ima strežnik trojno vlogo: (1) nudi samo programsko opremo, ki je bila narejena; (2) hrani nastavitve in individulane portfolje učencev; ter (3) služi kot medij za preposredovanje podatkov med učenci, ki tvorijo virtualno skupnost.

Ključne besede: *IKT, glasba, osnovna šola, strategije*

Abstract

Currently ICT offers teacher many opportunities to improve processes of learning and teaching (of music). The results of research indicate that the successful integration of technology depends on teacher's competencies, on educational standards of music and technology, and on designed strategies of modeling, implementing and following. We designed a flexible software application for music teaching that permits use of some means of contemporary learning, such as: (1) differencing particularly based on individualization; (2) design of self learning strategy; (3) problem based and constructivist learning; (4) possibility of achieving of higher cognitive and co-notational goals; (5) possibility of learners to participate in virtual community. The architecture we used was a standard server based architecture, where the server has a triple role: (1) provides the necessary software; (2) storing settings and learners' portfolio; and (3) provides a medium for the exchange of messages between the learners forming a virtual society.

Key words: *ICT, music, primary school, strategies*

Projekt SITES modul 2 - kako ohraniti inovativne prakse

Project SITES Modul 2 – How to keep inovative practices

Barbara Neža Brečko
Pedagoški Inštitut, nacionalna koordinatorka projekta SITES 2006

Maša Repež
Pedagoški inštitut, PISA nacionalni center

Povzetek:

Velika količina novosti v informacijskih in komunikacijskih tehnologijah (IKT), še posebej uporaba Interneta in Svetovnega spleta (WWW), je povzročila naraščajoče zanimanje za informacijske tehnologije po vsem svetu. Razvoj uporabe IKT v šolah po svetu kaže na potrebno vsebinsko podporo in nove utemeljene koncepte učenja in poučevanja z uporabo IKT. Raziskovalno delo pri nas in po svetu je odkrilo vpliv, ki ga imajo te nove tehnologije na izboljšanje izobraževanja in spreminjanje poteka dela v šolah.

Slovenija je sodelovala v mednarodnem projektu SITES M2, s katerim smo raziskovali inovativne pedagoške prakse, ki uporabljajo informacijsko tehnologijo.

V pričujočem prispevku pa analiziramo pogoje, ki so nujni za ohranitev in prenos inovacije.

Ključne besede: *IKT, šola, inovativne prakse*

Abstract:

The quantity of innovations in information and communication technologies (ICT) and the use of Internet and World Wide Web, has caused growing interest for information technologies over the World. Growing use of ICT in schools worldwide shows the need for conceptual support and new concepts of teaching and learning with the use of ICT. All over the world the research has shown the influence that new technologies have on education and changing practices at school.

Slovenia participated in the international project SITES M2, the aim of which was to study innovative pedagogical practices, which use information technologies.

In the article the conditions necessary for keeping the innovation are presented.

Key words: *ICT, school, innovative practices*

Planiranje izobraževanja in menedžment sprememb

Education Planning and Management of Changes

Metod Černetič,
Fakulteta za organizacijske vede, Kranj
e-mail: metod.cernetic@fov.uni-mb.si

Olga Dečman Dobrnjič,
Zavod R S za šolstvo, Poljanska 26, Ljubljana
e-mail: olga.decman@gmail.com

Povzetek

Načrtovanje izobraževanja je bilo, kot ločena dejavnost, pozno vpeljano na splošno področje ekonomskega in družbenega načrtovanja. Močno se je povečalo s potrebo po ureditvi/soočenju s populacijsko eksplozijo v poznih štiridesetih prejšnjega stoletja in je bilo okrepljeno z rastjo zavedanja ekonomske vrednosti izobraževanja. Dandanes je povezanost med načrtovanjem izobraževanja in ekonomsko razvitostjo oz. med vsemi vidiki izobraževanja in ekonomsko razvitostjo deležna vedno večje pozornosti, ki vodi do naraščanja potreb po načrtovanju razvoja. Oblikovane so razne strategije z določenimi cilji, ki naj bi bili prevedeni v prihodnji čas. Optimalne izobrazbene strukture "države" ali nacionalne makroekonomije za bodoči tehnološki razvoj danes še ni mogoče napovedovati. Razlogov je več: tehnološki, ekonomski in socialni. Zato je bil oblikovan tudi tako imenovan hevristični pristop oziroma model planiranja kadrov (Rus, 1979, 247, Černetič, 1999, 86). V tem modelu oziroma pristopu se vzpostavljajo štiri predpostavke: družbeni cilji, relevantne družbene okoliščine, kadrovski potencial in kadrovske potrebe. Kvantitativno in kvalitativno proučevanje odnosa med temi variablami hevrističnega pristopa je dinamičen proces.

V prispevku bodo obravnavana naslednja vprašanja: o metodah in scenarijih načrtovanja izobraževanja, predvidevanja in napovedi razvoja izobraževanja, raziskovalno in normativno napovedovanje izobraževanja, področja in dileme planiranja izobraževanja ter cilji organizacije in menedžment sprememb.

Vsa ta vprašanja so še kako aktualna z vključitvijo Slovenije v EU in v procese, ki v njej potekajo Predvsem gre za deduktiven pristop pri dveh pomembnih družbenih dokumentih/resolucijah: Nacionalni program razvoja visokega šolstva in Nacionalni program razvoja raziskovalne dejavnosti. Pri enem in drugem uvajanju so bili poleg politike premalo vključeni drugi nosilci sprememb.

Ključne besede: *Planiranje, politika izobraževanja, načrtovanje, cilji, vzgoja in izobraževanje, menedžment sprememb.*

Abstract

Planning of education as a separate activity was relatively lately introduced on universal area of economic and social planning. The need for planning education has increased heavily with a need for regulation of explosion of population in late forties in last century. It has been reinforced with a growth of consciousness of value of economical value of education. Nowadays the connection between planning of education and economical development is getting more and more attention, which leads to increasing need for planning of development. Different strategies *with fixed aims were developed. Optimal educational structures of a »state« or national macroeconomic for future technological development can not be predict even today. Reason for that are different: technological, economical in social. Therefore so-called hauristical approach or model of human resource planning has been developed (Rus, 1979, 247, Černetič, 1999, 86). Four presumptions are established in this model: social goals, relative social circumstances, human resource potential and needs. Quantitative and qualitative study of relationship between those variables of heuretical approach is a dynamic approach. .*

In this text the following questions will be address: of methods and scenarios of educational planning, assumptions and predictions of planning of education, research and normative prediction of educational planning, areas and dilemmas of planning of education and goals of organizations and management of changes. .

All this questions are deeply connected with inclusion of Slovenia in EU and with all the processes that are going on in EU. Above all this is a deductive approach to two important social documents: National program of development of higher education and National program of development of research activity.

Key words: *Planning, policy of education, goals, education, management of changes.*

Policy and Development of Boarding School

Olga Dečman Dobrnjič,
Zavod R S za šolstvo
e-mail: olga.decman@gmail.com

Metod Černetič,
Fakulteta za organizacijske vede
e-mail: metod.cernetic@fov.uni-mb.si

Abstract

The first years of sovereignty of Slovenia the number of pupils residing in boarding schools has decreased. The gap between the capacities and numbers of places taken has appeared as a result of the planning in 80s which was based on the then expected influx of pupils from other regions of former Yugoslavia and on the vision of economic development of individual areas which however was not realized. The number of places taken in the boarding schools dropped dramatically upon Slovenia becoming an independent country. The decrease was caused by several factors simultaneously. The management of boarding schools in Slovenia can choose between two extreme alternatives: abolishment of the boarding schools as such or finding a way of their development by forming new models. This article discusses the mission of boarding schools as organizations, the policy of their management and governance and provides data on the tendency of the number of pupils residing in boarding schools and finally we also got the answers what advantages bring information technology in the boarding schoos.,

Key words: *boarding school, development, changes, vision, information technology, management.*

Prizadevanja za izboljšanje računalniške pismenosti brezposelnih

Efforts to Promote e-Literacy

Gabrijel Devetak
Fakulteta za organizacijske vede,
info@devetakgabrijel.com

Neva Maher
Fakulteta za management
nevamaher@yahoo.com

Povzetek

V strategiji razvoja Slovenije je poudarjeno, da mora Slovenija vzpostaviti drugačno razmerje med ekonomsko učinkovitostjo trga in socialno odgovornostjo partnerske države. Pri tem velja posebej podčrtati razvitost gospodarskega sektorja na področju informacijsko komunikacijske tehnologije, ki omogoča Sloveniji učinkovitejše izkoriščanje obstoječih potencialov, ki jih ponujajo storitve informacijske družbe pri modernizaciji javnega sektorja oziroma gospodarstva.

Med temeljnimi sposobnostmi slovenske družbe, ki so ključne za razvoj v sklopu strategije razvoja Slovenije, so poudarki na visokih vlaganjih v izobraževanje mlade generacije, ki omogočajo osredotočenje na izboljšanje kakovosti izobrazbe oziroma znanja, prilagajanje zahtevam konkurenčnega gospodarstva ob uveljavljanju vseživljenjskega učenja v povezavi z zaposlovanjem. Pri tem je specifičnega pomena kakovost e-izobraževanja, vrste in uporabnost določenih e- znanj, predvsem v gospodarstvu.

V prispevku je prikazano kakšna so prizadevanja za izboljšanje računalniške pismenosti tudi brezposelnih oseb, obravnavan je specifični primer in omenjena skandinavska izkušnja kot vir navdiha, v smislu trojne spirale, ki temelji na sodelovanju med podjetji, univerzami in javnim sektorjem.

Ključne besede: *računalniška pismenost, informacijsko komunikacijska tehnologija, strategija, Phare 2003, marketing*

Abstract

It is stressed in the Strategy of the development of the Republic Slovenia that there should be a more efficient consistency to pose among the market efficiency and a social repsonsibility of a modern state. It is to underline the development of infomation communication technology, ICT, and its meaning for economy which enables Slovenia to use potentials efficiently.

Among basic there is to stress high investments in education and training to use ICT: ICT enables good quality of edication and skills, but also it enables to activate all potentials that withou ICT use would never be used. It is impotant that ICT also pormotes adaptability to be competitive in globalisation processes; it is also very supportative to access of life-long-learning. All exposed is of very specific meaning: it brings to values as employment, social inclusion, cohesion and social cohesion. That is why it is very important a quality of e-education and training, how to use e-skills in a funcial way to bring to competitivnessof all subjects and on all levels.

Efforts to improve e-literacy are great and they are on all levels – EU, the level of state, sectors, projects and individuals. There are efforts to get resources to promote e-lerning and e-skills as we are within the processes of Lisbon strategy and at the very beginning of the next financing perspective 2007-2013.

Key words: *e-literacy, infomation communication technology, ICT, strategy, human potentials, partnership*

Model ocenjevanja Kakovost elektronskih učnih gradiv

A Model for Quality Assessment of Electronic Learning Material

Dejan Dinevski
Univerza v Mariboru in Univerza na Primorskem, Pedagoška fakulteta
dejan.dinevski@uni-mb.si

Janja Jakončič Faganel
Gimnazija Poljane, Ljubljana
janja.faganel@guest.arnes.si

Matija Lokar
Univerza v Ljubljani, Fakulteta za matematiko in fiziko
matija.lokar@fmf.uni-lj.si

Boštjan Žnidaršič
Gimnazija Poljane, Ljubljana
bostjan.znidarsic@guest.arnes.si

Povzetek

Model ustreznega ocenjevalnega sistema za doseganje kakovosti elektronskih učnih gradiv, ki ga razvija skupina za vzpostavitev ocenjevalnega sistema za e-gradiva pri Zavodu Republike Slovenije za šolstvo, predstavlja pomemben prispevek k izboljšanju sodobnih učnih in izobraževalnih procesov. V postopku ugotavljanja kakovosti elektronskih učnih gradiv združuje že uveljavljene pojme standardizacije kakor tudi posebnosti gradiv ter učnega procesa. Predlagani model obsega definicijo tipov elektronskih učnih gradiv, njihovo opisovanje ter predlog ocenjevalnih kriterijev. V prispevku je podan predlog sistema zbiranja e-gradiv, opredeljene pa so tudi faze njihovega vrednotenja. Tematika je zaokrožena z umestitvijo opisanega modela ocenjevanja kakovosti e-učnih gradiv v nacionalno strategijo e-izobraževanja, ki je v času objave tega članka v javni obravnavi.

Ključne besede: *Kakovost, e-gradiva*

Abstract

A model for the quality assessment system of electronic learning material is being developed by the group of experts at the National Education Institute of the Republic of Slovenia. The presented model is an important contribution to the improvement of the modern learning and educational processes. The standardization concepts and the specifics of the learning material are considered in the scope of the quality assessment procedure. The presented model defines the electronic learning material classification, its description and the criteria for its assessment. The steps for collection of e-learning material linked with the phases of assessment procedure are proposed in the paper. In order to round up the topic the presented model is tied to the national strategy of e-learning which is currently going trough the phase of public hearing.

Key words: *Quality, learning objects*

Uvajanje medpredmetnega povezovanja s pomočjo uporabe IKT na srednji poklicni šoli

Introducing Interdisciplinary Linkage with the Assistance of ICT at Vocational School

Polona Drenik Trop
polona.drenik-trop@guest.arnes.si

Bojan Vučko
bojan.vucko@guest.arnes.si

Povzetek

Medpredmetno povezovanje je eno izmed prvin sodobne kakovostne šole in pomeni povezovanje posameznih informacij in vsebin iz različnih predmetov, predvsem z namenom podajanja celovite in uporabne informacije o neki določeni temi. V praksi se pojavlja problem drobljenja in nepotrebnega podvajanja informacij, ki jih dijaki niso sposobni povezati, ker jih k temu niti ustrezno ne napeljujemo niti jih k temu ne motiviramo. V članku je na konkretnem primeru opisano medpredmetno povezovanje, vključno s pozitivnimi in negativnimi ugotovitvami ter uporabo IKT.

Ključne besede: *medpredmetno povezovanje, medpredmetno načrtovanje, IKT, kakovost v šoli, e-učilnica, timsko delo*

Abstract

Interdisciplinary linkage is one of the basic elements of a quality school and it is meant to link individual information and topics from different subjects, especially to offer complete and useful data on certain theme.

In everyday practice the problem of inability of linking given information is often with students due to insufficient motivation. In the article the concrete example of interdisciplinary linkage is described including the pros and cons in using the ICT.

Key words: *interdisciplinary linkage, interdisciplinary planning, ICT, Quality at school, e-classroom, teamwork*

Koncept slovenskega šolskega izobraževalnega omrežja

Concept of Slovenian Educatonal Network

Andrej Flogie,
Renato Lukač,
Robert Gajšek,
Marjan Kozjek

***Povzetek**:*

Kvaliteta izobraževalnega sisteme ima daljnosežne posledice na vse ravni življenja, zato je šolstvo vitalnega pomena za napredek in blaginjo sleherne družbe. Razvijajoče se družbe potrjujejo, da je vpliv IKT na vsakdanje življenje zelo velik in da bo v bližnji prihodnosti pomen IKT še večji ter ključnega pomena za razvoj in delovanje družbe, saj smo priča tako temeljitim spremembam, da lahko govorimo o informacijski revoluciji. V članku je predstavljen nov koncept – predlog vsebinske in tehnične organizacije slovenskega izobraževalnega omrežja (SIO) po vzoru uspešnih izobraževalnih omrežij širom evropskega prostora. Ugotavljamo, da je čim prej treba izvesti koordiniran niz ukrepov, med katerimi so najpomembnejši izgradnja širokopasovnih povezav, vzpostavitev enotnega administrativno-pedagoškega informacijskega sistema, ustanovitev regionalnih izobraževalnih centrov in nenazadnje tudi z vlaganja v človeške vire – usposabljanje za efektivno rabo IKT v pedagoškem procesu.

***Ključne besede:** IKT, izobraževanje, šolsko izobraževalno omrežje*

***Abstract**:*

The quality of the educational system has far-reaching effects on all levels of our life. Therefore, education is vital for the progress and prosperity of every society. Well developed countries are confirming huge impact of ICT on everyday life. Moreover, they are predicting even bigger importance of ICT in the near future and essential role for the development and operation of the society. We are nowadays witness to such a radical changes that we can make an assertion about an informational revolution. In the present paper we are following successful European education networks and introducing novel concept about content- and technical organisation of the Slovenian education network (SIO). As soon as possible series of coordinated steps has to be put into execution. Most important are: building of a broadband computer network, establishment of a uniform administrative-pedagogical informational system, establishment of the regional education centres and investment in the human resources, i.e. training for effective use of ICT in the pedagogical process

***Key words:** ICT, educat, educational network*

Konceptualno učenje in interaktivna učna gradiva

Coceptual Learning and Interactive Learning Materials

Ivan GERLIČ
Univerza v Mariboru, Pedagoška Fakulteta Maribor
ivan.gerlic@uni-mb.si

Povzetek

Pouk s pomočjo računalnik (IKT) obsega njeno pomoč v vzgojno-izobraževalnem procesu povsod tam, kjer je to mogoče in smiselno. Namen računalnik oz. IKT kot učnega pripomočka je iskanje optimalnih elementov in pripomočkov za pedagoško učinkovitost ter za boljše doseganje vzgojno-izobraževalnih smotrov. Pouk naravoslovno-matematičnih in tehniških predmetov v osnovni šoli v mnogih učnih situacijah zahteva praktično delo in problemski pouk. V prispevku bomo prikazali nekaj didaktičnih načinov za pripravo interaktivnih spletnih učnih gradiv – listov (z uporabo simulacij oz. javanskih programčkov - apletov)

Ključne besede: *izobraževalni sistem, računalnik v izobraževanju, naravoslovje, informacijska in komunikacijska tehnologija (IKT), izobraževalna programska oprema, interaktivno učenje, simulacije, javanski programčki – apleti, fizleti, flashleti.*

Abstract

Teaching and learning with computers (ICT) encompasses her help in educational process everywhere there where is this perhaps and reasonable. Using ICT as educated accessory mean search of optimal elements for teaching efficiency and for better achieving teaching objectives. Learning process of science, mathematic and technical subjects in elementary school in many situations demands practically and problem solved work. In article we will show some didactic manners of preparing interactive web-oriented educated materials - papers (based on simulations - java applets).

Key words: *educational system, computers in education, science, information and communication technology (ICT), educational software, interactive teaching, simulations, applets, physlets, flashlets.*

Uvajanje novih storitev v vzgojno-izobraževalne zavode

Introduce New Services to Slovene Schools

Janko Harej
TŠC Nova Gorica
in
Zavod RS za šolstvo, OE Nova Gorica
janko.harej@guest.arnes.si

Povzetek

V zadnjih leti se vzgojno-izobraževalni zavodi (v nadaljevanju VIZ) intenzivneje opremljajo z računalniško opremo. Z boljšo opremljenostjo z računalniško strojno opremo nastopa ugoden čas za uvajanje novih storitev v šole. Najprej je potrebno nove storitve opredeliti, določiti način in stroške vpeljave le-teh v VIZ in skozi pilotne projekte odkriti načine za povezovanje VIZ in optimalno uporabo novih storitev. Nato lahko sledi obsežno uvajanje novih storitev.

Ključne besede: *internet, upravljanje vsebin, gradiva, e-izobraževanje, vzdrževanje, tehnična podpora*

Abstract

In the last few years several efforts have been made to provide ICT to schools. Now that schools are better equipped with computer hardware, the time has come to introduce new services. New project team has been founded on National Institute of Republic of Slovenia for education with the following tasks: to select services to be introduced to schools, determine cost and proper ways of connecting schools and teachers together to increase the use of ICT in classroom. Some tasks will be accomplished through the pilot project, where three school centers will be equipped with new technologies and guided to use it.

Key words: *Internet, Content Management Systems, e-learning, e-content, technical support*

Mnenja študentov o e-preverjanju znanja pred in po e-testiranju

Students' Opinion about Electronic Examinations before and after E-Testing

Eva Jereb
Fakulteta za organizacijske vede, Univerza v Mariboru
Eva.jereb@fov.uni-mb.si

Igor Bernik
Fakulteta za organizacijske vede, Univerza v Mariboru
igor.bernik@fov.uni-mb.si

Povzetek

Prispevek obravnava eno ključnih komponent elektronskega izobraževanja, to je elektronsko preverjanje znanja. Podaja mnenja študentov o takem načinu preverjanja znanja pred in po elektronskem testiranju. Raziskava izpeljana v letih 2004 in 2005 je pokazala, da je večina študentov pripravljenih na elektronsko preverjanje znanja. Navdušeni so predvsem nad takojšnjo povratno informacijo in prilagodljivim časom ter lokacijo izpitov. Skrbelo pa jih je pomanjkljivo obvladanje sodobne informacijsko-komunikacijske tehnologije. Motivirani s pozitivnim odzivom študentov smo pristopili k izvajanju e-testov in ponovno preverili mnenja udeležencev. Večina je bila navdušena in si želi e-preverjanja znanja s še večjo gotovostjo. Kaže pa se tudi, da nekateri še vedno v enaki meri menijo, da je tako preverjanje sicer mogoče, vendar ne prinaša nobene prednosti v primerjavi s klasičnimi načini.

Ključne besede: *e-izobraževanje, e-preverjanje znanja, mnenja študentov, orodje za e-preverjanje Perception*

Abstract

This paper is about one of the essential matters in electronic learning: taking electronic exams. It presents students' opinion about electronic examinations before and after electronic testing. The studies in the years 2004 and 2005 confirmed that the majority of participants were prepared to take electronic exams. They were enthusiastic about the immediate feedback and time and place flexibility. However they had some reservations about the technological issues. Motivated by the positive students' response we performed a pilot e-testing. After the testing we checked the students' opinion again. The majority was enthusiastic and even more certain in introducing e-exams. Some of them think that this kind of taking exams is possible but they still do not see any advantages in it.

Key words*: e-learning, e-examination, students' opinion, e-testing tool Perception*

Proces ustvarjanja e-učnih vsebin

The Proces of Creating e-Learning Content

Ivan Jovan
Šolski center Velenje,
ivan.jovan@guest.arnes.si

Povzetek

Proces ustvarjanja e-učne vsebine se prične z jasnim konceptom v obliki scenarija, ki se skozi večfazni postopek privede do končnega produkta. Uporaba profesionalnih orodij pri ustvarjanju vsebin je včasih edina rešitev, dobrodošla pa so vsa nekomercialna orodja, ki izpolnjujejo naše zahteve po kakovosti. Transformacija vsebin pred objavo v virtualnem učnem okolju je v primeru, če nimamo celotne tehnologije od enega samega ponudnika, vedno prisotna. Virtualno učno okolje je na profesionalni ravni zahteven pedagoški projekt za vsako izobraževalno ustanovo.

Ključne besede: *Virtualno učno okolje, e-učne vsebine, Sistem za upravljanje učnih vsebin, Captivate, Reload Editor, Moodle, Mešano učenje, SCORM.*

Abstract

The creative process of e-learning concepts begins with a clear concept in the form of a script which leads to a final production. Using professional tools in creating the contents is sometimes the only solution and any non commercial tools is welcome if it complies with quality requests. The need for transformation of contents in the virtual learning environment is always present. Virtual learning environment is a highly demanding pedagogycal process for any educational institution.

Key words: *Virtual Learning Environments, e-learning content, Learning Management System, Captivate, Reload Editor, Moodle, Blended learnig, SCORM.*

Poskus kot sredstvo vizualizacije za aktivno in kvalitetno učenje

Kampos Tjaša
kampos.tjaša@guest.arnes.si

Povzetek:

Poskus v šoli ima močan vizualizacijski učinek, zato ne sme biti zgolj element motivacije pouka. Biti mora podpora pri razumevanju kemijskih pojmov.

V raziskavi želimo preveriti sposobnost zaznavanja in razumevanja sprememb, ki so jih učenci opazovali na multimedijskih posnetkih treh poskusov; proučiti želimo vpliv dodanih vizualnih elementov (podnapisi in kemijske formule, enačba kemijske reakcije) v multimedijskih posnetkih poskusov ter vpliv učnega uspeha učencev na sposobnost zaznave in pravilnost razlage.

Ključne besede: *poskus, vizualna pismenost, zaznava, razlaga, učni uspeh*

Abstract

Experiment in the school has strong visual effect on the children, therefore it should not be use as a motivational factor in the classroom but it should also support the understanding of the chemical processes. The goal of the research is to check capability of acknowledement and understanding of changes, which were obsereved by the pupils on the three different multimedia footage of the chemical experiments; main goal is to determine the added value of added visual elements (names and formulas of reagents, equation of the chemical reaction) in multimedia footage of the chemical experiments and school success of the pupil on the capability of perception and the proper understanding of it.

Key words: *experiment, visual literacy, perception, explanation, school success*

Uporaba IP telefonije in videokonference pri pouku multimedije v osnovni šoli

The Use of IP Telephony and Videoconference at Multimedia Classes in Primary School

Martina Kern
Osnovna šola Staneta Žagarja Kranj,
martina.kern@guest.arnes.si

Janja Gorjanc
Osnovna šola Šenčur,
janja.gorjanc@guest.arnes.si

Bojanka Pust
Osnovna šola prof. dr. Josipa Plemlja Bled,
bojanka.pust@guest.arnes.si

Alenka Jurančič
OŠ Matije Valjavca Preddvor,
alenka.jurancic@guest.arnes.si

Povzetek

V članku je prikazan praktičen primer uporabe brezplačne IP telefonije s pomočjo programa Skype in vidoekonference med učenci štirih slovenskih osnovnih šol pri pouku računalništva, in sicer pri izbirnem predmetu multimedija. Opisani so osnovni koraki uporabe IP telefonije ter tudi prednosti in slabosti, ki jih prinaša. Program Skype in videokonferenca zaenkrat predstavljata učencem v osnovni šoli še dokaj neznani orodji za istočasno komunikacijo med učenci na različnih lokacijah. Glede na to, da je pilotski projekt uporabe nove tehnologije izredno dobro uspel, je na koncu opisan tudi načrt za nadaljnje delo in uporabo obeh tehnologij pri izbirnem predmetu multimedije.

Ključne besede: *izbirni predmet multimedija, IP telefonija, Skype, videokonferenca*

Abstract

The article is about the use of free IP telephony - programme Skype and videoconference - among pupils of four Slovenian primary schools, particularly at multimedia classes. First there are basic steps of usage IP telephony described, benefits and weaknesses follow. Programme Skype and videoconference are still rather new tools for communication among pupils at the same time at different places. Regarding a successful trying project at the end of the article there is a plan for further work and the use of both technologies at Multimedia classes.

Key words: *multimedia class, IP telephony, Skype, Videoconference*

Timsko delo z uporabo IKT

Team Work using IKT

Saša F. Kocijančič, Barbka Ambrožič, Mateja Bončina,
Marjana Kralj, Ivan Damjan Mašič, Maja Smolej
Srednja gostinska in turistična šola Radovljica
E-mail: sasa.kocijancic@guest.arnes.si

Povzetek

Avtorji so samoiniciativno kot tim izvedli projekt medpredmetnega načrtovanja in povezovanja »Seminarska naloga«, ki je del obveznih izbirnih vsebin dijakov 1. letnika programa turistični tehnik na Srednji gostinski in turistični šoli Radovljica in pri tem so vsi aktivno uporabljali IKT (informacijsko-komunikacijsko tehnologijo).

Ključne besede: *IKT, medpredmetno povezovanje, informacijska pismenost, knjižnična informacijska znanja, srednja strokovna šola.*

Abstract

The authors have carried out on their own initiative the project of inter-subject planning and linking »Seminar paper« as part of the 1st year tourism programme compulsory curriculum at High school of catering and tourism in Radovljica, using ICT (information communication technology).

Key words: *ICT, inter-subject linking, information literacy, library information knowledge , secondary vocational school.*

Programiranje v parih v srednjih šolah

Programming in Pairs in High Schools

Gabrijela Krajnc
TŠC Kranj,
gabrijela.krajnc@guest.arnes.si

Viljan Mahnič
Univerza v Ljubljani, Fakulteta za računalništvo,
viljan.mahnic@fri.uni-lj.si

Povzetek

Ekstremno programiranje je nov stil razvoja programske opreme, ki temelji na odličnih aplikacijah programskih tehnik, medsebojne komunikacije in teamskega dela. S pomočjo le tega dobimo rezultate, ki si jih nismo mogli niti zamisliti. Glavna praksa ekstremnega programiraja je programiranje v parih. Pri programiranju v paru dva programerja drug ob drugem, za istim računalnikom hkrati analizirata, načrtujeta in razvijata ter testirata programsko opremo. Zagovorniki te prakse trdijo, da so programi, ki so nastali pri delu v paru, boljši, z manj napakami in lepšim vmesnikom. Menimo, da je programiranje v parihzelo uspešna metoda tudi za učenje programiranja v sredni šoli. Začetni kvalitativni in kvantitativni rezultati prikazujejo, da je programiranje v parih pri učenju programiranja povečalo znanje in zadovoljstvo dijakov. Raziskali smo naravo programiranja v parih in preizkusili na kakšen način lahko s to prakso izboljšamo poučevanje, zvečamo motivacijo in povečamo znanje dijakov pri poučevanju programiranja v srednjih šolah.

Ključne besede: *Agilne metodologije, ekstremno programiranje, programiranje v parih, kvalitativni in kvantitativni rezultati*

Abstract

Extreme programming (XP) is a new style of software development focusing on excellent applications of programming tecniques, clear communication, and team work, which gives unimaginable results. A major practice of Extreme programming is Pair Programming. There are two programmers working side by side at the same computer, collaborating on the same analysis, the same design, implementation and test. Proponents of pair programming argue that programs produced by pairs are of higher quality, with less errors, better design than those produced by one programmer. And they are made in the shortest time possible as well. We think that pair programming model has also been found to be beneficial for students. Initial quantitative and qualitative results demonstrate that the use of pair programming in the computer science classroom enhances student learning and satisfaction. We explore the nature of pair programming, then examine the ways such a practise may enhance teaching and learning in computer science education.

Key words: *agile methods, extreme programming, pair programming, quantitative and qualitative results.*

Uporaba informacijsko komunikacijske tehnologije pri izboru srednje šole

The Use of Information and Communication Technology (ICT) for Secondary School Selection

Gabrijela Krajnc
TŠC Kraj,
gabrijela.krajnc@guest.arnes.si

Vladislav Rajkovič
Univerza v Mariboru, Fakulteta za organizacijske vede,
vladislav.rajkovic@fov.uni-mb.si

Povzetek

S pomočjo reklamnih zgibank, posvetovanj s svetovalnimi delovkami na osnovnih in srednjih šolah smo pripravili spisek kriterijev, ki vplivajo na izbor šole s podobnimi programi. Šole se med seboj razlikujejo po pogojih dela, dodatni ponudbi, nadstandardnimi storitvami, kadru in infrastrukturi. Namen naloge je bil preučiti kriterije, ki vplivajo na izbiro šole, strukturiranje le teh, jim določiti uteži in seveda preveriti model na določenih realnih variantah. Za variante smo izbrali šole na Gorenjskem, ki izobražujejo po gimnazijskem programu. Za izgradnjo odločitvenega modela smo uporabili lupino večparametrnega odločanja DEXi, za prikaz in vrednotenje variant pa program Vredana. S pomočjo modela smo na šoli pridobili pomembne informacije o željah, kriterijih in zmožnostih osnovnošolcev pri izbiri srednje šole. Prav tako lahko model služi kot pomoč svetovalnim delavkam na osnovnih šolah, ki usmerjajo učence in jim svetujejo pri izbiri srednje šole.

Ključne besede: *srednje šole, odločitev, večparametrni odločitveni model, parametri, atributi, izbor, Dex-i, Vredana*

Abstract

With the help of advertising folders, of consultations with advisory workers on basic and secondary schools we have a list of criteria that influence the selection of school with similar programmes. The important difference between individual schools shows in work conditions, additional offer, extra services, the staff and infrastructure. The purpose of the assignment is to look into criteria that influence the choice of school, the importance of individual criteria and of course to check the model on certain realistic versions. We have chosen schools on Gorenjska, the ones that prepare students for universities. We have chosen the multiparameter DEX-i shell for the construction of decision model and Vredana programme for displaying and evaluating versions. We gained important information concerning wishes, criteria and abilities of pupils at ehrn choosing their school. The model can help to advisory workers on primary schools to help and advise pupils which secondary school to choose.

Key words: *secondary schools, decision, multiparameter decision model, parameters, attributes, choice*

Ponovno uporabljiva gradiva – učni objekti

Reusable Materials - Learning Objects

Radovan Krajnc
Srednja ekonomska šola Maribor,
radovan.krajnc@guest.arnes.si

Povzetek

Eden od izzivov informacijske družbe je tudi prilagoditev izobraževanja nenehnim spremembam in potrebam po novih znanjih. Spletno podprto učenje kljub vsem prednostim še ni polno zaživelo. Eden od razlogov je pomanjkanje ustreznih elektronskih gradiv. Ponovno uporabljiva gradiva (učni objekti) bi lahko bila rešitev saj nudijo možnost enostavne in "cenene" izmenjave e-gradiv med učitelji, različnimi predmeti, izobraževanji, institucijami in celo kulturami. Zaradi zahteve po ponovni uporabljivosti mora biti učni objekt samostojno celota, ki se za razumevanje s strani učečega ne sme sklicevati na druge učne objekte. Učni objekt mora biti brez konteksta in mora voditi k doseganju vsaj enega učnega cilja.

Ključne besede: *e-učenje, ponovno uporabljiva gradiva, učni objekti*

Abstract

One of the challenges of the informational society is the adaptation of education to the constant transformations and the need for new types of knowledge. Despite its advantages, the web-based (supported) learning has not fully come into practice. One reason for this is the lack of adequate electronic materials. Reusable materials (learning objects) could be the solution since they offer the possibility of simple and "inexpensive" exchange of e-materials between teachers, different subjects, institutions and even cultures. Due to the demands for reusable materials, learning object should be an independent whole (unit) which must be understandable for the learner without a reference to other learning objects. The learning object should be without any context and should lead the way to achieve at least one of the learning aims.

Key words: *e-learning, reusable materials, learning objects,*

Elektronski portfolijo v izobraževalnem procesu

Electronic Portfolio in Teaching-Learning Process

Špela Kunčič
OŠ Prežihovega Voranca, Ljubljana,
spela.kuncic@guest.arnes.si

Povzetek

Namen članka je predstaviti neomejene možnosti, ki jih ponuja elektronska oblika portfolija t.i. ePortfolijo. Le-ta izhaja iz klasične, »papirne« oblike predstavitvenega portfolija. Definiran je kot zbirka multimedijskih vsebin, ki prikazujejo rast posameznika ali skupine skozi čas. Praviloma je izdelan za predstavitev javnosti. Opisan je proces nastajanja »zgodbe o razredu« ter prednosti in pomanjkljivosti pri njegovi izdelavi in uporabi. Predstavljeni primer iz prakse prikazuje enega izmed načinov vključevanja sodobnih večpredstavnih tehnologij v učni proces. Njegov namen je vzdrževanje in spodbujanje notranje učne motivacije ter kritične refleksije s strani vseh udeležencev vseživljenjskega učnega procesa.

Ključne besede: *predstavitveni portfolijo, ePortfolijo, izobraževalne multimedijske vsebine*

Abstract

The aim of the article is to present endless possibilities that electronic version of portfolio offers. It originates from paper-based version of presentation portfolio. It is often referred as ePortfolio which is defined as a collection of multimedia contents representing someone's (person or group) personal growth over time. The intention of its construction is usually public presentation. The development process of building »a story of deep learning« according to its benefits and weaknesses is shown. The presented example shows one of the ways of including multimedia contents into teaching-learning process. Its purpose is to consolidate or raise intrinsic learning motivation and critical reflection of the participants in lifelong learning process.

Key words: *presentation portfolio, ePortfolio, educational multimedia contents*

Raztrgani žamet bolonjske reforme

The Lost Direction of the Bologna Renewal

Janez Mayer
Fakulteta za organizacijske vede Univerze v Mariboru
janez.mayer@fov.uni-mb.si

***Povzetek*:**

Bolonjska prenova slovenskega visokega šolstva ne sledi smernicam EU. Univerze se odrekajo avtonomiji in podlegajo diktatu politike (zmanjševanje avtorskih pravic učiteljem, omejevanje vpisa na družboslovne fakultete), kriterij trajanja študija ostaja nad kriterijem kakovosti, med učitelji ni konkurenčnosti in študentje se bolj kot za povečevanje kakovosti študija zavzemajo za še večje socialne ugodnosti. Visokošolski strokovni študij je ostal v slepi ulici in s tem je tudi splošna matura izgubila svojo selektivno vrednost. Poglavitni vzrok za vse to vidimo v odsotnosti ustvarjalnega dialoga (in ne pogajanj) med vsemi partnerji v visokem šolstvu.

Ključne besede: *visoko šolstvo, univerza, bolonjska prenova*

***Abstract*:**

The Bologna renewal of Slovenian university education does not follow the guidelines set by the EU. Universities are increasingly losing their independent status undermined by the dictation of politics (reduction of teachers' copyrights, gradual limiting of inscription to social studies). Duration of study seems to be more important criterion than its quality. There is no competition among teachers, and students seem to be far more interested in their social rights than in raising the quality of study process. At this moment, Slovenian university education is stuck in the cul-de-sac whereas graduation from a secondary school has lost its selective value. The main reason for above mentioned problems could be the absence of creative dialogue (not negotiations) among all partners participating in the university education system.

Key words: *University education, Bologna reform*

Terminalsko omrežje v šoli

Terminal Network in Primary School

Tomaž Miholič
tomaz.miholic@guest.arnes.si

Povzetek

Organizator informacijskih dejavnosti (OID) v osnovni šoli ponavadi izpolnjuje širok spekter zadolžitev in nalog; med najbolj opaznimi je vsekakor zagotavljanje nemotenega delovanja informacijske tehnologije, kar v praksi velikokrat pomeni vzdrževanje računalnikov. Z veliko količino računalnikov, ki jih potrebujejo tako učenci kot učitelji, se čas za njihovo vzdrževanje strmo povečuje, tako da za delo, ki je po mojem mnenju pomembnejše – spremljanje in uvajanje IKT novosti v učni proces – zmanjkuje časa.

V prispevku je opisana možnost kako si je mogoče to nalogo olajšati s pomočjo centraliziranega sistema terminalov in terminalskega strežnika, hkrati pa zmanjšat stroške potrebne za računalniško opremo.

Ključne besede: *Terminal, terminalski strežnik, lahki odjemalec, ThinStation, Windows Server 2003*

Abstract

With the growing number of personal computers used in primary schools in Slovenia managing information and communication technology (ICT) usually becomes no more than managing personal computers. In this paper we will demonstrate one of the possibilities to organize a centralised system which can save our time and money.

By saving time in managing ICT we can spend more quality time for integrating modern concepts of teaching in to our schools.

Key words: *Terminal, terminal server, thin client, ThinStation, Windows Server 2003*

Posodobitev srednješolskega pouka geografije z uvajanjem GIS

Bojan Močnik
Institut Jožef Stefan,
bojan.mocnik@ijs.si

Jože Rugelj
Institut Jožef Stefan,
Pedagoška fakulteta, Univerza v Ljubljani
joze.rugelj@ijs.si

Povzetek

Projekt GISAS v evropskem programu Socrates-Minerva je strateški pilotski projekt na področju aktivnega uvajanja informacijske tehnologije v pouk evropskih srednjih šol. Cilji projekta so poiskati metodologijo, ki bo učinkovito vključevala IKT v pouk, hkrati pa v okviru pouka geografije raziskati kvaliteto vodotokov v okolici sodelujočih evropskih šol in s pomočjo sodobne informacijsko-komunikacijske tehnologije izmenjati pridobljene rezultate in jih uporabiti za analizo ter primerjave.

Med globalne cilje projekta sodi tudi vzpostavljanje povezav z univerzami in drugimi inštitucijami, ki bi poskrbele za nadgradnjo usposabljanja učiteljev, ki bodo izvajalci pouka s pomočjo novih tehnologij. Ob vzporednem izvajanju konkretne naloge, to je raziskave kvalitete vodotokov v okolici sodelujočih šol, se spopadamo tudi z vsemi omejitvami, ki so se pojavile zaradi heterogenosti sodelujočih partnerjev in omejitev, ki izhajajo iz njihovih okolij

Izvajalci projekta GISAS se v okviru triletnega projektnega cikla spopadamo z drugo fazo projekta. Faza zasnove, priprave in zagotavljanja virov je za nami. V tej fazi smo se soočili s težavnim zagotavljanjem čim bolj poenotenih digitalnih zemljevidov, ki so osnova za delo z GIS. V drug fazi, fazi realizacije, smo se spopadli z dvojno nalogo: z usposabljanjem učiteljev za uporabo tehnologije GIS (programska in strojna oprema) ter hkrati z usposabljanjem učiteljev za nov pristop k poučevanju, ki je problemsko usmerjen.

Ključne besede: *projekt GISAS, geografski informacijski sistemi (GIS), informacijske tehnologije v izobraževanju, uvajanje GIS v pouk geografije*

Abstract

The GISAS project from the European Socrates-Minerva program is a strategic pilot project in the field of active introduction of information technology in the education process of European secondary schools. Aims of the project are finding the methodology which could effectively incorporate IT in the classroom. Concurrently with the above strategic aims, the GISAS project executes real-life task exploring the quality of creeks, rivers and river basin environment in nearby school surroundings. Among the most important strategic aims of the project is the study of possible establishing closer cooperation between secondary schools, universities and other education institutions which would provide advanced education process for teachers who will execute the new sophisticated IT courses in secondary schools.

Carrying out the GISAS project theme of exploration the river water quality, we encountered many limitations resulting from the partner heterogenic regional roots.

The GISAS project consortium currently carries out the second of the three general project phases. The first phase, the phase of project planning, preparation and providing working sources is successfully concluded. In this phase one of the major problems was to provide all partners a digital map of the school surroundings which are basics for the GIS technology.

Currently the project is in its second phase, called the realisation phase. The major topic of this phase is a 2-layer teacher training for project involved teachers: advanced GIS education (new software and hardware) and preparing them for a new problem oriented concept of the learning process.

Key words: *GISAS Project, Geographical Information Systems (GIS), Information Technology in Education, Introduction of GIS in Schools*

Zasnova intranet portalov za potrebe osnovnih šol

Design of Intranet Portals for Primary Schools

Boštjan Mohorič
OŠ Davorina Jenka Cerklje na Gorenjskem,
Bostjan.Mohoric1@guest.arnes.si

Povzetek

V prispevku bi rad prikazal intranetni portal kot orodje, ki bi postalo nepogrešljiv del sodobne šole. Uvodoma je napisanih nekaj težav, ki nas spremljajo čez delovni dan, teden in šolsko leto. Drugo poglavje nam pojasni pojem intraneta ter tehnične zahteve za njegovo postavitev. V četrtem poglavju pa se dotaknem splošne ideje in zasnove intraneta za potrebe šole. Kratko so opisane osnovne storitve, ki bi jih na portalu našli zaposleni, starši in učenci. Na koncu pa sledi primer portala, ki ga uporabljamo na naši šoli. Sam portal se bo še v naprej razvijal in dopolnjeval.

Ključne besede: *intranet, šola, portal.*

Abstract

In this article, I would like to show intranet portal as a tool, which will become an indispensable tool of modern school. Introduction shows us some problems that follows us everyday, everyweek and every year. Second chapter explains us what intranet is and which are technical demands to set up an intranet. In fourth chapter I mention some general idea how should an Intranet in primary school look. In a very short idea is shown what on Intranet could be found by employed, parents and students. At the end there is an example of Intranet portal, which we use in our school. The portal will be developed step by step in the future.

Key words: *intranet, school, portal.*

Učenje in poučevanje z računalnikom v prvem triletju osnovne šole

Learning and Teaching with ICT in the Primary Level of Elementary School

Ivana Mori
Zavod RS za šolstvo, OE Slovenj Gradec
ivana.mori@zrss.si

Mateja Kovše
Osnovna šola Neznanih talcev, Dravograd
mateja.kovse@guest.arnes.si

Povzetek

Priročnik in DVD Učenje in poučevanje z računalnikom v prvem triletju osnovne šole kažeta učiteljem razrednega pouka na temelju dobre šolske prakse nove smeri na uspešnih poteh do znanja ob vključevanju informacijsko-komunikacijske tehnologije v pouk.

Še vedno je vse preveč učiteljev prepričanih, da se samo z večjim naporom pri učenju dosežejo večji učinki. Dobri didaktični računalniški programi pa niso samo za motivacijo, temveč jih lahko uporabijo z ustrezno organizacijo dela zlasti pri obravnavi novih učnih vsebin.

Z dobro načrtovanim delom so učitelji in učenci presegli uporabo računalnika samo za popestritev učne ure in za igranje igric, ki imajo z učenjem le malo skupnega. Računalnik je postal učno orodje v rokah učencev na poti do znanja tudi na umetnostnem področju.

Zakaj torej likovno ustvarjanje s pomočjo računalnika? Odgovori so naslednji. Uporaba računalnika pri likovni vzgoji: povečuje interes za likovno ustvarjanje,omogoča kvalitetne likovne izdelke z relativno enostavnimi računalniškimi programi in daje možnost brisanja in popravljanja likovnih kreacij.

Ključne besede: *didaktična uporaba računalnika, učinki uporabe računalnika pri likovni vzgoji, razredna stopnja osnovne šole*

Novi pristopi pri poučevanju multimedije v osnovnih šolah

New Approaches by Teaching Multimedia in Primary Schools

Tomaž Murn
tomaz.murn@guest.arnes.si

Povzetek

Na OŠ Vižmarje Brod se že vrsto let ukvarjamo pri fakultativnem pouku računalništva s projektnim delom na področju multimedije. Učenci se s programom PowerPoint seznanijo že v tretjem razredu devetletne šole in nadaljujejo učenje skozi razne projektne naloge do osmega razreda devetletne šole, kjer se lahko vključijo v izbirni predmet multimedija. Učenci izdelajo filmsko predlogo - scenarij v urejevalniku besedil MS Word po katerem izdelajo PowerPoint animacijo. Projekt poteka od decembra do konca maja in se zaključi s filmsko predstavitvijo v slogu podelitve Oskarjev za najboljši film. Odziv učencev in staršev je izjemen, saj so spoznali, da je mogoče na enostaven in atraktiven način priti do konkretnega rezultata, kar je utrdilo njihovo znanje, samozavest in željo po novih izzivih.Učitelj računalništva v vlogi »režiserja« pa pridobi nov smisel in veselje do dela.

Ključne besede: *računalništvo, multimadija, PowerPoint, animacije, film, festival*

Abstract

For some years Vižmarje Brod Primary School has been involved in project work in the multimedia field at computer science course. The students get familiar with the PowerPoint program already in the 3rd class of the 9-year primary school through different projects up to the 8th class where they can choose elective subject - Multimedia. The students create a script for a movie in MS Word from which PowerPoint animation is made. The project starts in December and ends in the end of May with a film presentation in the Oscars' style for the best film. The response from both students and parents is exceptional, as they have realized that it is possible to reach concrete results in a simple and attractive way, which has deepened their knowledge, self-confidence and wish for new challenges. Moreover, the computer science teacher acting as "director" has gained new sense and pleasure in work.

Key words: *computer science, multimedia, PowerPoint, animations, movie, festival*

Perspektiva uvajanja e-izobraževanja v programe stalnega strokovnega izpopolnjevanja učiteljev

The Perspective of E-Education in Lifelong Learning of School Teachers

Andreja Nekrep
Univerza v Mariboru, Pedagoška fakulteta
e-mail: andreja.nekrep@uni-mb.si

Jožica Slana
Univerza v Mariboru, Pedagoška fakulteta
e-mail: jozica.slana@uni-mb.si

Povzetek

Sodobna informacijsko-komunikacijska tehnologija je danes prisotna v vseh segmentih izobraževalnega sistema, v procesih poučevanja, učenja, raziskovanja, kakor tudi v podpornem sistemu organizacijske strukture institucije, sistemu njenega financiranja in upravljanja. V sklopu celovite sistemske prenove programov nadaljnjega izobraževanja in usposabljanja kot oblike vseživljenjskega učenja strokovnih delavcev v vzgoji in izobraževanju smo z raziskavo želeli oceniti možnosti in perspektivo uvajanja e-izobraževalne oblike v programe izpopolnjevanj. Izsledki raziskave kažejo, da je najpomembnejša prednost uvajanja e-izobraževanja, kot jo zaznavajo anketirane osebe, prilagodljivost dinamike, časa in kraja študija oz. možnost samostojnega organiziranja časa in dela. Glede na sodoben način življenja je njihova odločitev pričakovana, saj pomeni večjo možnost za usklajevanje različnih življenjskih vlog. Vpeljava e-izobraževalne oblike je povezana z izpolnjenostjo objektivnih (opremljenost izobraževalnih institucij z računalniki, dostopnost do interneta, pogostnost uporabe interneta) in subjektivnih (pripravljenost za sodelovanje, nameni uporabe interneta) pogojev, ki kaže, da je opremljenost slovenskih šol s sodobno informacijsko-komunikacijsko tehnologijo in urejenostjo dostopa do interneta spodbudna, prav tako je zaznati motiviranost strokovnih delavcev v vzgoji in izobraževanju za sodelovanje v e-izobraževalnih oblikah.

Ključne besede: *vzgoja in izobraževanje, sistem nadaljnjega izobraževanja strokovnih delavcev v vzgoji in izobraževanju (vseživljenjsko učenje), informacijsko-komunikacijska tehnologija, računalniško opismenjevanje, e-izobraževanje, profesionalni razvoj učiteljev*

Abstract

The new information-communication technologies are nowadays ingrained in all domains of education system. The new technologies are not only influencing the intellectual activities of the university and other schools on primary and secondary educational level (learning, teaching and research), but are also changing how the educational organisation is organised, financed and governed. The basic purpose of this research is to assess the perspective of e-education implementation in the system of pedagogical training and expert advanced study courses as a form of life-long learning of school teachers. We have to admit that electronic media and internet became a significant tool used also for educational purposes, especially for delivery of study materials and communication between tutor and learner. The results of this research show that the most important advantage of e-learning as emphasised by survey participants is the flexibility *of place and time of study. The research also indicates that the basic objective (computer equipment, internet access, frequency of internet usage) and subjective (purpose of internet usage, willingness for making use of e-learning) conditions for e-learning implementation in Slovenian schools are satisfied. To conclude, the teachers are mostly aware of the advantages of distance life-long learning and would like to participate in such modern modes of education. We have to notice that pure distance education is extreme that rarely exists, so what we have meant here is the effective combination of traditional (classroom-based) and distance based education.*

Key words: *education, system of pedagogical training and expert advanced study courses (life-long learning), information-communication technology, computer literacy, e-education, professional development of teachers*

Priprava in uporaba e-gradiv Učne vsebine pri sodobnem pouku imajo tudi e-obliko

Learning Contents with Contemporary Class Also Have an E-Form

Mirko Pešec
II. gimnazija Maribor,
mirko.pesec@guest.arnes.si

Povzetek

V prispevku so predstavljene metode dela, ki sem jih vpeljal pri pouku Računalništva in informatike na II. gimnaziji v Mariboru. Določene ugotovitve so morda specifične samo za srednjo šolo gimnazijske smeri, v večini pa so spoznanja skladna tudi z mnenji kolegov z drugih šol. Hitre tehnološke spremembe v svetu namreč narekujejo spremembo učne tehnologije, zato računalnik postaja zelo pomemben učni pripomoček v procesu izobraževanja pri vseh učnih predmetih. Računalnik je samo sredstvo, ki samo po sebi ne omogoča ničesar. Zato, da bomo lahko računalnik tudi izkoristili kot dobro učno tehnologijo, morajo uporabniki v izobraževalnem procesu (dijaki, profesorji in tudi starši) osvojiti zadostno znanje o IKT in izostriti sposobnost, kako se hitro in sproti prilagajati spremembam v razvoju strojne in programske opreme, konceptualnim spremembam v informacijski družbi itd. Predstavljene oblike dela pri pouku informatike bodo koristno lahko uporabili tudi drugi učitelji pri svojem delu.

Ključne besede: *e-gradivo, e-izobraževanje, informatika, srednja šola, II. gimnazija Maribor*

Abstract

In my presentation I want to point out the methods I have introduced in my Computer Science and Information Technology Class at II.gimnazija Maribor. Some of my concepts might be subject specific and do not apply to all secondary school programmes, yet most of my views synchronize with the ideas of my colleagues from other schools. Swift technological advances the world over call for a change in learning technology with the computer becoming the integral learning equipment in the process of training and education within every subject domain. The computer is, nonetheless, a means only which is of no practical use on its own. In order to become a useful device in school, educators, students and parents need to acquire sufficient knowledge of the use of information technology and learn to quickly adjust to the up-dates and changes of hardware and software development, thus accepting the challenges of the technological advances of information society. The presented forms and methods of classroom teaching of Computer Scienece and Information Technology can easily be used by other teachers in their classroom work.

Key words: *e-material, e-education and training, information technology, secondary school, II.gimnazija Maribor*

Program metajezikovnega zavedanja pri opismenjevanju in zgodnji pomoči pri dislektičnih težavah z uporabo računalnika

The Programme of Metalingual Awareness on Teaching to Write and Early Help with Dyslectic Difficulties Based on The Use of a Computer

Dina Pintarič
Osnovna šola Bistrica, Tržič, Slovenija
dina.pintaric@guest.arnes.si

Grega Janežič
Osnovna šola Bistrica, Tržič, Slovenija
Grega.Janezic@guest.arners.si

Neža Zelinka
Osnovna šola Staneta Žagarja, Kranj, Slovenija
neza.zelinka@guest.arnes.si

Povzetek

Otroci z disleksijo so posamezniki, ki se kljub nekaterim skupnim značilnostim bistveno razlikujejo drug od drugega, zato jim moramo pomagati in poučevati tako, da upoštevamo njihovo različnost.

V predšolskem in zgodnjem šolskem obdobju je težje govoriti o disleksiji saj večina otrok še ne bere in ne piše, lahko pa se že kažejo določeni znaki kot npr. pozabljivost, težave v govorjenju, zamenjava besed, ki podobno zvenijo, prisotnost disleksije v družini.

Pomembno je, da bi bili vsi otroci, v procesu učenja, deležni programa vaj metajezikovnega zavedanja, ki pomenijo temelj za dobro opismenjevanje in branje ter zmanjševanje, lajšanje začetnih dislektičnih težav.

V veliko pomoč in uporabnost so številne specifične računalniške igre, ki v veliki meri pokrivajo posamezne faze metajezikovnega zavedanja. Delo z računalnikom otroke zelo motivira in jih skozi igro vodi do doseganja ciljev oz. do boljših učnih uspehov, uspeh pri reševanju nalog je večji. Praksa kaže, da so otroci prijetno počutijo v učnem okolju s pomočjo računalnika in takšen učni stil nanje pozitivno deluje.

Ključne besede: *disleksija, bralno napisovalne težave, motnje v branju in pisanju, legestenija*

Abstract

Children with dyslexia are individuals who essentially differ one from another despite some common characteristics. Consequently we should help and teach them in a way to take their differences into consideration.

In the pre school and early school period it is more difficult to talk about dyslexia because most children cannot read and write yet. However, some signs like forgetfulness, speaking difficulties, the exchange of similarly sounded words, the presence of dyslexia in the family, can already be noticed.

It is important for all the children in the learning process to be part of the programme containing exercises of metalingual awareness which are the basis of a good writing and reading procedure as well as decrease and relief of beginning dyslectic difficulties.

Several specific computer programmes covering individual parts of metalingual awareness to a great extent are very useful and helpful. Working on a computer motivates children a lot and leads them through a game towards the goals or in other words, better learning results. In this way they are more successful in doing exercises. The practice shows children feel comfortable in the learning environment with a computer and these teaching styles have got a positive effect upon them.

Key words: *dyslexia, expressions like reading and writing difficulties, reading and writing troubles, legastenie,…*

Spletna učilnica pri pouku nemščine: uporaba klepetalnice

A Virtual Classroom for Learning German: Using the Chatroom

Saša Podgoršek
Filozofska fakulteta,
sasa.podgorsek@guest.arnes.si

Povzetek

V prispevku je opisan primer mednarodnega projektnega dela, pri katerem sta sodelovala dva gimnazijska oddelka (gimnazija Frana Miklošiča iz Ljutomera in gimnazija Pardubice s Češke). Sodelovanje je potekalo od novembra 2005 do marca 2006. Prispevek natančneje obravnava tretjo fazo sodelovanja, v kateri sta partnerska razreda komunicirala v klepetalnici spletne učilnice, ustvarjene v okolju Moodle. Avtorica poda nekatera izhodišča, ki jih velja upoštevati pri načrtovanju večmesečnega mednarodnega projektnega dela s ciljem, da bi dijaki (med drugim) simultano komunicirali v spletni učilnici.

Ključne besede: *nemščina, didaktika nemščine, IKT, mednarodno sodelovanje, spletna učilnica, medkulturno učenje, klepetalnica*

Abstract

The paper present the case of an international school project linking two grammar school classes, one from Slovenia and one from the Czech Republic. They cooperated between November 2005 and March 2006. The paper presents in detail the third phase of the project, in which the two classes engaged in a chat using an internet classroom in the Moodle e-learning environment. On the basis of an evaluation of this experiment, the author provides some guidelines to consider when planning similar international classroom-twinning projects involving simultaneous internet communication between groups of students.

Key words: *German, German Teaching Methodology, ICT, International Cooperation, Virtual Classroom, Intercultural Learning, Chat*

Težave pri prehodu na e-izobraževanje

Problems Regarding Implementation of E-Learning

Sašo Puppis
Gimnazija Moste

Povzetek

Kadar razmišljamo o vpeljavi e-izobraževanja v šolski sistem moramo biti posebej pozorni na specifičnosti, ki jih zahteva posamezni nivo izobraževanja. Znano je namreč, da se zahtevnost glede uvedbe e-izobraževanja spreminja od osnovnošolskega do univerzitetnega nivoja. Na nivoju osnovne šole je e-izobraževanje zgolj dopolnitev (popestritev) klasičnim predavanjem, medtem ko so lahko na univerzi vsa predavanja izpeljana na ta način. Med tema dvema nivojema pa se nahaja srednješolski nivo, kjer je količina uporabe e-izobraževanja slabo definirana in je njena vpeljava dosti bolj problematična kot bi si lahko mislili.

V idealnem primeru bi se namreč učenčevo osamosvajanje, v procesu izobraževanja, približno linearno povečevalo od osnovne šole do univerze, kar bi omogočalo tudi postopno povečevanje e-izobraževalnih elementov v učne vsebine. Toda to se v resničnem svetu izobraževanja ne dogaja. Zavedati se moramo, da prehodi med osnovno in srednjo šolo ter med srednjo šolo in univerzo niso tako gladki kot bi si želeli.

Med tema dvema prehodnima stopnjama je namreč kar prevelik razkorak med idealnim in dejanskim potekom osamosvajanja izobraževanja, kar povzroča upad rezultatov pri mnogih učencih. Dodatne težave pri prehodih iz enega na drug nivo, pa lahko povzroča tudi povečana uporaba e-izobraževalnih vsebin na naslednjem nivoju izobraževaja. Učenci imajo že tako veliko težav zaradi povečane zahtevnosti v samostojnosti izobraževanja na naslednjem nivoju, tako da dodatna sprememba (kakorkoli pozitivna) lahko povzroči še dodaten upad rezutatov.

Ključne besede: *e-izobraževanje, izobraževanje, srednja šola, informatizacija, tehnologija, samostojnost, osamosvajanje*

Abstract

When considering the implementation of e-learning into our system of education, attention must be paid to the demands to be met at different levels.

It is a known fact that the difficulty of implementation varies from primary school to university. In primary schools, e-learning is only a supplement to traditional lessons, while at university tutorials can be made up entirely of e-learning elements. However, High School falls between these two levels - the extent of e-learning is not adequately defined and its implementation is much more problematic than one would expect.

Ideally, the progress of a student's comprehension should grow linearly from primary school to university. This would also allow for a gradual increase in the e-learning content of lessons. However, the reality in education is quite different. It must be recognised that the transition between primary and high school, and between high school and university is not as smooth as it should be.

There exists a large gap in a student's comprehension at these two stages of transition, which for many students results in a reduced level of achievement. This happens because, before the *transitional stage, students are not as competent in their independent learning skills as the next stage would require.*

A decrease in overall success rates is seen very early in the first year of these stages of transition (the first year of high school and the first year at university).

This gap in a student's comprehension at these transitional stages results in further difficulties because of the increased use of e-learning in the stage that follows. Students have enough problems developing their learning capabilities and further changes (however positive) can also lead to a reduced level of achievement.

When considering implementation into the system of education, all three levels must be coordinated in order to reduce the large disparities that cause so many problems.

***Key words**: e-learning, learning, high school, informatisation, technology, comprehension*

Kaj lahko pričakujemo od tehnologij znanja pri vodenju izobraževalne institucije

Knowledge technologies in education: challenges and expectations

Vladislav Rajkovič
Univerza v Mariboru, Fakulteta za organizacijske vede in
Institut Jožef Stefan
vladislav.rajkovic@fov.uni-mb.si

***Povzetek**:*

V prispevku bodo predstavljene sodobne informacijske tehnologije z vidika upravljanja znanj. Poseben poudarek bo na upravljanju odločitvenih znanj in njihovem mestu ter vlogi v managementu izobraževalne institucije. V ta namen je bil razvit program DEXi, ki omogoča razvoj in uporabo večparametrskih hierarhičnih odločitvenih modelov. Osnovni namen uporabe tovrstnih modelov je sprejemanje boljših odločitev tako v pogledu ravnanja z ljudmi, kot tudi izbiri poslovnih partnerjev, npr. pri nakupu opreme. S tem lahko prispevamo h kakovosti šole. Predstavljeni bodo rezultati projekta ocenjevanja učiteljev, kjer bodo posebej izpostavljene ocene s strani učencev in načrtovanje učiteljeve kariere.

Ključne besede: *izobraževanje, management, IKT, tehnologije znanja*

Abstract

The contribution deals with contemporary information and communication technology from the viewpoint of knowledge management. Special emphasis will be on decision knowledge management and its role in management of educational institutions. Programme DEXi for multi-criteria decision-making modelling was developed. The aim of such modelling is to improve decision-making in the field of human resource management or in other fields, for example in selecting the most appropriate supplier. Better decisions can contribute to improved quality of schools. The model of teacher evaluation will be presented. In the model students' opinions play a special role.

Key words: *Education, Management, ICT, Knowledge technologies*

Poučevanje odločitvenih znanj v osnovni šoli

Teaching Decision-making Knowledge in Primary School

Marjan Rodman
Osnovni šoli Dušana Muniha Most na Soči
marjan.rodman@guest.arnes.si

Vladislav Rajkovič
Univerza v Mariboru, Fakulteta za organizacijske vede
vladislav.rajkovic@fov.uni-mb.si

Povzetek

Odločanje je proces, pri katerem izbiramo med več možnostmi, in je ena izmed človeških aktivnosti, ki nas najbolj zaznamuje. V vsakodnevnem življenju predstavlja odločanje bistvo vsakega upravljanja in vodenja. To se kaže na vseh nivojih, od posameznika preko poslovnih sistemov in države do globalne družbe. Kljub temu pa je v naših kurikulih o procesu odločanja napisano zelo malo. Težava je morda v tem, da je težko ponuditi vsebinsko in pedagoško primerne elemente. Prav tehnologije znanja pa pri pomoči za boljše odločanje ponujajo konkretne rešitve in pripomočke.

Sprejemanje kompleksnih odločitev je težak proces. Zato smo se na Osnovni šoli Dušana Muniha Most na Soči odločili, da poskusimo s poučevanjem odločitvenih znanj. Najprej smo izdelali model za poučevanje odločitvenih znanj v osnovni šoli. Potem smo izdelali učni načrt in predlog časovne razporeditve ur ter pripravili gradiva kot pripomočke pri pouku. Nato smo v praksi preverili primernost uvajanja le-tega. Na koncu smo z anketo izmerili uspešnost svojega dela.

Ključne besede: *vzgoja in izobraževanje, računalništvo, devetletka, večkriterijsko odločanje, ekspertni sistemi, DEXi*

Abstract

Making decisions is a process within which we choose among different possibilities and is one of human activities that marks us most. Making decisions represents the essence of direction and leadership in everyday life. This can be noticed on all levels from an individual across business systems and the state to the global society. Despite this fact we cannot find very much written about the process of making decisions in our school curricula. Perhaps the problem is to offer elements appropriate from the content and pedagogical point of view. The knowledge technologies offer the concrete solutions and support to help making better decisions.

Making complex decisions is a hard process. At Dušan Munih Primary School Most na Soči we decided to try with teaching of skills how to make decisions. First we made a model for teaching such skills at a primary school. Then we worked out a teaching plan and a suggestion for the programme of lessons and prepared the material to be used in the classroom. After we had checked the suitability of its introduction, we measured the efficiency of our work with a questionnaire.

Key words: *education and instruction, computer science, nine-year primary school, multi-parametric decision making, expert systems, DEXi*

Napovedovanje učnega neuspeha

Prediction of Academic Failure

Dejan Rudolf
Srednja zdravstvena šola Ljubljana
dejan.rudolf@guest.arnes.si

Povzetek

Za učinkovito preprečevanje šolskega neuspeha potrebujejo šolski svetovalci orodje za napovedovanje učnega uspeha. Za takšne napovedi uporabljajo šolski svetovalci v slovenskih srednjih šolah predvsem ročno pridobljene podatke v povezavi s nekaterimi ugotovitvami in značilnostmi, ki jih odkrijejo v letih svojega dela. Predstavljena metoda bi lahko izboljšala zanesljivost teh napovedi.

Ključne besede: *napovedovanje učnega uspeha, izobraževalno svetovanje, odkrivanje znanja iz podatkov, odločitvena drevesa*

Abstract

For efficient prevention of academic failure counselors need a tool for prediction of final academic achievement. For such predictions counselors in Slovenian high schools use manually created data bases, based on expert knowledge. It is possibile that application and method proposed in this paper would increase the accuracy of predictions and quality of educational counseling.

Key words: *prediction of academic achievements, educational counselling, knowledge discovery from data, decision trees*

Projekti in projektno vodenje v šoli

Projects and Project Management in Schools

Viljenka Šavli,
OŠ Solkan
viljenka.savli@guest.arnes.si

Janko Harej
TŠC Nova Gorica
janko.harej@guest.arnes.si

Milan Podbrščček,
TŠC Nova Gorica
milan.podbrscek@guest.arnes.si

Povzetek

Prispevek prikazuje različne tipe projektov glede na trajanje, vsebino in financiranje, ki se izvajajo v osnovni šoli, in nekaj primerov dobre prakse (Osnovna šola Solkan). Predstavljena so možna orodja za podporo sodelovalnemu in projektnemu delu, ter praktičen primer uvajanja takega sistema v TŠC Nova Gorica.

Ključne besede: *projektno in sodelovalno delo, mednarodni projekti, e-izobraževanje, aplikacije za spremljanje projektnega dela, spletne aplikacije, brezplačna orodja*

Abstract

Our contribution presents different types of projects regarding duration, contents and funding that are common in primary school and some practical examples of good practice (Solkan Primary School). It is also focused on possible tools for assisting cooperative and project work with presentation of introducing such a system at TŠC Nova Gorica

Key words: *project and cooperative work, international projects, e-education, applications for project work, internet applications, open source tools*

Vzpodbujanje kreativnosti pri likovni vzgoji z uporabo metode umetnega ustvarjanja

The Use of Artificial Creativity Method in the Area of Visual Art Education

Bogdan Soban
bogdan@soban-art.com,
http://www.soban-art.com

Povzetek

Uporaba informacijske tehnologije se širi tudi na tista področja, ki so bila izključno v domeni človeka. Govori se o inteligentnih sistemih, ki bi bili sposobni miselnega oziroma ustvarjalnega procesa. Tako se v sklop raziskav umetne inteligence umešča tudi umetno ustvarjanje, ki si z generativno metodo utira pot na različna področja ustvarjanja. Generativno koncipirani računalniški programi, ki kopirajo evolucijske procese v naravi, lahko producirajo fantastične in v praksi uporabne rešitve. V prispevku je opisana metoda in primer programa, ki bi jo bilo možno uporabiti za vzpodbujanje ustvarjalnosti pri likovni vzgoji. Predstavljeni ustvarjalni pristop omogoča generiranje neskončnega števila slik na izbrano tematiko, ki služijo po eni strani za utrjevanje in preverjanje znanja osnovnih likovnih principov, po drugi strani pa se lahko uporabijo kot izhodišča slušateljem likovne vzgoje, da jih v nadaljevanju nadgrajujejo po lastnih zamislih.

Ključne besede: *Informacijska tehnologija, računalnik, ustvarjanje, likovna vzgoja, program, algoritem, slika, generative art, umetna inteligenca, umetnost, likovno delo, ustvarjalni proces, izobraževalni proces*

Abstract

The use of information technology is spreading to the fields previously exclusively in the men's domain. The author writes about intelligent systems, capable of thinking and creating. Because of these systems, research of artificial intelligence must also encompass artificial creativity, which has been growing generatively in the various segments of the creative field. Generative designed software that simulates natural evolutionary processes can generate fantastic and practical solutions. The creative method and a demo program presented in this paper could be used in the area of visual art education. Introducing described approach is possible to generate an immense number of images based on selected themes, which can be used to test the art principle knowledge of students. Images generated in an artificial way could be used also as the basic ideas, which could be then upgraded by students into an artwork as the result of machine-human collaboration.

Key words: *Information technology, computer, creativity, art education, program, algorithm, image, generative art, artificial intelligence, art, artwork, creative process, educational process*

Naravoslovni eksperiment: most med šolskim znanjem in vsakdanjimi izkušnjami

School Science Experiments: A Bridge between School Knowledge and Everyday Experiences

Andrej Šorgo
Prva gimnazija Maribor; Živilska šola Maribor – višja strokovna šola
andrej.sorgo@guest.arnes.si

Saša F. Kocijančič
Srednja gostinska in turistična šola Radovljica
sasa.kocijancic@guest.arnes.si

Povzetek

V slovenskih gimnazijah je naravoslovje porazdeljeno med tri predmete (biologija, fizika, kemija), ki so vsebinsko in časovno le slabo povezani med seboj, skupno pa jim je to, da niso v nikakršni povezavi z realnimi primeri iz življenja. Ena od posledic takšnega pristopa je nepovezano in po predmetih razdrobljeno znanje, ki ga dijaki ne znajo uporabiti v vsakdanjih življenjskih situacijah. Povsem drugačno je stanje na srednjih strokovnih in poklicnih šolah, kjer je veliko predmetov vezanih na prakso, naravoslovje pa se zdi kot nekakšen privesek h kurikulu. Avtorja vsak na svoji šoli poskušata premostiti ta dva problema z uvajanjem računalniško podprtih eksperimentov v poučevanje biologije in fizike. Eksperimenti so zasnovani tako, da jih je mogoče v praktično enaki obliki uporabiti pri pouku dveh različnih predmetov na dveh različnih šolah. Razlike so le v kontekstu, v katerem so obravnavani. Skupno vsem eksperimentom pa je, da poskušajo premostiti prepad med šolskim znanjem biologije in fizike ter izkušnjami, pridobljenimi doma in v delovnem okolju.

Ključne besede: *računalniško podprti eksperimenti, e-prolab, biologija, fizika, naravoslovje, gimnazija, srednja strokovna šola*

Abstract

In Slovene grammar schools (gimnazija), Science is separated into three subjects: Biology, Chemistry and Physics. Correlations between the subjects are weak or even non-existent. All three subjects have only one thing in common: they are mostly academic, and barely connected with everyday phenomena and experiences. A consequence of this approach is that the knowledge of the students is patchy, and they are unable to use gained knowledge to explain the nature around them. In vocational schools the situation is completely different. School subjects are heavy interconnected with practice, but a scientific phenomenon is seen as an appendix to the curriculum. The authors are trying to overcome this situation at their schools with the introduction of computerized experiments into the teaching of Biology and Physics.

Experiments are constructed in such a way, that they can be used with practically identical setups at two different types of school, and within two different subjects. The difference is in the context and purpose of the experiments. In such a way, the authors are trying to overcome a gap between school science and the everyday experiences gained at homes or in the workplace.

Key words: *computerized experiments, e-prolab, biology, physics, science, grammar school, vocational school*

SLOMAMBO – enostavna pot do šolskega spletišča

SLOMAMBO – simple way to school web site

Sašo Stanojev
Srednja trgovska šola Kranj,
saso.stanojev@guest.arnes.si

Povzetek

Ključ do uspešne predstavitve na spletu je vsekakor vsebina. Sistemi za upravljanje z vsebinami so namenjeni ustvarjanju, vzdrževanju in upravljanju vsebin na spletnih straneh, brez potrebnega predznanja programiranja. Pri tem uporabniku sistem ponuja različne obrazce in "čarovnike", s pomočjo katerih lahko vnaša ali upravlja spletne strani, povezave, članke v različnih formatih, avdio in video vsebine in slike. Poleg tega mu nudi tudi uporabne funkcije kot so koledar, e-poslovanje, klepetalnice, aktualne novice, spletne galerije in podobno.

Ključne besede: *Dinamična spletna stran, upravljanje vsebin, CMS, Slomambo*

Abstract

The key to successful presentation on the Internet is definitely the contents. A CMS is a system used to create, maintain and manage the content of a website, without knowing anything about programming, design or HTML. Using simple form and wizards, user can manage the pages, links, text, audio, video contents and images. Special modules can be added to the CMS to control website funcionality like calendar, e-commerce, forum, news and image gallery.

Key words: *Interactive web page, content management, CMS, Slomambo*

Spletni dnevniki v učnem procesu

Blogs in the Learning Process

Marija Šubic
Tehniški šolski center Kranj

Povzetek

Namen članka je predstaviti spletne dnevnike - bloge in predvsem njihovo uporabno vključevanje v proces učenja in poučevanja. Spletni dnevniki so enostavna, privlačna, interaktivna in ponavadi brezplačna spletna aplikacija, ki se v učnem procesu uporablja za razvijanje branja, pisanja in neodvisnega učenja. Obenem vzpodbujajo ustvarjalno in kritično razmišljanje, samostojno raziskovanje, analiziranje, odgovorno predstavljanje in izmenjavanje informacij, komunikacijo in sodelovanje. Spletni dnevniki so koristno izobraževalno orodje za vsa predmetna področja in na vseh nivojih izobraževanja tako za učenca kot za učitelja.

Ključne besede: *spletni dnevnik, spletno orodje, učni proces, učenčev spletni dnevnik, učiteljev spletni dnevnik, razredni spletni dnevnik, spretnosti branja in pisanja, ustvarjalnost, kritično mišljenje, odgovornost, komunikacija, motivacija, IKT, uporabnikom prijazna tehnologija*

Abstract

The article focuses on the presentation of »blogs« and mostly on the ways of their integrating into the learning and teaching process. Blogs, being simple, attractive, interactive and usually free online tools are used to promote reading, writing, as well as initiative and independent learning. They stimulate creative and critical thinking, exploring, analysing, presenting and exchanging information responsibly, communication and collaboration in all content areas and grade levels for students and teachers alike.

Key words: *blog, online tool, learning process, learner's blog, teacher's blog, class blog, reading and writing skills, creativity, critical thinking, responsibility, communication, motivation, ICT, user-friendly technology*

Odločitveni model za izbor učitelja – razrednika

Decision Model for Choosing Class Teacher

Zdenka Vrbinc
Gimnazija Kranj,
zdenka.vrbinc@guest.arnes.si

Povzetek

V pomoč vodstvu pri izbiri učitelja-razrednika na srednji šoli, je bil s pomočjo lupine DEX izdelan odločitveni model za izbiro učitelja-razrednika. Z uporabo sistema DEXi kot pomoč ravnateljem pri izbiri najprimernejšega učitelja za razrednika je omogočena večkriterijska ocena in transparentna razlaga odločitve. Taka razlaga je učinkovita povratna informacija in s tem spodbuda za kvalitetno, hitro in nepristransko odločanje. Model in njegova praktična uporaba sta prikazana na primeru izbora štirih kandidatov z različnimi lastnostmi. Model je samo pomoč pri odločitvi, odločitev pa mora v končni fazi sprejeti človek. V izogib možnim konfliktom ob neustrezni izbiri kandidata, lahko skrbno premišljen model, v danih pogojih, omogoči optimalno izbiro. Model lahko ravnatelji prilagodijo individualnim potrebam in potrebam zavoda. Ekspertni sistemi poleg svojega prvotnega namena kot pomoč pri ocenjevanju prispevajo veliko k celovitemu, globalnemu, predvsem pa jasnejšemu pregledu problema.

Ključne besede: *Učitelj-razrednik, srednja šola, ravnatelj, DEXi, večparametrski odločitveni model, odločanje.*

Abstract

With the intention of helping headmaster in secondary school was developed (by the help of expert system shell DEX) a decision model for choosing class teacher.

This paper introduces the use of the system DEXi as headmasters' aid at choosing the most suitable teacher for class teacher. With this, it is possible a multi parameter evaluation and a transparent explanation of the decision. Such explanation is an efficient feedback information which encourages a qualitatively, quick and impartial decision. The model and its practical use are demonstrated in the case of selecting four candidates with different characteristics. The model is only an aid at deciding, it is a person who must make the decision in the final phase. The decision model may be adjusted to headmaster's or school's individual needs.

Expert systems beside their basic use as the help with evaluation also help to improve the global and clearer view on solving the problem.

Key words: *Class teacher, secondary school, headmaster, DEXi, multi-attribute decision model, decision support.*

Informacijska revolucija v izobraževanju

Information Revolution in Education

Rado Wechtersbach
Zavod RS za šolstvo,
e-pošta: rado.wechtersbach@zrss.si

Povzetek

Informacijska tehnologija revolucionarno spreminja naš vsakdan. Nič ni več tako, kot je bilo nekoč, in tudi izobraževanje se spreminja in se mora spreminjati. Aktualno vprašanje, o katerem razpravljamo v članku, je, kakšno znanje in kakšne spretnosti naj učenci razvijajo z izobraževanjem v mladosti ter na kakšen način, da bodo kot odrasli lahko aktivno sodelovali in odločali v družbi, ki prihaja.

Ključne besede: *izobraževanje, informacijska tehnologija, informacijska pismenost*

Abstract

The information technology revolutionary changes our everyday life. There is nothing as it was once and also education is changing and should change. Actual question, we are discussing about in this article, is what knowledge and skills are essential and should be developed during education in youth to qualify pupils for active cooperation and having the authority to decide in the coming world future society.

Key words: *education, information technology, information literacy*

Prenova katalogov na SIO

The Modernization of Catalogues on SIO

Alenka Zabukovec
Srednja ekonomska šola Ljubljana,
alenka.zabukovec@guest.arnes.si

Povzetek

Slovensko izobraževalno omrežje je bilo izdelano leta 1995 z namenom ponuditi aktualne, verodostojne in relevantne informacije na izobraževalnem področju v Sloveniji. Ker sistem, na katerem SIO deluje, dopušča vpise vsakogar in vsakršne vrste, se je z leti nabralo v katalogih kar veliko neprimernih vpisov. Skupina strokovnjakov s področja izobraževanja je prenovila dva kataloga na SIO: izobraževalnih gradiv in spletnih naslovov. V prispevku je opisano konkretno delo skupine in predstavljeno stanje na SIO pred in po prenovi.

Ključne besede: *SIO, Slovensko izobraževalno omrežje, spletni katalog, e-gradiva, katalog e-gradiv.*

Abstract

Slovene educational network (SIO) was set up in 1995 with the aim to provide fresh, accurate, relevant information in the field of education in Slovenia. Since the system, which supports SIO, allows limitless input of unchecked entries, it turned out that in the course of time a large number of inadequate entries was added to the catalogue. Therefore, a group of experts in the field of education has modernized two catalogues on SIO: educational materials and web addresses. The text gives a reports on the group work and provides a description of the SIO before and after the modernization.

Key words: *SIO, Slovene educational network, web catalogue, e-materials, a catalogue of e-materials*

Model informacijske rešitve za razrednike

A Model of Informational Solution for Class Teachers

Alenka Zabukovec
Srednja ekonomska šola Ljubljana,
alenka.zabukovec@guest.arnes.si

Povzetek

V delo razrednika v srednji šoli je vključeno tudi izpolnjevanje vse več dokumentacije. Avtorica je izdelala model, ki nudi informacijsko podporo temu delu njegovih obveznosti. Razredniku je ob uporabi tega modela omogočeno hitrejše, interaktivno in sistematično pregledovanje bolj točnih, natančnih in zanesljivejših podatkov, šola pa s tem lahko pridobi tudi na kakovosti. V prispevku je prikazana izdelava takega modela, od analiz prek gradnje podatkovnega skladišča do praktičnih primerov OLAP poročil za razrednike. Poleg tega je dodana evalvacija modela in prikazana možna pot uvedbe v šole.

Ključne besede: *OLAP, razrednik, srednja šola, analiza podatkov, podatkovno skladišče, informacijska podpora, model OLAP, MS Excel.*

Abstract

A secondary school class teacher's job includes plenty of paperwork; therefore the author has designed a model of an informational support. Using the model a class teacher will check data faster, more systematically and interactively. What is more, data will be more accurate and reliable. Consequently school will improve its quality. The text presents the process of designing the model, from analysis to building a data warehouse as well as some practical examples of OLAP reports for class teachers. What follows are an evaluation of the model and an example how to launch it in schools.

Key words: *OLAP, class teacher, secondary school, data analysis, data warehouse, informational support, the OLAP model, MS Excel.*

Podpora odločanju pri izboru najboljših kandidatov za častnike v šoli za častnike

Decision Support Modelling a Procedure for Selecting the Best Candidate for Officer

Anita Založnik
Slovenska vojska,
anita@rsklan.com

Povzetek

V nalogi je prikazan model za pomoč pri odločanju. Pri izdelavi modela kriterijev za izbor najboljšega kandidata na Šoli za častnike, je ključno vlogo igral izbor samih kriterijev ter njihova obtežitev in vrednotenje. Poudarek je tudi na načinu analize po tem modelu. Kot računalniška podpora je bil uporabljen računalniški program DEXi, ki je predstavljen na podlagi vzorca zaključene generacije.

Ključne besede: *sistem za podporo odločanju, večparametrsko odločanje, DEX.*

Abstract

This paper presents a decision support model as a viable alternative to current ad-hoc grading procedures used in School for officers. The key role in building a model is determining a list of criteria to select the best candidate for officer. Scaling and valuation of criteria follows a thorough analysis, and is – according to my experience – one of the more difficult steps. One of the recent generations of candidates for officers is used as a benchmark and DEXi is used to automate and simplify the process of decision support.

Key words: *decision support systems, multi-attribute decision making, DEX.*

Bogastvo Evrope skozi projekte mednarodnega sodelovanja

The Riches of Europe through the International Projects

Mateja Žepič
Gimnazija Kranj,
mateja.zepic@guest.arnes.si

Povzetek

Mednarodno sodelovanje je ena od dejavnosti, ki motivirajo dijake za učinkovitejše in uspešnejše delo v šoli. Vključevanje v projekte pomeni nove izkušnje za šolo, učitelje, dijake in njihove starše. Od učitelja sicer zahteva dodatni napor in iznajdljivost, vendar pa s tem poveča motivacijo učencev, njihovo ustvarjalnost, komunikacijo, spoznajo pomen učenja tujih jezikov, znajo spretno reševati konfliktne situacije … V nadaljevanju bom predstavila primer praktičnega vključevanja v projekte mednarodnega sodelovanja na naši šoli.

Ključne besede: *mednarodno sodelovanje, projektno delo, timsko delo, internet*

Abstract

The international co-operation is one of the activities which motivate students for more efficient and successful work at school. Their task in such projects means new experiences for school as well as for teachers, students and their parents. On one hand it forces the teachers to include some extra effort and inventiveness, but on the other hand it increases students' motivation, their creativity, communication, they learn the significance of learning foreign languages, they are able to solve conflict situations. I will introduce the practical example of the activities with international co-operation at our school.

Key words: *international project, project work, team work, internet*

Nacionalna strategija e-izobraževanja, 2006−2010, E-izobraževanje: pot v družbo najuspešnejših

Slovenian National e-Learning Strategy, 2006−2010, E-learning: Leading the Field

Rok Kokalj; Urša Mekiš; Simon Bergant; Robert Guštin;
Borut Čampelj; Dejan Dinevski; Tanja Arh; Andrej Brodnik;
Janja Jakončič Faganel; Ivan Gerlič; Milan Ojsteršek; Marko Papić

Povzetek

Glavni namen strategije e-izobraževanja je do leta 2013 vzpostaviti enega najučinkovitejših in v celoti informacijsko podprtih nacionalnih sistemov izobraževanja ter tako zagotoviti trajnostno gospodarsko rast, blaginjo in kakovost vseh državljanov RS, hkrati pa postati sinonim za eno najuspešnejših družb na svetu, temelječih na znanju, stalnih inovacijah in hitrem razvoju. Glavna usmeritev je strateški dokument i2010, ki je nastal na nivoju EU-ja in definira bistvene poudarke pri razvoju informacijske družbe.

Strategija e-izobraževanja sledi tudi vsem petim razvojnim prioritetam Strategije razvoja Slovenije (SRS). Še posebej je strategija e-izobraževanja usmerjena v uresničevanje druge razvojne prioritete "Izboljšanje kakovosti izobraževanja in spodbujanje vseživljenjskega učenja".

Nacionalna strategija e-izobraževanja opredeljuje več strateških področij, katerih ukrepi bodo zagotovili hitrejši razvoj e-izobraževanja v Sloveniji, povečan nivo znanja med prebivalstvom ter posledično boljšo konkurenčnost tako posameznikov kot celotne slovenske družbe.

Nacionalna strategija e-izobraževanja obravnava vse družbene cilje skupine izobraževancev. Najučinkovitejši načini za dostop do znanja glede na potrebe posameznika morajo biti omogočeni vsem državljanom Republike Slovenije.

Za učinkovito izvedbo ukrepov znotraj opredeljenih strateških področij in zadovoljevanje potreb po znanju vseh družbenih slojev se predlaga ustanovitev "Agencije za e-izobraževanje", ki bo zagotovila uresničevanje zastavljenih ciljev nacionalne strategije e-izobraževanja.

Ključne besede: *e-izobraževanje, e-učenje, strategija e-izobraževanja, agencija za e-izobraževanje, strateška področja, e-učne vsebine, vseživljenjsko učenje, vzgoja in izobraževanje, informacijsko komunikacijska tehnologija, IKT, i2010, družba znanja.*

Abstract

The main purpose of the Slovenian national e-learning strategy is establishing one of the most effective and information supported national systems of learning thus enable constant economic growth, welfare and good life for all the citizens of Slovenia and at the same time become one of the most successful societies in the world, based on knowledge, innovations and constant development. Groundwork for Slovenian national e-learning strategy were strategic EU document i2010 and Slovenian Development Strategy of which the strategy gives a special priority to its improving quality of education and lifelong learning.

Slovenian National e-learning strategy defines different strategic fields, which will help assure faster development of e-learning in Slovenia, higher level of knowledge among population and therefore better competitive position of individuals and Slovenian society as a whole. The Strategy considers all *social groups and claims that all Slovenian citizens must have the best access to the knowledge according to their needs.*

Key words: *e-learning, e-learning strategy, agency for e-learning, strategic field, e-content, lifelong learning, education, ICT, i2010, knowledge based society.*

Okroglo o maturi iz predmeta Informatika

Round-Table Discussion on the Matura Subject Informatics

Alenka Krapež
Gimnazija Vič,
alenka.krapez@guest.arnes.si

Rado Wechtersbach
Zavod RS za šolstvo,
rado.wechterzbach@zrss.si

Povzetek

Strokovni svet RS za splošno izobraževanje je februarja 2004 razširil nabor maturitetnih pedmetov z izbirnim maturitetnim predmetom Informatika. Kandidati bodo tako na letošnji maturi lahko prvič med izbirne predmete uvrstili tudi ta predmet.Na okrogli mizi bomo tik pred zdajci pretresli maturitetni koledar in priprave dijakov na maturitetni izpit.

Ključne besede: *srednja šola, Informatika, matura*

Abstract

In February 2004, the Council of Experts of the Republic of Slovenia for General Education added Informatics on the list of optional Matura subjects, thus making it possible for the students to choose Informatics as one of their optional Matura subjects. The round-table discussion will aim at the Matura calendar and the preparation of the students for the exam.

Key words: *Secondary schools, Informatics, Matura, Baccalaureat*

Računalniško opismenjevanje v osnovni šoli

Becoming computer literate in primary school

Rado Wechtersbach
Zavod RS za šolstvo,
rado.wechterzbach@zrss.si

Povzetek

Na Zavodu RS za šolstvo potekajo priprave na prenovo osnovnošolskega kurikula. Učni načrti izbirnih predmetov bodo na vrsti nekoliko kasneje, sa je potrebno najprej postaviti njihovo umestitev v predmetnik. Na okrogli mizi bomo pretresli nekaj zamisli računalniškega opuismenjevanje učencev v osnovni šoli in oblikovali stališče za nadaljno obravnavo.

Ključne besede: *osnovna šola, računalniška pismenost, učni načrt*

Abstract

The National Institute of Education has started work on the development of primary school curriculum. The syllabuses of optional subjects will be discussed a bit later, after these subjects have already been placed into the curriculum. The aim of the round-table debate will be to discuss ideas about how to make primary school pupils computer literate, as well as to take a stand on this issue, which would serve as a basis for further discussion.

Key words: *Primary schools, Computer literacy, Curriculum*

Izdelava interaktivnih nalog z uporabo različnih vizualizacijskih elementov

Creating Interactive Exercises with the Help of Various Elements for Visualization

Tjaša Kampos,
Osnovna šola Venclja Perka,
e-pošta: tjasa.kampos@guest.arnes.si

Mojca Orel,
Gimnazija Moste,
e-pošta: mojca.orel@guest.arnes.si

Boštjan Štih
Osnovna šola Hudinja,
e-pošta: bostjan.stih@gmail.com

Povzetek

V sodobni družbi imamo s hitrim razvojem informacijske in komunikacijske tehnologije možnost uporabe novih metod poučevanja, ki omogočajo kvalitetnejšo vizualizacijo ravni zaznave pojmov in procesov (npr. prikaz animacije/simulacije), hitrega in enostavnega dostopa do informacij s pomočjo medmrežja ter razvoja interaktivnih multimedijskih učnih gradiv. Pri tem je posameznikova vloga v procesu izgradnje znanja aktivnejša, saj proti zastavljenemu cilju napreduje po lastni poti in z lastno hitrostjo.

V okviru delavnice se bodo udeleženci seznanili z načini izdelave interaktivnih nalog za samostojno učenje in utrjevanje snovi, ki vključujejo različne vizualizacijske elemente. Spoznali bodo osnove izdelave preprostih animacij z računalniškim programom ChemSense.

Kvaliteta tovrstnih nalog se kaže ravno v interaktivnosti, saj delo z njimi razbremeni učitelja, hkrati pa učencem nudi takojšnjo povratno informacijo o njihovi uspešnosti pri reševanju. Delavnica je primerna za učitelje katerega koli predmetnega področja.

Ključne besede: *interaktivne naloge, animacija, aktivno učenje, vizualizacijski elementi*

Abstract

The modern world with its fast developing information and communication technology enables the use of new methods of learning, which promote higher quality visualization level in the perception of concepts and processes (For example: through animations and simulations), fast and easy access to information through internet, and the development of interactive multimedia learning material. This makes individuals more active in the process of building up knowledge as they choose their own path to the set goal and reach it in their own pace.

The participants of the workshop will get a first hand experience in creating interactive exercises for individual learning and revising, with the help of various visualization elements. They will learn the basis for creating simple animations with the computer programme ChemSense.

The quality of these exercises lies in the very interactivity; they make the teacher's work easier and give students immediate feedback and evaluation of their answers.

Key words: *interactive exercises, animation, active learning, elements of visualization*

Arnesova podpora domačim in mednarodnim IKT projektom v izobraževalnih omrežjih

Arnes' Support To Local and International ICT Educational Network Projects

Marko Bonač, Gorazd Božič, Tomi Dolenc, Jože Hanc, Avgust Jauk,
Rok Papež, Peter Sterle, Matjaž Straus, David Vrtin
tomi.dolenc@arnes.si

Povzetek

Arnes in sorodna izobraževalna in raziskovalna omrežja v Evropi vzpostavljajo skupen prostor komunikacijskih in informacijskih povezav ter storitev, ki temelji na enotnem in tehnološko naprednem omrežju GÉANT2 ter na skupnih prizadevanjih številnih delovnih skupin in projektov. V vse več državah se v nacionalna in evropsko izobraževalno ter raziskovalno omrežje vključujejo tudi šole, v Sloveniji že od leta 1994. Nekomercialni značaj teh omrežij in njihovo tesno medsebojno sodelovanje omogočajo boljšo tehnološko in strokovno podporo uporabe najnovejših IK tehnologij za intenzivnejše sodelovanje ter bogatejšo izmenjavo vsebin med izobraževalnimi organizacijami, pa tudi s knjižnicami, muzeji, raziskovalnimi organizacijami in drugimi, ki se vključujejo v ta skupni prostor.

Arnesovi sodelavci bodo pregledno predstavili tehnološko in organizacijsko podlago za podporo storitvam v izobraževalnih omrežjih, aktualne trende in vidnejše mednarodne pobude oz. projekte, ki se posvečajo predvsem potrebam izobraževanja: pobuda VISIT za kakovostnejše multimedijsko sodelovanje in dostop do bogatejših vsebin, varnost v šolskih omrežjih, izgradnja slovenske in evropske infrastrukture za podporo mobilnosti ter vključevanje šol v omrežje Eduroam,

Namen delavnice je med drugim širjenje mreže sodelovanja in pridobitev partnerjev za sodelovanje v pilotnih projektih, zato bomo tudi prisluhnili potrebam tistih šol in učiteljev, ki orjejo ledino pri izvajanju domačih in mednarodnih projektov, temelječih na IKT. Rezultati sodelovanja naj bi pomagali usmerjati aktivnosti Arnesa v podporo tem dejavnostim.

Ključne besede: *Arnes, izobraževalno omrežje, storitve, GENT2, Eduroam*

Abstract

Arnes and other educational and research networks around Europe are building a common space for communication and information connections and services that is based on the unified, technically advanced GÉANT2 network and on joint efforts of numerous working groups and projects. In more and more countries, schools are joining the national and European educational and research network, in Slovenia this has been a continuous process since 1994. The non-commercial characteristics of these networks and their close mutual cooperation enable better technical and professional support of the latest IC technology in use. This also means a greater exchange of information between educational organisations, libraries, museums, research facilities and others included in this common space.

The Arnes employees will provide a transparent introduction of the technical and organisational base for service support in the educational networks. They will also detail the current trends and some of the more notable international initiatives or projects, dedicated to the needs of education: the VISIT initiative for a better quality, efficient multimedia cooperation and access to more exhaustive content, *school network security, establishment of the Slovene and European infrastructure for mobility support and having schools join the Eduroam network.*

The purpose of the workshop also is to widen the cooperation network and to gain partners for the pilot projects. This is why we will consider the needs of those schools and teachers that are the first to break fresh ground in carrying out local and international projects based on ICT. The results of this cooperation should help guide Arnes' activities to support these projects.

Key words: *Arnes, Educational network, Services, GENT2, Eduroam*

Zbornik 9. mednarodne multikonference
Proceeding of the 9th International Multiconference

INFORMACIJSKA DRUŽBA IS 2009

INFORMATION SOCIETY IS 2009

Izkopavanje znanja in podatkovna skladišča

Data-Mining and Data-Warehouses

Uredila / Edited by

Dunja Mladenić, Marko Grobelnik

http://is.ijs.si

9. oktober 2006 / 9th October 2006
Ljubljana, Slovenia

Predgovor / Preface

Izkopavanje znanja in podatkovna skladišča

Tehnologije, ki se ukvarjajo s podatki so v zadnjem desetletju (devetdeseta leta) močno napredovale. Iz prve faze, kjer je šlo predvsem zato kako podatke shraniti in kako do njih učinkovito dostopati, se je razvila industrija za izdelavo orodij za delo s podatkovnimi bazami, prišlo je do standardizacije procesov, povpraševalnih jezikov itd. Ko shranjevanje podatkov ni bil več poseben problem se je pojavila potreba po bolj urejenih podatkovnih bazah, ki bi služile ne le transakcijskem procesiranju ampak tudi bolj analitskim pogledom v podatke – pojavilo se je skladiščenje podatkov (data warehousing), ki postaja vse bolj standarden del informacijskih sistemov v podjetjih. Paradigma OLAP (On-Line-Analytical-Processing) zahteva od uporabnika, da še vedno sam postavlja sistemu vprašanja in dobiva nanje odgovore in na vizualen način preverja in išče izstopajoče situacije. Ker seveda to vedno ni mogoče, se je pojavila potreba po avtomatski analizi teh podatkov oz. z drugimi besedami to, da tehnologija sama pove, kaj bi utegnilo biti zanimivo za človeka – to prinašajo tehnike izkopavanja znanja (data mining), ki iz podatkov, ki ze nekje obstajajo, skušajo pridobiti novo znanje, ki uporabniku ponudi novo razumevanje svojih lastnih procesov.

Konferenca bo ponudila nekaj predstavitev, ki se bodo ukvarjala z modernejšimi pogledi na delo s podatki – predvsem poslovno analitske poglede: pristope, orodja, probleme in rešitve.

Data Mining and Data Warehouses (SiKDD 2006)

Data handling technologies have significantly progressed in the last ten years. The first phases mainly dealing with storing and efficiently accessing the data, resulted in the development of industry delivering tools for handling large databases, standardization of related processes, queering languages, etc. When the data storage was not a primary problem any more the need for improving the database organization resulted in the databases supporting not only transactions but also analytical views of the data. At this point data warehousing with OLAP (On-Line-Analytical-Processing) entered as a usual part of a company information system. The OLAP paradigme stil requires from the user to set well defined questions which is not always easy and possible. This led to the development of Data Mining offering automatic data analysis trying to obtain some new information from the existing data and enabling the user some new insights in the data. The conference covers a broad area including Statistical Data Analysis, Data/Text and Web Mining, Semantic Web, Link Detection and Link Analysis, Data Warehouses.

Urednika / Editors and Program Chairs

- Marko Grobelnik
- Dunja Mladenič

HIERARCHICAL TEXT CATEGORIZATION USING CODING MATRICES

Janez Brank, Dunja Mladenić, Marko Grobelnik
Department of Knowledge Technologies, Jozef Stefan Institute
Jamova 39, 1000 Ljubljana, Slovenia
Tel: +386 1 477 3778; fax: +386 1 477 3315
e-mail: {janez.brank,dunja.mladenic,marko.grobelnik}@ijs.si

ABSTRACT

We discuss the task of ontology population as a machine learning problem with a large hierarchy of classes. Since many machine learning methods are designed primarily for two-class problems, it is desirable to transform the multiclass classification problem into several two-class problems. Coding matrices are a unifying formalism for describing such transformations. We present an approach for constructing coding matrices in a greedy way, with a focus on achieving good performance with a tractable number of two-class classification models.

1 INTRODUCTION

In modern information systems, information about the problem domain is often organized in an ontology, i.e. a shared conceptualization of the domain of interest, expressed in machine-processable form. An ontology typically consists of concepts, instances of these concepts, and relations (between concepts and/or between instances). Ontologies can often be quite large, and constructing them can be an expensive and time-consuming task. One part of this process that can be automated relatively well on a large scale is the population of an ontology, i.e. the assignment of instances to concepts. Given a hierarchy of concepts and a set of instances, the task of ontology population is to identify, for each instance, which concept or concepts of the ontology this instance belongs to. We approach this as a problem of machine learning, assuming that some training data is already available (a set of instances for which the correct assignment to concepts is known). Unlike in typical machine learning settings where the number of classes is moderate, in the case of ontology population the number of concepts can be fairly large (several thousands and even hundreds of thousands), and the approach must take this into account.

2 RELATED WORK

We look at the ontology population task as a large-scale classification problem, with a large number of hierarchically organized classes (corresponding to concepts of the ontology) and instances. Additionally, the instances are likely to be represented by a large number of attributes. In many topic ontologies, the instances are textual documents, in which each word is treated as an attribute for the purpose of representing the instance for the machine learning algorithms. Therefore, our approach to machine learning for ontology population will draw largely upon techniques from the area of text categorization [1].

Support vector machines or SVM [2, 3] is one state-of-the-art method that is commonly used for text categorization. It is particularly suitable for dealing with text classification problems, as it can handle a large number of attributes [4] and avoiding overfitting. Experiments have shown that SVM can lead to good and accurate models in many problem domains, including text categorization as one of the state-of-the-art methods.

Multi-class categorization. One of the disadvantages of the SVM is that, in its original formulation, it is targeted as binary (i.e. two-class) classification problems only. Various approaches have been considered for extending the SVM into the domain of multi-class problems, often at a considerable additional cost of the training. For example, [5] proposed an extension of the original optimization problem in which k models are sought simultaneously, where k is the number of classes. This approach does not scale well to problems with a many classes.

Most of the other approaches are based on translating the original k-class classification problem into several two-class problems. These approaches are usually not SVM-specific but could use any learning algorithm to train the models for the individual problems. When classifying a new instance, it is shown to the models for these two-class problems and the predictions of these models are then combined into an assignment of the instance to one of the k classes of the original multiclass problem.

The individual two-class problems can be defined in various ways. A typical example is "one vs. rest", in which there is one two-class problem for each of the k classes of the original problem; in the two-class problem corresponding to class i, instances from class i are treated as positive and those from other classes are treated as negative. Thus each model tries to predict whether a given instance belongs to that particular class or not. An alternative is the "one vs. one" approach, in which there is one two-class problem for each pair of classes. Thus for a pair of classes (i, j), where $1 \leq i \leq j \leq k$, the corresponding problem treats members of class i as positive, those of class j as negative, and the rest of the training instances is not used at all for this particular two-class problem. The individual problems are simpler than in the one-vs-rest approach, but the number of models is much larger, $k(k-1)/2$ rather than just k. For a large number of classes, this approach is infeasible. We can speed up at the classification by avoiding having each instance classified by all the models e.g., [6].

Coding matrices provide a conceptual unification of one-vs.-one, one-vs.-rest and other approaches translating the original k-class problem into several two-class problems. Consider a k-class problem that has been translated into m two-class problems. The corresponding coding matrix M has k rows and m columns; the entry M_{cj} indicates how the instances from class c are used in the j-th two-class problem. Thus $M_{cj} = 1$ if instances from class c are treated as positive in the j-th two-class problem, $M_{cj} = –1$ if they are treated as negative, and $M_{cj} = 0$ if they are not used in the definition of the j-th two-class problem.

Thus, each column of the matrix corresponds to one of the two-class problems into which the original k-class problem has been translated. After training, each column now also corresponds to a binary classification model. Ideally, the model for the j-th problem should, when shown an instance from class c, predict +1 if $M_{cj} = 1$ and –1 if $M_{cj} = –1$. (If $M_{cj} = 0$, we cannot form any concrete expectations about the predictions of model j on instances from class c because no such instances were used in training that model.) Thus we can say that class c has been coded into the row of binary predictions $M^c = (M_{c1}, M_{c2}, \ldots, M_{cm})$; *coding matrix*.

Once a row of actual predictions of the m binary models on some new instances are avilable, e.g. $y = (y_1, y_2, \ldots, y_m)$, the final assignment of this instance to one of the m classes is obtained by comparing the row of predictions y to each row M^c of the matrix. The c for which the similarity between y and M^c is maximized is then selected as the final prediction of our multiclass model. If the sign of y_j expresses the prediction of the j-th model, and the absolute value of y_j expresses its confidence in the prediction, a formula for comparing the similarity can be a simple dot product of the form $\Sigma_{j=1..m}\, y_j\, M_{cj}$.

For example, coding matrices corresponding to the one-vs.-one and one-vs.-rest approaches:

$$\begin{bmatrix} 1 & -1 & -1 & -1 & -1 \\ -1 & 1 & -1 & -1 & -1 \\ -1 & -1 & 1 & -1 & -1 \\ -1 & -1 & -1 & 1 & -1 \\ -1 & -1 & -1 & -1 & 1 \end{bmatrix} \quad \begin{bmatrix} 1 & 1 & 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ -1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 & -1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & -1 & 0 & 0 & -1 & 0 & -1 & 0 & 1 \\ 0 & 0 & 0 & -1 & 0 & 0 & -1 & 0 & -1 & -1 \end{bmatrix}$$

Various desirable properties of the coding matrix can be considered. For example, the rows should not be too similar to one another; if two rows are very similar, then even a small number of incorrect predictions may cause the row of predictions y to become more similar to the wrong row of the coding matrix. Similarly, the columns should not be too similar either, because this means that the corresponding models are effectively solving very similar two-class classification problems; their errors are therefore also likely to be more correlated. In this case many errors may be made simultaneously, which hampers decoding.

Another desirable characteristic of the matrix is sparsity, i.e. the proportion of entries that are set to 0. If a column is sparse, this means that training the corresponding binary classification model involves fewer training examples (and is therefore faster), and the resulting model is likely to be more accurate. However, if the matrix is very sparse, this also means that the rows are very sparse and it is therefore more difficult to ensure that the rows are different enough from each other. Sparsity also reduces the memory requirements if only the nonzero elements of the matrix are stored. Various families of coding matrices have been considered in the literature [8, 9, 10]. In addition to the one-vs.-one and one-vs.-rest matrices, these include:

Matrices based on error-correcting output codes [7]. These codes are used e.g. in information theory to provide error-correcting bits during the transmission of data. They have mathematical guarantees on minimal row separation, i.e. ensuring that there is a certain minimum Hamming distance between any two rows. Their downside is that the resulting matrix is usually quite dense, i.e. all its entries are nonzero, and that m is typically $\geq k$. This may make it unfeasible to store the matrix for a large number of classes.

Random coding matrices. In this approach, entries of the matrix are randomly set to +1 or –1. Depending on whether we want a sparse matrix or not, some (or most) entries can be kept at 0. The performance of this family of coding matrices has been found by several authors to be as good as that of more carefully designed matrices (e.g. based on one-vs.-one, one-vs.-all, or error-correcting codes).

Matrices of theoretical interest. The smallest matrix that can theoretically distinguish k classes requires $\lceil \log_2 k \rceil$ columns. However, the corresponding binary classification problems would be extremely difficult, leading to poor performance of the ensemble as a whole. On the other extreme, a matrix can have at most $(3^k – 2^{k+1} + 1)/2$ different columns if we require that each column has at least one +1 and at least one –1 entry, and that no column is equal to or a negation of any other. However, such a matrix is intractably large for any but extremely small values of k.

3 CODING MATRICES FOR LARGE HIERARCHIES

The techniques for the construction of coding matrices presented in the previous section have several drawbacks when applied to problems with a large number of categories and when furthermore these categories are organized into a hierarchy. Most of these methods require at least $O(k)$ models to deal with a k-class classification problem, which could be problematic if the number of classes k is large and the individual models are relatively expensive to train (as is the case for the SVM). Thus, it would be desirable to have a method that focuses on constructing a matrix with a sublinear number of models. Another drawback is that the methods described so far are not aware of the hierarchical relationships between the classes. This will be addressed by our approach, which we present in this section.

3.1. Constraints - hierarchical organization of classes

The structure of the matrix must take the hierarchical organization of the original k classes into account. In particular, if class c is the ancestor of class c' in the hierarchy, and a particular model j uses one of them as positive and the other one as negative (e.g. $M_{cj} = 1$, $M_{c'j} = –1$), this would imply that the instances from class c' must be simultaneously negative and (since any instance of c' is also an instance of c) positive. Thus, it follows that whenever c is an ancestor of c', the condition $M_{cj}\, M_{c'j} \geq 0$ should hold for all columns j of the coding matrix. This constraint is relatively straightforward to incorporate in the random matrix generation algorithm.

Algorithm A: To construct the j-th column of the matrix:
1 set $M_{cj} = 0$ for all $c = 1, \ldots, k$;
2 set $Anc_1 = \{\}$, $Anc_{-1} = \{\}$;
3 while there are sufficiently few nonzero entries in the jth column, and not all pairs of classes (c, c') have been tried:
4 select two random classes, c and c', such that neither is an ancestor of the other, and such that the pair (c, c') has not yet been considered in some previous iteration of this loop;
5 if $M_{cj} \neq 0$ then $A_c = \{M_{cj}\}$
else if $c \in Anc_1$ then $A_c = \{1\}$
else if $c \in Anc_{-1}$ then $A_c = \{-1\}$
else $A_c = \{-1, 1\}$;
6 initialize $A_{c'}$ based on $M_{c'j}$ analogously to step 5;
7 $A = \{ (a, a') : a \in A_c, a' \in A_{c'}, a\, a' < 0 \}$
8 if $A = \{\}$, go back to step 3;
9 let (a, a') be a random element of A;
set $M_{c''j} = a$ for all c'' that are descendants of c (incl. $c'' = c$);
set $M_{c''j} = a$ for all c' that are descendants of c' (incl. $c'' = c'$);
10 include c and all its ancestors in Anc_a,
include c' and all its ancestors in $Anc_{a'}$;
11 end while;

In the sets Anc_1 and Anc_{-1}, we keep track of the ancestors of classes that have already been used as either positive or negative in the current binary problem. Membership of a class c in either of these two sets limits our choice of acceptable nonzero values for M_{cj}, represented by the set A_c that we compute in step 5. If the sets A_c and $A_{c'}$ indicate that c and c' cannot be given opposite labels, we try some other random pair of classes c and c'.

3.2. Greedy construction of the coding matrix

In this section we propose an approach for greedy construction of the coding matrix one column at a time. The families of coding matrices described in section 2 are all based on either constructing the whole matrix at once (e.g. one-vs.-one, one-vs.-rest, error-correcting codes), or constructing it one column at a time but with each column independent of the others (e.g. random coding matrices, where the only thing that connects different columns can be some general constraint e.g. regarding the density of the matrix).

It may be desirable to construct the matrix gradually, one column at a time (or at least a few columns at a time), while taking into account the part of the matrix that has already been constructed. In particular, if our goal is to maintain or improve the classification performance of the matrix as a whole (i.e. of the ensemble of binary classifiers implied by the matrix) while avoiding the need for an intractably large number of models, it makes sense to try constructing each new column of the matrix in such a way that the model for the binary problem defined by this new column will contribute as much as possible to the performance of the current ensemble of binary models. Therefore, we propose the following greedy approach for constructing the coding matrix:

Algorithm B: greedy construction of the coding matrix.
1 begin by initializing the first few columns of the matrix randomly, as described by Algorithm A in the previous section;
2 for each subsequent column j:
3 set $M_{cj} = 0$ for all $c = 1, \ldots, k$;
4 set $Anc_1 = \{\}$, $Anc_{-1} = \{\}$;
5 evaluate the current assembly of models, corresponding to columns $1, 2, \ldots, j-1$ of the matrix, on a validation set
6 let $E = (E_{cc'})$ be the *confusion matrix*, i.e. $E_{cc'}$ is the number of instances that belong to class c but were incorrectly predicted as belonging to class c';
7 while there are sufficiently few nonzero entries in the jth column, and not all pairs of classes (c, c') have been tried:
8 take next pair of classes (c, c') in decreasing order of $E_{cc'} + E_{c'c}$;
9 for this pair (c, c'), perform steps 5–10 of Algorithm A;
10 end while;

This algorithm uses the confusion matrix to identify difficult parts of the learning problem, and constructs the next column of the matrix so that its model will focus on those problematic parts, hopefully correcting the mistakes made by the previous models. The measure used to determine which classes to focus on is simply the number of confusions. The principle is similar to the one known in boosting, but boosting works on the level of individual instances, modifying the training set but keeping the number of classes intact. By contrast, the approach presented here could be thought of as boosting on the level of classes.

If the original classification problem has k classes, the confusion matrix is in principle a $k \times k$ matrix, but it's very sparse as each instance from the validation set can contribute only a limited number of confusions. Storing the matrix in memory becomes tractable if only the nonzero entries are stored explicitly. When computing the confusion matrix, the hierarchical structure of classes must also be taken into account. Thus an instance that belongs to (or is predicted as belonging to) a class c also belongs to (or is predicted as belonging to) any ancestor of that class. Currently, we use the following approach to compute the confusion matrix:

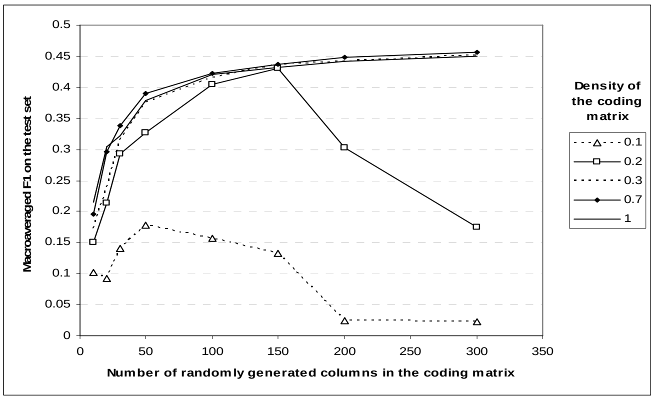
1 set $E_{cc'} = 0$ for all c from 1 to k and all c' from 1 to k;
2 for each instance x from the validation set:
3 let c be the correct class label of x, and A_c be the set of all ancestors of c;
4 let c' be the label predicted for x by the current ensemble, and let $A_{c'}$ be the set of all ancestors of c';
5 for each $c_1 \in A_c - A_{c'}$ and each $c_2 \in A_{c'} - A_c$,
6 increment $E_{c_1 c_2}$ by 1;

A problem with Algorithm B as described above is that the confusion matrix may not change much when a single new model is added to the ensemble. Therefore the next few models will be constructed similar to the current one, and will make similar prediction mistakes, causing poor performance of the ensemble as a whole. To avoid this problem, our current approach is to use a tabu list – a list of pairs of classes that have been used in the construction of the last few models and should therefore be ignored (skipped in step 8 of Algorithm B) when constructing the next model.

4 EXPERIMENTAL EVALUATION

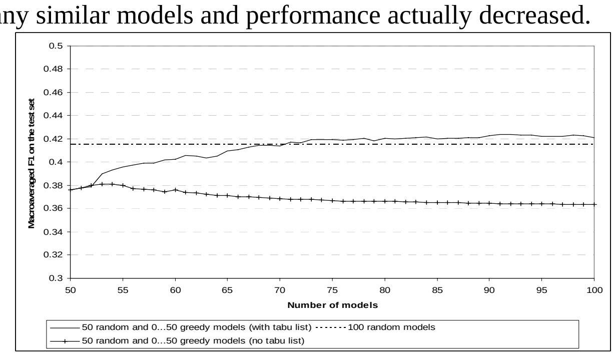
In this section we present some steps towards an experimental evaluation of our proposed approach. We use a subset of the *dmoz* ontology, consisting of the Top/Science category, seven of its subcategories, and 72 of its subsubcategories. From each of the resulting 80 categories, we included 100 documents for training and an additional 100 documents for testing.

The following chart explores the effect of two parameters used in the construction of a random coding matrix: the number of columns in the matrix and the average number of nonzero elements in each row of the matrix (and thus the density or sparsity of the matrix). The several line series on the chart correspond to different levels of matrix sparsity (i.e. 0.1 represents matrices with approx. 10% nonzero entries, etc.). All performance are averages over ten random matrices.



This experiment indicates that excessively sparse matrices should be avoided (the two lowest lines in the graph), especially if they consist of a large number of models, because decoding can be problematic under these conditions and the performance of the ensemble as a whole can degrade. Note that the macro-averaged F_1 measure that was used to evaluate these ensembles is somewhat problematic in this setting since it completely disregards the hierarchical relationship between the classes.

The following experiment illustrates the benefits of the greedy matrix construction algorithm over the purely random approach. Starting with 50 random columns, then generating up to 50 additional columns using our greedy approach. For comparison, we show the performance of a purely random matrix with 100 columns. As this example shows, extending the initial ensemble of 50 random columns by just 20 additional greedily-constructed columns led to the same performance as adding 50 additional random columns. Note that the use of tabu lists proved crucial in this case, as without it there were too many similar models and performance actually decreased.



5 CONCLUSIONS AND FUTURE WORK

As the experiments in sec. 4 show, the current approach is an improvement over random coding matrices in the sense that it requires fewer models are required to achieve comparable or better performance. At the same time, it is not significantly more expensive than the approach based on random matrices; the main additional cost is more evaluation of the ensemble (after each addition of a new column).

For future work, there are many changes and refinements that may be considered. The current approach is a greedy technique for exploring the space of possible coding matrices. The greedy constraints could be relaxed, or other optimization techniques could be used instead, such as local optimization or even genetic algorithms. However, this may make the training process too time-consuming, especially for large hierarchies of classes. Another direction for further work is a more thorough experimental evaluation of the proposed approach and a comparison with other approaches, especially other families of coding matrices, with a focus on large topic ontologies. It would also be interesting to extend the approach proposed here and make it able to deal with changing ontologies (i.e. addition or removal of concepts, etc.).

Acknowledgement

This work was supported by the Slovenian Research Agency SEKT (IST-1-506826-IP), and PASCAL (IST-2002-506778).

References

[1] Sebastiani, F., Machine learning in automated text categorization. ACM Computing Surveys, 34(1):1–47, March 2002.
[2] Boser, B. E., Guyon, I. M., Vapnik, V. N., A training algorithm for optimal margin classifiers. COLT, 1992.
[3] Cortes, C., Vapnik, V. N., Support-vector networks. Machine Learning, 20(3):273–297, September 1995.
[4] Joachims, T., Text categorization with support vector machines:Learning with many relevant features. ECML, 1998.
[5] Weston, J., Watkins, C., Support vector machines for multi-class pattern recognition. Proc. ESANN, 1999.
[6] Platt, J. C., Christianini, N., Shawe-Taylor, J., Large margin DAGs for multiclass classification. NIPS 12, The MIT Press, 2000.
[7] Dietterich, T. G., Bakiri, G., Solving multiclass learning problems via error-correcting output codes. JAIR, 2:263–286, January 1995.
[8] Berger, A., Error-correcting output coding for text classification. Workshop on Machine Learning for Inf. Filtering, IJCAI 1999.
[9] Rennie, J., Rifkin, R., Improving multiclass text classification with the support vector machine. MIT, AI Memo AIM-2001-026, 2001.
[10] Ghani, R., Using error-correcting codes for efficient text classification with a large number of categories. M.Sc. Thesis, Carnegie Mellon University, 2001.

SEMI-AUTOMATIC DATA-DRIVEN ONTOLOGY CONSTRUCTION SYSTEM

Blaž Fortuna, Marko Grobelnik, Dunja Mladenić
Department of Knowledge Technologies, Jozef Stefan Institute
Jamova 39, 1000 Ljubljana, Slovenia
Tel: +386 1 477 3127; fax: +386 1 477 3315
e-mail: blaz.fortuna@ijs.si

ABSTRACT

In this paper we present a new version of OntoGen system for semi-automatic data-driven ontology construction. The system is based on a novel ontology learning framework which formalizes and extends the role of machine learning and text mining algorithms used in the previous version. List of new features includes extended number of supported ontology formats (RDFS and OWL), supervised methods for concept discovery (based on Active Learning), adding of new instances to ontology and improved user interface (based on comments from the users).

1 INTRODUCTION

In [Fortuna05a] we introduce a semi-automatic, data-driven system for constructing topic ontologies called **OntoGen**. The phrases "semi-automatic" and "data-driven" stand for:

- **Semi-Automatic** – The system is an interactive tool that aids the user during the ontology construction process. The system suggests concepts, relations and their names, automatically assigns instances to concepts and provides a good overview of the ontology to the user trough concept browsing and visualization. At the same time the user can fully adjust all the properties of the ontology by manually adding or deleting concepts, relations and reassigning instances.
- **Data-Driven** – Most of the aid provided by the system (concept, relation suggestion, etc.) is based on some underlying data provided by the user at the beginning of the ontology construction. The data reflects the domain for which the user is building an ontology. Instance and instance co-occurrences are extracted from the data together with their profiles. Representation of profiles will be discussed later.

The system is used in the EU project SEKT as well as in several other smaller projects. We got very informative feedback from the users which we took very seriously when developing the new version.

Besides improvements based on the users feedback, we also continued research in the direction of improving and generalizing the system. The new functionality included in the system is based on machine learning and text mining methods such as *simultaneous ontologies* [4], *active learning* [10], *automatic ontology population* [6], *text corpora visualization* [5] and *semi-automatic ontology construction* [3].

The rest of this report is organized as follows. In the next section we give a short overview of the previous version of the system and analysis of the users feedback. We also give a short description of methods from previous deliverables which are included in the new version of the system. Section 3 describes a theoretical framework on which the new version of the system is based while Section 4 demonstrates its implementation. We conclude this report with future work directions and final conclusions.

2 RELATED WORK

Here we give a short description of the previous version of the system together with a list of most notable user comments about it. Following that are descriptions of the machine learning methods which we integrated into the new version presented in this paper.

2.1 OntoGen v1.0

In [3] we introduced a system called OntoGen for semi-automatic construction of topic ontologies. Topic ontology consists of a set of topics (or concepts) and a set of relations between the topics which best describe the data. The OntoGen system helps the user by discovering possible concepts and basic relations between them within the data.

For the representation of documents we use the well established bag-of-words document representation, where each document is encoded as a vector of term frequencies and the similarity of a pair of documents is calculated by the number and the weights of the words that these two documents share.

The central parts of OntoGen are the methods for discovering concepts from a collection of documents. OntoGen uses Latent Semantic Indexing (LSI) [2] and k-means clustering [7]. LSI is a method for linear dimensionality reduction by learning an optimal sub-basis for approximating documents' bag-of-words vectors. The sub-basis vectors are treated as topics. k-means clustering is used to discover topics by clustering the documents' bag-of-words vectors into k clusters where each cluster is treated as a topic.

The user interaction with the system is via a graphical user interface (GUI). When the user selects a topic, the system automatically suggests its potential subtopics. This is done by LSI or k-means algorithms only on the documents from the selected topic. The number of suggested topics is supervised by the user. User then selects the subtopics s/he finds reasonable and the system adds them to the ontology as subtopics of the selected topic.
The system also has two methods for extracting the main keywords which help the user to understand and name the topics: keyword extraction using centroid vectors (descriptive keywords) and keyword extraction using Support Vector Machine (SVM) [8] (distinctive keywords).

2.2 Active Learning

Active learning is a generic term describing a special interactive kind of learning process. In contrast to the usual (passive) learning where the student is presented with a static set of examples that are then used to construct a model, the active learning paradigm means that the student can 'ask' the 'oracle' (eg., a domain expert, the user, …) for a label of an example (see Figure 1). Here we use the SVM based method originally proposed in [10].

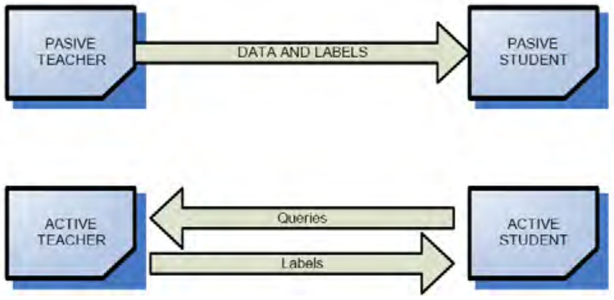


Figure 1: *Passive vs. Active Learning.*

2.3 Simultaneous Ontologies

The topic suggestion methods presented above heavily rely on the weights associated with the words – the higher the weight of a specific word the more probable that two documents are similar if they share this word. The weights of the words are commonly calculated by the so called TFIDF weighting [9].
In [4] we argue that this provides just one of the possible views on the data and propose an alternative word weighting that also takes into account the domain knowledge which provides the user's view on the documents. We integrated this method into data loading functions of the system.

2.4 Text Corpora Visualization

In [5] we presented a system for visualizing larger collection of documents. This system is now loosely integrated into OntoGen system to aid the user at comprehending and understanding the topics covered by the instances inside a specific concept. This is done by visualization of the instances using the Document Atlas tool [5].
Document Atlas is a tool for creating, showing and exploring visualizations of text corpora. The documents are presented as points on a map and the density is shown as a texture in the background. Most common keywords are shown for each area of the map. When the user moves the mouse around the map a set of the most common keywords is shown for the area around the mouse (the area is marked with a transparent circle). The user can also zoom-in to see specific areas in more details.

2.5 Ontology Population

In order to support addition of new instances to the ontology (ontology population) we use the approach proposed in [6], but instead of using k-nearest neighbors classifier in each of the concepts we use the concept's SVM linear model for classification of new instances into the existing ontology. The system shows to the user all the concepts that the instance belongs to together with the level of certainty for instance belonging to the concept (see Figure 5). Note that a new instance can be classified into more then one leaf concept.

3 USERS FEEDBACK

The topic ontology construction system was used in several projects, most notable being SEKT Case Studies *Decision Support for Legal Professionals* and *BT Digital Library*. We gathered the feedback from the users and used it as a guide when deciding what features to develop in the new version of the system.
Here we give a list of the main suggestions from the users, together with the related changes in the new version of OntoGen:

- Concept learning:
  - *"More details about the suggested concepts"* – the new version has extended keyword list describing suggested concepts
  - *"Generate suggestions only when explicitly asked"* – now the user must click a button to generate a suggestion list
  - *"I know what sub-concept to add but the system does not suggest it"* – now the user can generate concept suggestions by providing a query (for this task we used active learning)
- Concept management
  - *"How can I move a sub-concept?"* – this was already possible in the previous version by adding and removing relations; this is greatly simplified in the new version
  - *"System suggests a sub-concept which is not related to the selected concept"* – we added option to prune the suggested sub-concept which also removes related documents from the selected concept
- Ontology management

- *“Can I add new documents to the existing OntoGen ontology (e.g., to support online learning of digital library knowledge spaces)?”* – we added support for including new documents to the already built ontology

4 SYSTEM IMPLEMENTATION

4.1 Overview

The main window (Figure 2) is divided into three main areas. The largest part of the windows is dedicated to ontology visualization and document management part (the right side of the window). On the upper left side is the concept tree showing all the concepts from ontology and on the bottom left side is the area where the user can check details and manage properties of the selected concept and get suggestions for its sub-concepts.

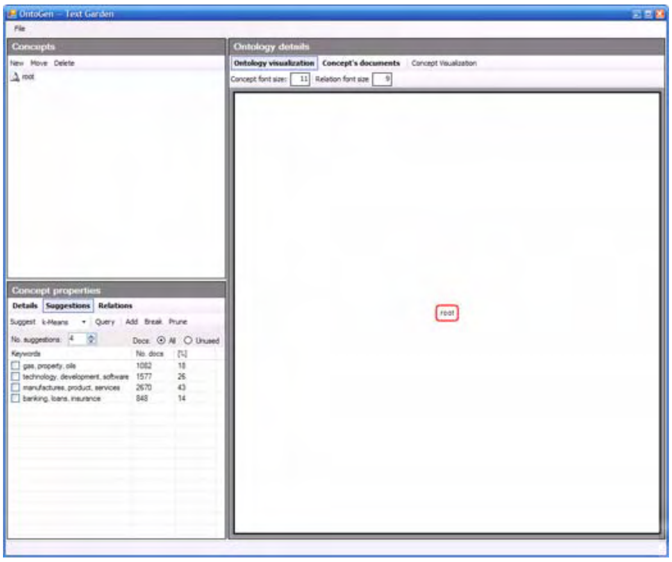


Figure 2: *The main window of the system.*

OntoGen supports several input formats for text instances and support for proprietary Text Garden format Bag-Of-Words. If the instances already have assigned some preliminary labels in the input data, then OntoGen automatically asks if it should apply SVM word weighting method [4]. Otherwise the TFIDF word weighting is used by default. Ontologies created in OntoGen can be saved as Proton Topic Ontology (also available in the previous version), RDF Schema or OWL ontology. OntoGen is also integrated into OntoStudio as a plug-in. The user can use it for creating initial version of ontology which he can then further refine inside OntoStudio.

4.2 Concept Suggestion

One of the main parts of the system is concept learning. There are two different approaches implemented for concept learning, supervised and unsupervised. In the unsupervised approach the system provides suggestions for possible sub-concepts of the selected concept and this was already implemented in the previous version of the system.

Sometimes the system identifies a sub-concept for which the user thinks that should not be part of the concept. The user can decide to prune the suggested sub-concept from the selected concept which effectively removes suggested sub-concept’s instances from the selected concept. The prune feature is new.

A new feature in OntoGen is a supervised method for adding concepts. In the supervised approach the user has an initial idea of what a sub-concept should be about and enters it into the system as a query. Implementation is based on active learning method described in Section 2.2. The querying and active learning is only applied to the instances from the selected concept.

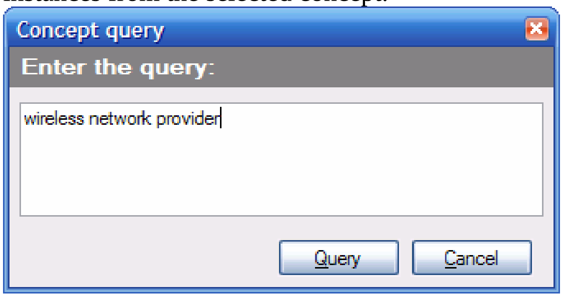


Figure 3: *The main window of the system.*

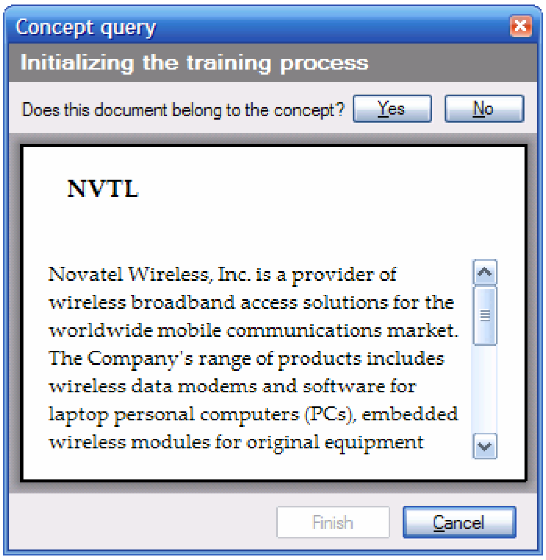


Figure 4: *The main window of the system.*

The user can start this method by clicking “Query” button. The system then launches a dialog that takes the query from the user (Figure 3). After the user enters a query the active learning system starts asking questions and labeling the instances (Figure 4). On each step the system asks if a particular instance belongs to the concept and the user can select Yes or No.

Questions are selected so that the most information about the desired concept is retrieved from the user. After some initial labeled sample is collected from the user the system displays some additional information about the concept. It displays the current size (number of documents positively classified into the concept) and most important keywords for the concept (using SVM keyword extraction). The user can continue answering the questions or finish by clicking on the Finish button. The more questions that the user answers the more correct assignment of instances in the final concept are. After the concept is constructed it is added to the ontology as a sub-concept of the selected concept.

Unsupervised vs. Supervised: There is a fundamental difference between the unsupervised and supervised methods. The main advantage of unsupervised methods is that it requires very little input from the user. The unsupervised methods provide well balanced suggestions for sub-concepts based on the instances and are also good for exploring the data. The supervised method on the other hand requires more input. The user has to first figure out what should the sub-concept be, he has to describe the sub-concept trough a query and go trough the sequence of questions to clarify the query. This is intended for the cases where the user has a clear idea of the sub-concept he wants to add to the ontology but the unsupervised methods do not discover it.

4.2 New Instance Importing

The new version of OntoGen also enables the user to add new instances to an existing ontology. Ontology population described in Section 2.5 is used for this.

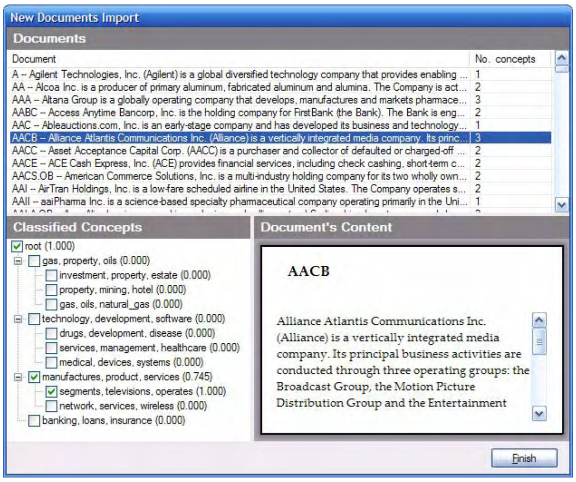


Figure 5: *Classification of new instances into the ontology.*

First the user loads new instances into the system. In the next step the system trains SVM classifiers on the instances already arranged into ontology and uses them to classify the new instances.

In the next step the OntoGen presents to the user a list of all the newly imported instances and their classification results (Figure 5). User can check and correct classifications for each of the instances by first selecting the instance from the list and then checking the appropriate concepts in the concept tree. Preview of the selected instance is also displayed to aid the user. The instances are automatically added to the ontology after the user clicks Finish.

4 CONCLUSIONS

In this paper we presented integration of various machine learning and text mining algorithms in a novel software tool for semi-automatic data-driven ontology construction. The system builds on top of our previous form [Fortuna05a] and includes new features based on users feedback and other research results from machine learning and text mining field.

As part of the future work we are planning to fully integrate relation learning into the system and to perform evaluation of the system based on ontology evaluation methods presented in [1].

OntoGen system is available as a free download from `http://ontogen.ijs.si/`.

Acknowledgement

This work was supported by the Slovenian Research Agency and the IST Programme of the EC under SEKT (IST-1-506826-IP), and PASCAL (IST-2002-506778).

References

[1] Brank, J., Grobelnik, M., Mladenić, D. A Survey of Ontology Evaluation Techniques. Conference on Data Mining and Data Warehouses (SiKDD 2005), Ljubljana, Slovenia, 2005.

[2] Deerwester S., Dumais S., Furnas G., Landuer T. & Harshman R. Indexing by Latent Semantic Analysis. J. of the American Society of Information Science, vol. 41/6, 391-407, 1990.

[3] Fortuna, B., Grobelnik, M. Mladenić, D. *Semi-automatic construction of topic ontology*. Proceedings of the ECML/PKDD KDO’05 Workshop.

[4] Fortuna, B., Grobelnik, M., Mladenić, D. *Background Knowledge for Ontology Construction*. WWW 2006, May 23.26, 2006, Edinburgh, Scotland.

[5] Fortuna, B., Grobelnik, M. Mladenić, D. *Visualization of Text Document Corpus*. Informatica 29 (2005), 497-502.

[6] Grobelnik M., Mladenik D. *Simple classification into large topic ontology of Web documents*. In Proceedings: 27th International Conference on Information Tech-nology Interfaces, 20-24 June, Cavtat, Croatia, 2005.

[7] Jain, A. K., Murty M. N., & Flynn P. J. *Data Clustering: A Review*. ACM Computing Surveys, vol 31/3, 264-323, 1999.

[8] Joachims, T. *Making large-scale svm learning practical*. In B. Scholkopf, C. Burges, and A. Smola, editors, Advances in Kernel Methods, Support Vector Learning, MIT-Press, 1999.

[9] Salton, G. *Developments in Automatic Text Retrieval*. Science, Vol 253, 974-979, 1991.

[10] Tong, S., Koller, D. *Support Vector Machine Active Learning with Applications to Text Classification*. In Proceedings of 17th International Conference on Machine Learning (ICML), 2000.

COMPARISON OF ONTOLOGIES BUILT ON TITLES, ABSTRACTS AND ENTIRE TEXTS OF ARTICLES

Ingrid Petrič[1], Tanja Urbančič[1,2], Bojan Cestnik[2,3]
[1]University of Nova Gorica
Vipavska 13, 5000 Nova Gorica, Slovenia
[2]Jozef Stefan Institute
Jamova 39, 1000 Ljubljana, Slovenia
[3]Temida, d.o.o.
Dunajska 51, 1000 Ljubljana, Slovenia
e-mail: ingrid.petric@p-ng.si, tanja.urbancic@p-ng.si, bojan.cestnik@temida.si

ABSTRACT

This work investigates the differences in automatically constructed ontologies from titles, abstracts and bodies of texts, respectively. Articles about autism from database PubMed Central served as our testbed. In the comparison of autism onthologies, built with OntoGen, we focuse on vocabulary level of results of automatic concepts construction. A graphical presentation of comparison results is also proposed. The experiments show high similarity between ontologies built on abstracts and ontologies built on texts in the case of a subfield with specific terminology while in other cases, the role of whole texts was more important.

1 INTRODUCTION

Ontologies have the capability to share a common understanding of domains, and therefore to support a research with ability to reason over and to analyze the information at issue (Joshi, Undercoffer, 2004). Every ontology should efficiently communicate the intended meaning of analyzed context (Gruber, 1993). In the recent years, many tools that help constructing ontologies from texts in a given problem domain were developed and successfully used in practice (Brank et al, 2005). Among them, OntoGen (Fortuna et al, 2006) achieved a remarkable attention in the text-mining community.

Our comparison of ontologies, built with the tool OntoGen, was made on 214 articles from database PubMed Central that treat problems of autism. When dealing with complex phenomena, one good strategy is to decompose it to more manageable parts (Zupan et al., 1997). The document corpora can be usually divided by hierarchical structure of a document into logical sections such as title, abstract and main body (Hollingsworth, 2005). For these reasons we compared the different ontologies built with OntoGen on titles, abstracts and texts (main bodies) of PubMed articles, also to find out the most objective definitions of autism concepts. In addition, upon finding autism as a multilevel, complex phenomena, our goal was also to review the autism literature and to identify the most frequent topics researched in this domain.

Autism belongs to a group of pervasive developmental disorders, that are characterised by early delay and abnormal development of cognitive, communication and social interaction skills of a person. In the fourth edition of Diagnostic and Statistical Manual of Mental Disorders, revised, the category of pervasive developmental disorders refers to a group of symptoms of neurological development, connected with early brain mechanisms, that in large extent condition the social abilities already in the childhood (American Psychiatric Association, 2000). Heterogeneity of this developmental disturbance and its different degrees of affecting children has led to contemporary naming of autism with term: *Autism spectrum disorders*, to which suits the abbreviation *ASD*. Among data on autism there is often used the term *Asperger syndrome* together with the term *autism*. There are few content similarities between Asperger syndrome and autism, where no mental retardation is present (Klin, Volkmar, 1995). Both disorders are diagnostically placed within the group of autism spectrum disorders (American Psychiatric Association, 2000).

In this article we investigate the impact of how the inclusion and exclusion of various parts of scientific articles from the autism domain affect the constructed ontologies. More specifically, we study the differences in automatically constructed ontologies from titles, abstracts and bodies of texts respectively. First, we describe the origin and preparation of input texts. Then, we present the process of ontology construction with OntoGen. Next, we compare the obtained ontologies on vocabulary level and analyze the observed similarities and differences.

2 TARGET DATASET

For the purpose of mining the data on autism, we chose to analyze the professional literature that is publicly accessible on the World Wide Web in the data base of biomedical publications, PubMed. In the PubMed data base there we found 10.821 documents (till August 21, 2006) that contain derived forms of *autis**, the expression root for autism. Between them there were 354 articles for which also their entire text has been published in the PubMed Central data base. Other relevant publications were either restricted to abstracts of documents or their entire texts were published in sources outside PubMed. From the listed 354 articles we further restricted the target set of articles on documents to those that have been published in the last ten years. As a result, we got 214 articles from 1997 forward, which we decomposed to titles, abstracts and texts for the analysis purpose.

3 ONTOLOGIES CONSTRUCTION BY ONTOGEN ON DOCUMENTS FROM PUBMED CENTRAL

OntoGen is a tool that enables interactive construction of ontologies about certain domain. The input for the tool is a collection of text documents. The user can create concepts, organize them into topic ontology and also assign documents to concepts. With the use of machine learning techniques OntoGen supports individual phases of ontology construction by suggesting concepts and their names, by defining relations between them, and by automatic assignment of documents to the concepts (Fortuna, 2005).
From the 214 documents, which had also their whole text published in the PubMed Central data base since 1997, the next 3 input text files were made: the file of 214 titles, the file of 214 abstracts, and the file of 214 texts (without their titles and abstracts). Each text file was entered into OntoGen, that from the entry data forms a model of most frequent terms and relations between them by K-means clustering technique. K-means algorithm tries to find such groups of documents that share similar words (Fortuna et al., 2006). The ontologies were built with two values for parameter *k* (for K-means algorithm in OntoGen): first, with parameter *k*=8, as automatically suggested by OntoGen, and second, with parameter *k*=5 that turned out to be a balanced tradeoff between the complexity and comprehensibility in this domain. In this way we got 8 and 5 topics respectively on the first level of domain ontology on entered titles, on abstracts and on entire texts of 214 autism documents. The concepts names (Keywords) and numbers of related documents (No. Docs) are presented by parts of OntoGen's screenshots in figures 1-6.

Id	Keywords	No. Docs
0	root	214
1	preference, assessment, effects	31
2	reinforcement, children_autism, early	27
3	genes, susceptibility, specific	32
4	functioning, syndrome, analysis	26
5	autism, teach, child	25
6	vaccination, schedules, activated	24
7	social, evidence, chromosome	17
8	disorders, linkage, case	32

Figure 1: *Concepts of autism ontology with 8 subgroups of 214 titles from the PubMed Central data base.*

Id	Keywords	No. Docs
0	root	214
1	sensory, sounds, auditory	8
2	stereotypy, behavioral, problems_behavioral	26
3	reinforcers, preferred, stimulus	41
4	teach, question, procedure	18
5	gene, linkage, regional	60
6	parent, mmr, vaccine	16
7	language, age, children	28
8	vaccine, mmr, mmr_vaccine	17

Figure 2: *Concepts of autism ontology with 8 subgroups of 214 abstracts from the PubMed Central data base.*

Id	Keywords	No. Docs
0	root	214
1	executive, nv, cortical	26
2	stereotypies, reinforcement, problems_behavior	27
3	reinforcement, session, aggression	38
4	prompted, script, teaching	21
5	linkage, family, gene	55
6	ht, secretin, legs	8
7	chemical, infant, sleep	14
8	vaccine, mmr, mmr_vaccine	25

Figure 3: *Concepts of autism ontology with 8 subgroups of 214 texts from the PubMed Central data base.*

Id	Keywords	No. Docs
0	root	214
22	autism, children_autism, children	67
23	syndrome, detection, social	19
24	disorders, spectrum, neurodevelopmental	39
25	genetic, chromosome, linkage	50
26	reinforcement, effects, behavior	39

Figure 4: *Concepts of autism ontology with 5 subgroups of 214 titles from the PubMed Central data base.*

Id	Keywords	No. Docs
0	root	214
22	reinforcers, behavioral, problems_behavioral	49
23	language, foxp2, children	52
24	reinforcers, vaccine, aggression	46
25	linkage, gene, regional	55
26	virus, infection, trim5alpha	12

Figure 5: *Concepts of autism ontology with 5 subgroups of 214 abstracts from the PubMed Central data base.*

Id	Keywords	No. Docs
0	root	214
22	reinforcement, session, trial	72
23	reinforcement, sleep, infant	37
24	vaccine, mmr, mmr_vaccine	24
25	linkage, family, gene	71
26	infection, pml, patients	10

Figure 6: *Concepts of autism ontology with 5 subgroups of 214 texts from the PubMed Central data base.*

The distribution of documents among 8 subgroups of titles ontology (Fig. 1) is quite uniform. Differently from that, the ontologies of 8 abstracts subgroups (Fig. 2), and 8 texts subgroups (Fig. 3), both show one major subgroup of documents that treat genetics, and another important group that describe reinforcers or stimulus for autists. Documents distributions in ontologies of 5 subgroups are a little different. There are two major groups of titles (Fig. 4) and texts (Fig. 6). The biggest group of titles describe autism in general, whereas the largest texts group writes about reinforcement trials. The second major group in both cases (titles and texts) deals with genetics. Abstracts distributions (Fig. 5), on the contrary show two most important groups that both treat genetics in some way. The first one has clear genetic keywords. The second group includes, beside others, the keyword *foxp2*, which is a gene important for the development of speech.

4 COMPARISON OF AUTISM ONTOLOGIES ON VOCABULARY LEVEL

Ontologies are complex structures, where there is often more reasonable to focus the attention on the evaluation of separate levels of ontology, rather than on the direct evaluation of whole ontology (Brank et al., 2005). In our comparison of autism ontologies, built with OntoGen, we focused on vocabulary level of results of automatic concepts construction about autism domain. We observed distribution of documents within individual ontology groups on the first level of each ontology model (first level subgroups of autism domain), considering terminology that was chosen by OntoGen for presentation of concepts. In addition, with the support of OntoGen, we tried to evaluate also the content compliance of titles and summaries to belonging entire texts of related documents.

Clustering algorithms, such as K-means, are useful tools for data mining; however when we have to cluster datasets, it is not always clear, which is the most suitable number of clusters (parameter *k*) to use (Hamerly, Elkan, 2003). OntoGen automatically proposes 8 clusters, beside this the user should try with different *k*-s in order to find out the best result for the investigated domain.

4.1 Comparison of ontologies, analysed by parameter *k*=8 in K-means clustering

The evaluation of different results, next to changing the parameter *k* when analysing the phenomenon of autism as it is described in 214 documents from PubMed Central data base, showed differences between conceptual design of titles, abstracts and related texts. Our graphic display in figure 7 is result of comparison of ontologies above abstracts and texts, that were analysed by parameter *k*=8 in K-means clustering performed by OntoGen. From the comparison between ontology of 8 texts groups versus 8 abstracts groups, the major similarity is shown between the group of genetic documents, which include the same 40 articles from the observed dataset. An important similarity is seen also between the group of texts and the group of articles, that talk about reinforcement. Without the specific similarity with groups of abstracts remains only the smallest group of texts, with keywords: *ht, secretin, legs*. From the keywords of this group and by the contextual knowledge of the autism phenomenon we deduce, that in this case, the group is related to documents which present the concepts, that are rarely mentioned in autism context.

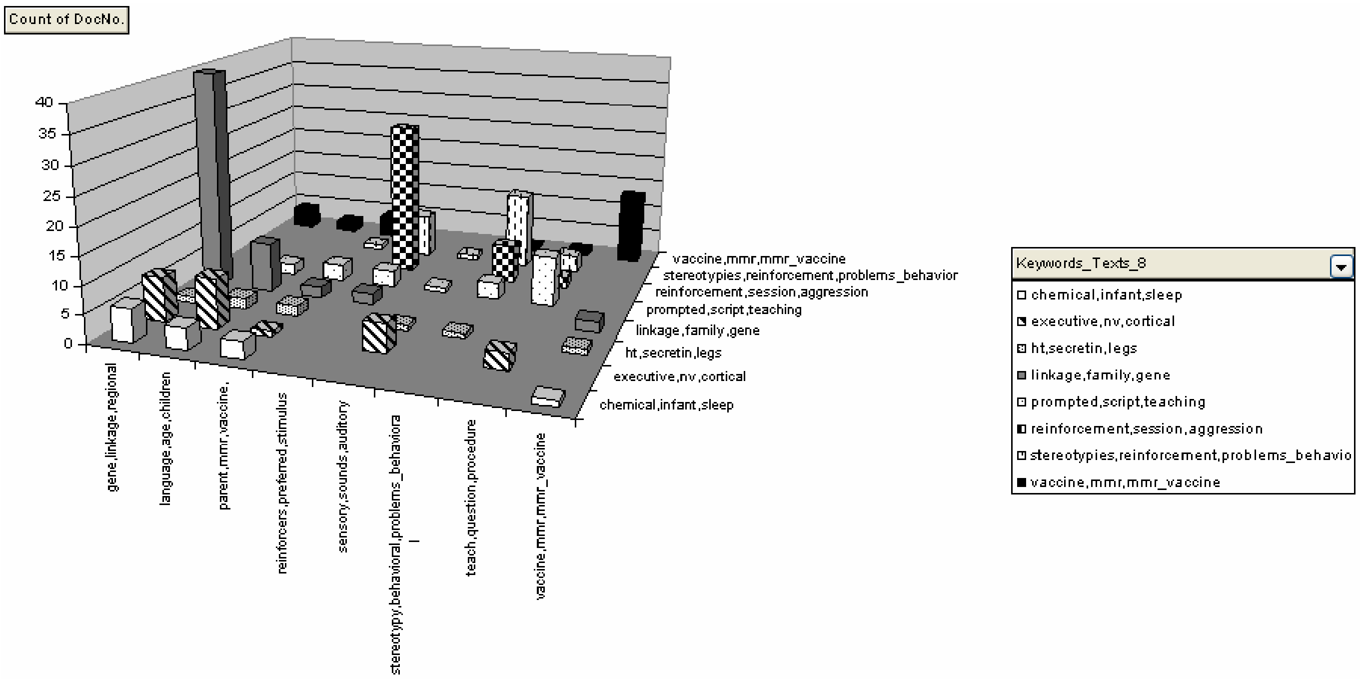


Figure 7: *Comparison between the distribution of abstracts and texts in ontologies with 8 subgroups.*

Compared to analysis of texts and abstracts matching, there is significantly lower similarity between texts and titles or between abstracts and titles of relative articles. Articles about genetics are the only rather important group of documents that have some more similar vocabulary both in texts versus titles, as well as in abstracts versus titles comparison. This is due to the genetic terminology, and to the genetic context itself, which is very specific, if compared to other researching fields of autism.

4.2 Comparison of ontologies, generated with parameter *k*=5

After having analysed the autism domain by parameter *k*=8, we analysed autism, as it is presented by 214 documents from PubMed Central data base, by *k*=5 and many other different parametres as well. Among the groups of documents which belong to the certain of 5 subgroups of texts and at the same time to its relative subgroup of abstracts, the largest similarity is between the group of genetic texts and abstracts, which cover the same 51 documents. Relatively large similarity is seen also between the texts and the abstracts groups that deal with virus infections. Less similarity is between the group of texts and corresponding abstracts subgroup about MMR vaccine. Even less specific is similarity between abstracts and texts from groups: *reinforcement, session, trial* and *reinforcement, sleep, infant*. In this case we can notice one of the keywords used twice, as a part of definition of two separate concepts in texts ontology (the term *reinforcement*), like in abstracts ontology (the term *reinforcers*).
The comparison of ontologies with 5 groups of texts and 5 groups of titles shows the biggest similarity between the groups of texts and titles on genetics, as well as between the group of texts: *reinforcement, session, trial* and a group of titles, to which belong keywords: *autism, children_autism, children*. Besides the already mentioned genetics articles, there are no specific similarities between the ontology of abstracts and the ontology of titles.

5 CONCLUSIONS AND FUTURE WORK

When trying to identify some useful knowledge from huge volumes of digital data, rather then reading and manually analysing all available data, which is a time consuming task, we can guide our attention only on the most relevant information above domain of interest. Such information can be identified by ontologies construction, that we found as a very fast and effective way of exploration of large datasets. Ontologies actually helped us to review and understand the complex and heterogeneous specter of scientific articles about autism.
Comparison of ontologies is, such as ontology itself, complex and requires thorough examination of possible causes for revealed distributions of documents inside certain ontology. Our graphic presentation of compared ontologies clearly exposes the main clusters of autism articles, which are shown as the highest columns in the graph. Thus it provides a powerful way to visualize the biggest similarities in observed ontologies, where we can see that the largest collection of autism documents always deal with genetics. The only exception comes from the comparison of ontologies of 5 texts groups and 5 titles groups, that beside genetics, gives importance also to the keyword *autism* (*autism, children_autism, children*). Here rises the question, whether the distribution of documents within ontologies, woud be the same, if we delete from the input files those expressions, that mark the domain itself, as is in our case the term *autism* and its derivatives. In our opinion, this entry data preprocessing step could significantly change distributions of documents between groups of ontology and would contribute to the clearer identification of ontology concepts.

References

1. American Psychiatric Association: Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision. Washington, DC, 2000.
2. Brank J, Grobelnik M, Mladenić D: A survey of ontology evaluation techniques. In: SIKDD 2005 at multiconference IS 2005, Ljubljana, Slovenia, 17 October 2005.
3. Fortuna B:[http://ontogen.ijs.si/index.html], OntoGen: Description, 2006.
4. Fortuna B, Grobelnik M, Mladenić D: System for semi-automatic ontology construction. Demo at ESWC 2006. Budva, Montenegro, June, 2006.
5. Gruber TR: Toward Principles for the Design of Ontologies Used for Knowledge Sharing. In: Formal Ontology in Conceptual Analysis and Knowledge Representation. Padova, Italy, 1993.
6. Hamerly G, Elkan C: Learning the k in k-means, Proc. of the Neural Information Processing Systems 2003, [http://citeseer.ist.psu.edu/hamerly03learning.html].
7. Hollingsworth B, Lewin I, Tidhar D.: Retrieving Hierarchical Text Structure from Typeset Scientific Articles - a Prerequisite for E-Science Text Mining. In: Proceedings of the 4th UK E-Science All Hands Meeting, Nottingham 2005, 267-273.
8. Joshi A, Undercoffer JL: On Data Mining, Semantics, and Intrusion Detection. What to Dig for and Where to Find It. In: Data mining. Next Generation Challenges and Future Directions. Menlo Park, California, 2004. 437-460.
9. Klin A, Volkmar FR: Asperger's Syndrome, Guidelines for Assessment and Diagnosis. Pittsburgh, Learning Disabilities Association of America, June 1995.
10. PubMed Central [http://www.ncbi.nlm.nih.gov/]
11. Zupan B, Bohanec M, Bratko I, Cestnik B: A Dataset Decomposition Approach to Data Mining and Machine Discovery. In: KDD 1997, Ljubljana, Slovenia. 299-302.

APPROXIMATE REPRESENTATION OF TEXTUAL DOCUMENTS IN THE CONCEPT SPACE

Jasminka Dobša
University of Zagreb,
Faculty of Organization and Informatics
Pavlinska 2, 42000 Varaždin, Croatia
jasminka.dobsa@foi.hr

Bojana Dalbelo Bašić
University of Zagreb,
Faculty of Electrical Engineering and Computing
Unska 3, 10 000 Zagreb, Croatia
Bojana.Dalbelo@fer.hr

ABSTRACT

In this paper we deal with the problem of addition of new documents in collection when documents are represented in lower dimensional space by concept indexing. Concept indexing is a method of feature construction that is relying on concept decomposition of term-document matrix. This problem is especially interesting for application on World Wide Web. Proposed methods are tested for the task of information retrieval.

Vectors on which the projection is done in the process of dimension reduction are constructed on the basis of representations of all documents in the collection, and computation of the new representations in the space of reduced dimension demands recomputation of concept decomposition. The solution to this problem is the development of methods which will give approximate representation of newly added documents in the space of reduced dimension.

1 INTRODUCTION

In this paper we deal with the problem of addition of new documents in collection when documents are represented in lower dimensional space by concept indexing. This problem is especially interesting for application on World Wide Web. Proposed methods are tested for the task of information retrieval [1].

Methods for dimension reduction in the vector space model based on extraction of new parameters for representation of documents (feature construction) tend to overcome the problem of synonyms and polysemies which are two major obstacles in information retrieval. Our investigation is based on the method of feature construction called *concept indexing* which was introduced 2001 by Dhillon and Modha [6]. This method is relying on the *concept decomposition* of the term-document matrix.

Representation of new document in the vector space model is trivial. The problem appears when we want to add new documents in the space of reduced dimension. Namely, vectors on which the projection is done in the process of dimension reduction are constructed on the base of representations of all documents in the collection, and computation of the new representations in the space of reduced dimension demands recomputation of the concept decomposition. The solution to this problem is the development of methods which will give approximate representation of newly added documents in the space of reduced dimension.

Methods for addition of representations of new documents in the space of reduced dimension are already developed for LSI method [3,8]. The method of LSI was introduced in 1990 [4] and improved in 1995 [3]. Since then LSI is a benchmark in the field of dimension reduction. Kolda and O'Leary [7] developed a method for addition of representations of new documents for LSI method that uses semi-discrete decomposition.

2 DIMENSIONALITY REDUCTION BY THE CONCEPT DECOMPOSITION

Let the $m \times n$ matrix $A = [a_{ij}]$ be the term-document matrix. Then a_{ij} is the weight of the i-th term in the j-th document. A query has the same form as a document; it is a vector whose i-th component is the weight of the i-th term in the query. A common measure of similarity between the query and the document is the cosine of the angle between them. In order to rank documents according to their relevance to the query, we compute $s = q^T A$, where q is the vector of the query, while the j-th entry in s represents the score in relevance to the j-th document.

Techniques of feature construction enable mapping documents representations, which are similar in their content, or contain many index terms in common, to the new representations in the space of reduced dimension, which are closer than their representations in original vector space. That enables retrieving of documents which are relevant for the query, but do not contain index terms contained in the vector representation of query.

In this section we will describe the algorithm for computation of concept decomposition by the fuzzy *k*-means algorithm [5].

2.1 Fuzzy k-means algorithm

The fuzzy *k*-means algorithm (FKM) [9] generalizes the hard *k*-means algorithm. The goal of the *k*-means algorithm is to cluster *n* objects (here documents) in *k* clusters and find *k* mean vectors or centroids for clusters. Here we will call these mean vectors *concept vectors*, because that is what they present. As opposed to the hard *k*-means algorithm, which allows a document to belong only to one cluster, FKM allows a document to partially belong to multiple clusters. FKM seeks a minimum of a heuristic global cost function $J_{fuzz} = \sum_{i=1}^{k} \sum_{j=1}^{n} \mu_{ij}^{b} \left\| a_j - c_i \right\|$ where $a_j, j = 1, \ldots, n$ are vectors of documents, $c_i, i = 1, \ldots, k$ are concept vectors, μ_{ij} is the fuzzy membership degree of document a_j in the cluster whose concept is c_i and b is a weight exponent of the fuzzy membership.

2.2 Concept decomposition

Our target is to approximate each document vector by a linear combination of concept vectors. The *concept matrix* is an $m \times k$ matrix whose *j*-th column is the concept vector c_j, that is $C_k = [c_1, c_2, \ldots c_k]$. If we assume linear independence of the concept vectors, then it follows that the concept matrix has rank *k*. Now we define the *concept decomposition* P_k of the term-document matrix *A* as the least-squares approximation of *A* on the column space of the concept matrix C_k. Concept decomposition is an $m \times n$ matrix $P_k = C_k Z^*$ where Z^* is the solution of the least-squares problem, that is

$$Z^* = \left(C_k^T C_k\right)^{-1} C_k^T A . \qquad (1)$$

Z^* is a matrix of the type $k \times n$ and its columns are representations of documents in the concept space. Similarly, representation of query *q* in the reduced dimension space is given by $\left(C_k^T C_k\right)^{-1} C_k^T q$ and similarity between document and the query is given by the cosine of the angle between them.

Concept indexing is a technique of indexing text documents by using concept decomposition.

3 ADDITION OF NEW DOCUMENT REPRESENTATIONS IN THE CONCEPT SPACE

In this section novel algorithms for addition text documents representations in the concept space are proposed. The goal is to add new documents in a collection represented in the reduced dimension space, and this goal is achieved with and without an extension of the list of the index terms.

Let us introduce matrix notation that will be used in the section. Matrix

$$A = \begin{bmatrix} A_1 & A_2 \\ A_3 & A_4 \end{bmatrix} \qquad (2)$$

will be an extended term-document matrix, where A_1 a is matrix of starting documents in the space of starting terms, A_3 is a matrix of starting documents in the space of added terms, A_2 is a matrix of added documents in the space of starting terms and A_4 is a matrix of added documents in the space of added terms. Further, let m_1 be number of starting terms, m_2 number of added terms, n_1 number of starting documents and n_2 number of added documents.

Here we will introduce two methods of approximate addition of new documents in the concept space:

(a) projection of new documents on existing concept vectors (Method CI_A),

(b) projection of new documents on existing concept vectors extended in dimensions of newly added terms (Method CI_B).

Assume that documents of a starting matrix A_1 are clustered by fuzzy *k*-means algorithm and centroids of clusters are computed. Let C_1 be the concept matrix the columns of which are concept vectors and let C_2 be a matrix consisting of extensions of concept vectors in dimensions of added terms. Extensions of concept vectors are calculated analogously as concept vectors by using respective columns of matrix A_3 instead of columns of A_1. Let extensions of concept vectors form extension of the concept matrix denoted by C_2. Then $C = \begin{bmatrix} C_1 \\ C_2 \end{bmatrix}$ is the concept matrix the columns of which are concept vectors extended in dimensions of newly added terms. Representations of documents in the concept space of extended term-document matrix will be given by expression

$$\left(\begin{bmatrix} C_1 \\ C_2 \end{bmatrix}^T \begin{bmatrix} C_1 \\ C_2 \end{bmatrix}\right)^{-1} \begin{bmatrix} C_1 \\ C_2 \end{bmatrix}^T \begin{bmatrix} A_1 & A_2 \\ A_3 & A_4 \end{bmatrix}$$
$$\approx [\left(C_1^T C_1\right)^{-1} C_1^T A_1 + \left(C_1^T C_1\right)^{-1} C_2^T A_2 \qquad (3)$$
$$\vdots \left(C_1^T C_1\right)^{-1} C_1^T A_3 + \left(C_1^T C_1\right)^{-1} C_2^T A_4]$$
$$= [(4) + (5) \ \vdots \ (6) + (7)].$$

This expression can easily be shown if approximation $\left(C_1^T C_1 + C_{21}^T C_2\right) \approx C_1^T C_1$ is assumed. Such an approximation is justified by the fact that extensions of concept vectors are sparser than concept vectors formed from starting documents, because the coordinates of extended concept vectors are weights of added terms which were not included in list of the index terms before addition of new documents. It was established, by experiment, that $\left\|C_2^T C_2\right\|_2 << \left\|C_1^T C_1\right\|_2$. The number of operations is significantly reduced by this approximation, because inverse $\left(C_1^T C_1\right)^{-1}$ is already computed during the computation of starting documents projection.

This approximation is not necessary for the application of Method CI_A, because this method does not use extensions of concept vectors. Representations of starting documents are given by expression (4), while representations of added documents are given by expression (5) in the last row of expression (3).

By the Method CI_B added documents are projected on the space of extended concept vectors. Vector representations of starting documents are already known, and they are given by the (4) in the last row of expression (3), while representations of added documents are computed by the formula

$$\left(C_1^T C_1\right)^{-1} C_1^T A_3 + \alpha \left(C_1^T C_1\right)^{-1} C_2^T A_4, \quad (8)$$

where coefficient $\alpha > 1$ has a role of stressing the importance of added terms and documents.

4 EXPERIMENT

Experiments are conducted on MEDLINE collection of documents. The collection contains 1033 documents (abstracts of medical scientific papers) and 35 queries. The documents of collection are split randomly into two parts: starting documents and added documents. The ratio of starting and added documents is varied: first added documents form 10% of the whole collection, then 20% of the whole collection, and so on. Starting list of index terms is formed on the basis of starting collection of documents. In the list are included all words contained in at least two documents of starting collection, which are not on the list of stop words. Further, the list of index terms is formed for the whole collection of documents in an analogous way. The obtained list of index terms for the whole collection contains 5940 index terms.

We have used measure of mean average precision (MAP) for evaluation of the experimental results. Concept decomposition is conducted under starting collection of documents and added documents are represented in the concept space by using one of the described methods for approximate addition of documents. After that, an evaluation of information retrieval performance is conducted under the whole collection of documents. Dimension of the space of reduced dimension is fixed to *k=75.*

In the second row of Table 1, there is MAP of information retrieval in the case that procedure of concept decomposition is conducted under whole collection of documents (percentage of added documents is 0%). This value presents MAP in the case of recomputation of concept decomposition when new documents are added in the collection. All other values of MAP in the cases when the collection is divided into collection of starting and added documents in the different ratios, could be compared to this value.

The second column of Table 1 presents number of added documents, while the third column presents number of added terms. Let us note that number of added terms grows linearly, and that the collection with only 20% of starting documents is indexed with a much smaller set of index terms then the whole collection. The fourth row presents MAP of information retrieval for approximate addition of new documents by Method CI_A (without addition of new index terms). The rest columns of Table 1 present MAP of information retrieval for approximate addition of new documents by Method CI_B (with addition of new index terms) for different values of parameter α.

From the results we can conclude that an addition of new index terms does not improve results of MAP significantly. The results obtained by Method CI_B, α=2.0 are not significantly better in comparison to results obtained by Method CI_A according to pared t-test (α=0.05).

5 CONCLUSIONS

Values of MAP for approximate methods are acceptable in comparison to repeated computation on concept decomposition when the number of added documents is the same or smaller than the number of starting documents. There is a drop of MAP when the number of added documents exceeds the number of starting documents.

Results of MAP are not significantly improved by the methods that use extended list of index terms obtained as a result of addition of documents. It is interesting to notice that this statement is valid even in the cases when the list of index terms is significantly enlarged, which is when larger proportion of documents is added. This results show a great redundancy present in the textual documents.

Percentage of added documents	**Number of added documents**	**Number of added terms**	**MAP** Method CI_A	**MAP** Method CI_B α=1.0	**MAP** Method CI_B α=1.5	**MAP** Method CI_B α=2.0
0	0	0	54.99	54.99	54.99	54.99
10	104	456	51.98	52.20	52.33	**52.37**
20	208	753	54.96	55.10	55.09	**55.23**
30	311	1264	51.90	51.78	51.97	**52.03**
40	414	1673	50.84	50.60	51.09	**51.64**
50	517	2089	48.64	47.99	48.29	**48.64**
60	620	2696	44.26	44.08	45.04	**45.49**
70	723	3282	43.59	41.86	42.32	**42.70**
80	826	4024	39.87	40.56	42.56	**43.74**

Table 1. *MAP of information retrieval for methods of approximate representation of added documents by projection on existing concept vectors (Method CI_A) and extended concept vectors (Method CI_B). The best results for every split of the collection are achieved by using Method CI_B, α=2.0 (shown bolded).*

References

[1] R. Baeza-Yates, B.Ribeiro-Neto. *Modern Information Retrieval*, Addison-Wesley, ACM Press, New York, 1999.

[2] M. W. Berry, Z. Drmač, E. R. Jessup. Matrices, Vector Spaces, and Information Retrieval, *SIAM Review*, Vol. 41. No. 2. 1999, pp. 335-362.

[3] M. W. Berry, S. T. Dumais, G. W. O'Brien. Using linear algebra for intelligent information retrieval, *SIAM Rewiew*, Vol. 37. 1995, pp. 573-595.

[4] S. Deerwester, S. Dumas. G. Furnas. T. Landauer, R. Harsman. Indexing by latent semantic analysis, *J. American Society for Information Science,* Vol. 41. 1990, pp. 391-407.

[5] J. Dobša, B. Dalbelo-Bašić. Concept decomposition by fuzzy k-means algorithm, *Proceedings of the IEEE/WIC International Conference on Web Intelligence, WI 2003*, 2003, pp. 684-688.

[6] I. S. Dhillon, D. S. Modha, Concept Decomposition for Large Sparse Text Data using Clustering, *Machine Learning* , Vol. 42. No. 1, 2001, pp. 143-175.

[7] T. Kolda, D. O'Leary. A semi-discrete matrix decomposition for latent semantic indexing in information retrieval, *ACM Trans. Inform. Systems*, Vol. 16, 1998, pp. 322-346.

[8] G.W. O'Brien. *In formation Management Tools for Updating an SVD-Encoded Indexing Scheme,* Master s thesis, The University of Knoxville, Tennessee, 1994.

[9] J. Yen. R. Langari. *Fuzzy Logic: Intelligence, Control and Information*, Prantice Hall, New Jersey, 1999.

OVERVIEW OF ALGORITHMS FOR GRAPH DRAWING

Boštjan Pajntar
Department of Knowledge Technologies
Jozef Stefan Institute
Jamova 39, 1000 Ljubljana, Slovenia
Tel: +386 1 4773128
E-mail: bostjan.pajntar@ijs.si

ABSTRACT

This paper presents an overview of many possible types of graph visualization, and also detailed descriptions of the most popular algorithms. Its primal goal is, to help a user, with some relational data on his hands and a need to visualizing it, with the choice of what to use, and what is out there that can be used. However, it can be also viewed as historical overview of graph drawing algorithms, and its evolution.

1 INTRODUCTION

Once, information was a commodity. However, with the development of internet, large amounts of data became publicly available. The problem shifted, from obtaining the information, to extracting the useful one. With, statistical analysis, and even more so, with data mining, we are able to extract the needed information. However, since the tabular view, output of most data mining techniques, is hardly human readable, a need for a visualization arises. Since a picture is worth a thousand words, graph, a way to draw any relational data became a good and very popular way for presenting harvested information.
Quite a few good algorithms for graph drawing were created; some just for certain type of graphs while other for any.

2 OF GRAPHS

Definitions in graph theory vary in the literature. For our needs a loose definition of graph G is a triple (V, E, λ)

- set of vertices V
- set of edges E
- function λ, that maps every end of edge to a vertex

A loop is an edge, which at both ends maps to the same vertex. A multi-edge means two vertices are connected by more than one edge (Figure 1). A graph without loops and multi-edges is simple. If edges are directed, we get directed graph (digraph).

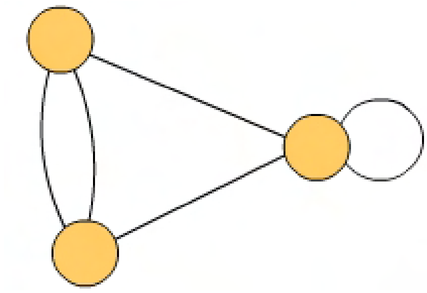


Figure 1: *Graph with one loop and one multi-edge.*

3 GRAPH SIZES

There is no commonly accepted nomenclature for graph sizes. Usually size is defined with the number of vertices, which is not necessarily the best solution. Computers are faster every day, so this numbers varies with time.
Perhaps a better approach is to define the size of a graph with the computational complexity.
We partition graphs to small, medium, large and huge.

- On small graphs one can run more or less any algorithm. This graphs today (2006) are of the order n*10 (up to 150 nodes).
- Medium graphs can be drawn with polynomial algorithms, of low degree. These graphs are also small enough, so they can be drawn on regular screen. Number of nodes n*100.
- Big graphs can no longer be drawn indirectly (we run out of pixels on the computer screen). However, they have to be small enough, to be stored in the memory.
- Even bigger graphs are called huge.

We also distinguish between differently sparse graphs. [5]

- Sparse: |E| <= |V|
- Normal: |V| < |E| <= 3 |V|
- Dense: |E| > 3 |V|

This nomenclature considers trees as sparse, hyper-cubes, polyhedra and such as normal graphs.

4 GRAPH EMBBEDING

The quality of graph visualization is of course a subjective judgment. It depends on the graph, and the information we want to extract from it. There are only few studies on how

people read information from graphs [7], most criterions are chosen intuitively.
The prime directive: the user should be able to obtain information from graph, that interest him, as easy as possible.
Some criterions for a good graph representation:

- Vertices should be equally distributed on the screen.
- Small number of edge crossings.
- The length of edges should be uniform.
- The symmetries in the graph structure should be visualized.
- Graf should be bound inside a frame.

These criteria usually well define our demands. However, there are exceptions.

- Planar drawings give better results if edges are of different length (Figure 3, 4)
- For large graphs, clusters of nodes must be used; one of the visualizations is, placing all the nodes in the cluster at one point.
- For very dense graphs, it makes sense to merge edges similar to train tracks. This way it is possible, to obtain a planar drawing of otherwise nonplanar graph. (Figure 2).

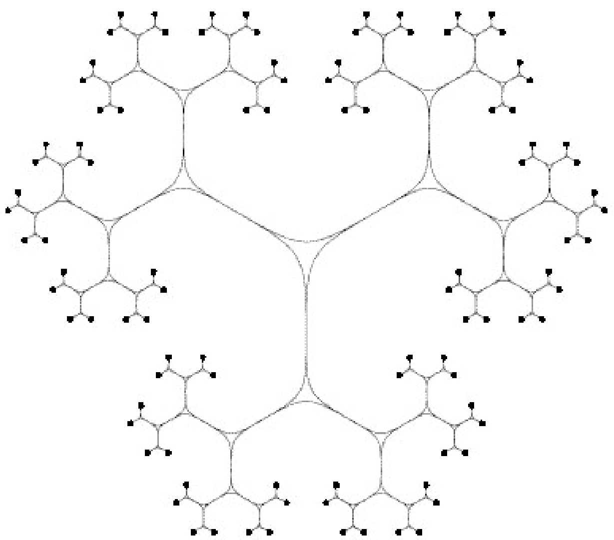


Figure 2: *Full graph on 96 nodes in delta-confluent drawing.*

5 ALGORITHMS

For visualizing graphs many types of algorithms exist. Most common for simple undirected graphs are algorithms that use an analogy from physics. This sort of algorithms will get the most attention in this paper. However, if the graph has some other characteristic, we can employ some other technique.

5.1 Algorithms for graphs with additional properties

5.1.1 Orthogonal style

Graphs can be drawn in orthogonal stile. Usually this method is used for digraphs, as we obtain diagrams. Every edge can bend, but every part is always either horizontal or vertical. This is way edge crossings are always orthogonal. Readability of graph benefits from this.

5.1.2 Sugiyama style

A good way of graph drawing is layered layout. If we have acyclic digraph (DAG), it is possible to layer the graph, on the base of topological numbering. Thus we obtain a flowchart, with all the edges directed in one direction. For example, if there exists an edge from vertex A to B, A is above (or left of) B. The beauty of this approach is that any undirected graph can be converted into DAG. A good algorithm was proposed by Sugiyama [11]. Look also in [8]. The algorithm decomposes into three phases.

1. Distribution of nodes to layers $O(|V| + |E|)$
2. Crossing minimization. (NP-hard, but with good heuristics)
3. Coordinate assignment $O(|E|)$

5.1.3 Planar embedding

Planar graph is a graph, which can be embedded into a plane (or sphere). In other words, there exists an embedding without edge crossings. There is more than one interesting algorithm which achieves this [12]. Any nonplanar graph can be converted to planar, drawn by these algorithms and than previously deleted edges, can be reinserted.

5.2 Drawing on Physical Analogies, historical overview

Here follows overview of algorithms on physical analogies. To every state (drawing) of the graph, we assign an energy value. Smaller energy stands for a better drawing. In this way, search for a good visualization is converted into search of a global minimum of some function. Algorithms vary, in both energy function, and search algorithm.

5.2.1 Spring embedder – Eades [4]

The most intuitive approach to graph drawing comes from a simple physical model. Every vertex is considered a steel ring. Edges between vertices are springs between them. We start with random placing and let the model to be governed by forces. Algorithm stops after a fixed number of iterations. This is a weakness, as different graphs, converge with different speeds.
There are two differences with physical laws. Spring force does not follow Hook law. Secondly forces in algorithm change velocity not acceleration. This difference is

important, as stationary stable state is preferred to a moving one.
Visually the algorithm takes care of two things. Firstly, the edge lengths are uniform, and secondly symmetries in graph structure are visualized. This is a nice surprise, as the algorithm does not aim toward symmetries explicitly.

5.2.2 Kamada and Kawai (KK) [9]

Kamada and Kawai have improved the spring embedder. Algorithm is otherwise similar, except we treat every two vertices as if they were connected by a spring of some length. Spring length is obtained from theoretical length between the vertices, which is the shortest path between them.
Another improvement was that one iteration moves only one vertex. Time complexity in theory remains the same; however, the convergence improves considerably.

5.2.3 Davidson and Harel (DH) [3]

Any energy function can be minimized with simulated annealing (SA). Energy function for the system is chosen, lower energy meaning better result. Move to a worse state is permitted with tolerance to current temperature. With SA the global minima is usually not found; however, the result is usually sufficiently close. One criterion for this algorithm to work is that walleyes of minima are as wide as deep.
Davidson and Harel chose neighborhoods of a state to be any state that is the same as initial with one vertex moved inside a ball of radius r. For better efficiency they chose to decrease r with lower temperature (usually in SA neighborhoods remain the same). For energy function they took a sum of desired properties: repulsion among vertices, frame action on vertices and attraction of edges. At the last stage of fine tuning of SA, when move into bad direction is no longer accepted, they added two more summands. The first one penalized edge crossings, the second one penalizes nodes being to close to edges.
The algorithm is very time consuming, due to SA. In some cases it can produce better results in contrast to others, as more planar drawing can be explicitly asked for. (Figure 3)

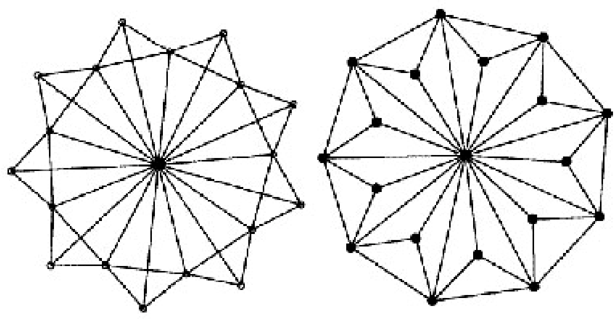


Figure 3: *Same graph drawn with FR and DH*

5.2.4 Fruchterman and Reingold (FR) [6]

Fruchterman and Reingold only demanded 2 criteria for a good graph drawing.

1. Connected nodes should be close.
2. No two different vertices should be to close.

In every iteration we calculate all the attracting forces from connected vertices, and the repulsing forces from all the nodes. Since there is no scalar penalty for edge crossings, the result is a vector, which points out not just how much out of place the vertex is (vector size) but also into which way it should move. The size of actual move is confined to current temperature, which is linearly decreased in every iteration.
This very simple algorithm provides excellent results. Its main advantage is its speed and robustness. Even today, after years of its creation, it is still one of the most popular algorithms for graph drawing.
Due to the fact, we do not penalize edge crossings; the final result often looks as projection of polyhedra into a plane (Figure 4). This can be considered as a feature.

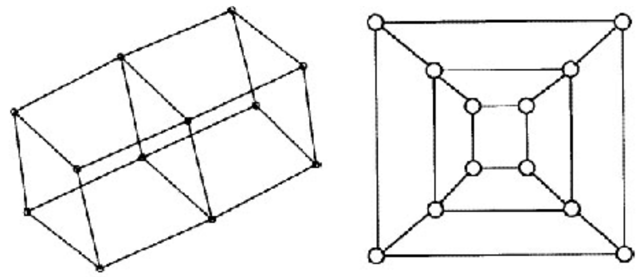


Figure 4: *Graph drawn with FR and the usual plane embedding*

5.2.5 Graph Embedder (GEM) [5]

GEM algorithm improves calculation time of FR. Main improvements are local temperature for every vertex, which provides a way to suppress rotation and oscillations around the optima, and increases a move into the right direction. Secondly gravitation towards barycenter is introduced, which helps disconnected graphs stick together, and also boosts the convergence. Thirdly algorithm is able to stop prematurely if average local temperature is low enough (drawing good enough).
The results are similar to FR algorithm, while the calculation time is better. However, the algorithm is not as robust as FR as some graphs exit algorithm too quickly.

5.2.6 LinLog vertex and edges repulsion [10]

LinLog model was introduced and well accepted at GD03 and GD05 conferences. Three different energy functions are at work; however they can be joined into one model.
One is similar to FR; the other two are created in a way that already tries to cluster graphs. The first of later two is called Vertex-Repulsion LinLog. The results can be seen

in Figure 5. The third energy function, Edge-Repulsion LinLog, is crafted especially for graphs with vertices with a considerable difference of the degree. Nodes with high degree are pushed further apart. This is very useful for social networks, which usually have high degree variance. Apart from different energy function, a Barnes and Hut's algorithm is used for vertex repulsion calculation. Time complexity is reduced from the usual $O(|V|^2)$ to $O(|V|\log(|V|))$.

Figure 5: Pseudo-random graph with intra-cluster edge probability 0.16 and inter-cluster edge probability 0.01; left LinLog right FR

5.2.7 Multi-Scale algorithm [13]

If even faster algorithm is required, we can use algorithm that comes from intuition that graph should look nice on all scales. First a decreasing sequence of radiuses $r_0, r_1 \dots r_n$, is chosen. Than for every radius r_i a locality preserving k-clustering with respect to r_i takes place. Value k is chosen appropriately to the current radius. All the vertices of the cluster are placed to cluster barycenter, and the locale beautification of the clusters takes place.
The algorithm is extremely fast; however, it has problems with graphs of degenerate diameter.

5.2.8 High-Dimensional Embedding [14]

This even faster algorithm runs in linear time! The idea behind it: a good graph drawing in a space of high dimension is easily drawn. Usually 50 dimensions suffice. The second phase is projecting the graph to the usual two or three dimensional space. Algorithm is lightning fast and works perfect on some of the usual graphs i.e. mash, while on more everyday - real life graphs, sometime maps to many points onto a single point. However, placing tens of thousands of nodes in couple of seconds is nice to have.

6 CONCLUSION

What algorithm to choose is up to the user and his needs. Fruchterman-Reingold algorithm is very robust and fast enough to draw most everyday graphs interactively. If we need interactive speed for large graphs, other methods must be used. On the other hand, with larger graphs, the placement is usually not as important as visualization of certain attributes we want to highlight. If graph has some additional data, we can usually harness it.

There are also many "off the shelf" applications under public licenses that provide graph drawing. They are usually written in java and freely available online. The algorithms used, are as of rule the ones presented here, with possible minor improvements.

Acknowledgement

This work was supported by the Slovenian Research Agency and the IST Programme of the EC under PASCAL Network of Excellence (IST-2002-506778).

References

[1] J. Barnes and P. Hut. A Hierarchical O(NlogN) Force Calculation Algorithm. Nature, 1986.
[2] Dirk Beyer and Andreas Noack. Clustering software artifacts based on frequent common changes. In IWPC '05: Proceedings of the 13th International Workshop on Program Comprehension, pages 259–268, Washington, DC, USA, 2005. IEEE Computer Society.
[3] Ron Davidson and David Harel. Drawing graphs nicely using simulated annealing. ACM Transactions on Graphics, 15(4):301–331, 1996.
[4] Peter Eades. A heuristic for graph drawing. 42:149–160, 1984.
[5] Arne Frick, Andreas Ludwig, and Heiko Mehldau. A fast adaptive layout algorithm for undirected graphs. In Roberto Tamassia and Ioannis G. Tollis, editors, Proc. DIMACS Int. Work. Graph Drawing, GD, number 894, pages 388–403, Berlin, Germany, 10–12 1994. Springer-Verlag.
[6] T. M. J. Fruchterman and E. M. Reingold. Graph drawing by forcedirected placement. Softw. Pract. Exper., 1991.
[7] Weidong Huang and Peter Eades. How people read graphs. In APVIS, pages 51–58, 2005.
[8] Michael J¨unger and Petra Mutzel, editors. Graph Drawing Software. Springer Mathematics and Visualization Series, 2004.
[9] T. Kamada and S. Kawai. An algorithm for drawing general undirected graphs. Inf. Process. Lett., 1989.
[10] A. Noack. An energy model for visual graph clustering, 2003.
[11] K. Sugiyama, S. Tagawa, and M. Toda. Methods for visual understanding of hierarchical system structures. SMC-11(2):109–125, February 1981.
[12] W. T. Tutte. How to draw a graph. In Proceedings London Math. Society, pages 743–768, 1963. Graph drawing.
[13] D. Harel, Y. Koren. A Fast Multi-Scale Method for Drawing Large Graphs, Journal of Graph Algorithms and Applications, vol. 6, no. 3, pp 179-202, 2002
[14] D. Harel, Y. Koren. Graph Drawing by High-Dimensional Embedding. Graph Drawing: 10t International Symposium, GD2002, Irvine, CA, USA, August 26-28, 2002

FINDING COMMUNITY STRUCTURE IN SOCIAL NETWORK ANALYSIS - OVERVIEW

Jan Rupnik
Department of Knowledge Technologies
Jozef Stefan Institute
Jamova 39, 1000 Ljubljana, Slovenia
Tel: +386 1 4773419; fax: +386 1 4251038
e-mail: jan.rupnik@ijs.si

ABSTRACT

This paper is an overview of some of the basic concepts in the theory of social network analysis. We start with defining social networks and basic structures such as walks and components. We introduce different measures of centrality, prestige, and a measure of modularity used in detecting community structure. We conclude with an overview of different approaches to finding communities in networks.

1 INTRODUCTION

A social network is a set of people or groups each of which has connections of some kind to some or all of the others. In the language of social network analysis, the people or groups are called ‘‘actors’’ and the connections ‘‘ties’’. Both actors and ties can be defined in different ways depending on the questions of interest. An actor might be a single person, a team, or a company. A tie might be a friendship between two people, a collaboration or common member between two teams, or a business relationship between companies. The realationships between actors can be symmetric (for example: communicates with) or directional (for example: lent money to). The corresponding mathematical models are un-drirected graph and directed graph.

2 COLLABORATION NETWORKS

A common type of social networks are the affiation networks. An affiliation network is a network of actors connected by common membership in groups of some sort, such as clubs, teams, or organizations. They are suitable for statistical analysis since membership to a group can usually be determined precisely. They can get very large, since they can be extracted automatically. interviews or questionnaires unnecessary. A network of movie actors, for example, and the movies in which they appear has been compiled using the resources of the Internet Movie Database , and contains the names of nearly half a million actors.

A good example of an affiliation network is the scientific collaboration network in which the link between two scientists is established by their coauthorship of one or meny articles. If a paper has *k* coauthors we get a *k*-clique. groups of coauthors of a single paper.
This network is in some ways more truly a social network than many affiliation networks; it is probably fair to say that most pairs of people who have written a paper together are genuinely acquainted with one another, in a way that movie actors who appeared together in a movie may not be.

3 WALKS, TRAILS, PATHS

A **walk** is a sequence of actors and relations that begins and ends with actors. A *closed walk* is one where the beginning and end point of the walk are the same actor. Process of the monetary exchange is an example where a dollar bill travels from one person to another with no limitations.

A **trail** between two actors is any walk that includes a given relation no more than once (the same other actors, however, can be part of a trail multiple times. The length of a trail is the number of relations in it. An example of a trail is the gossip process, where story is moving through an informal network. It never travels between the same pair of actors, but can reach the same actor multiple times.

A **path** is a walk in which each other actor and each other relation in the graph may be used at most one time. The single exception to this is a closed path, which beginsand ends with the same actor. Length of a path is the number of it’s links. Two paths are independent if they share no nodes (except beginning and the end). They are line independent if they share no lines. An example of a path is the viral infection which activates effective immunological response (every actor is infected at most once).

A **chain** is a walk in a directed graph, that ignores is not restricted by direction of edges.

4 COMPONENTS

A subset of vertices in a network is called ***a strongly connected component*** if (taking directions of lines into account) from every vertex of the subset we can reach every other vertex belonging to the same subset. Between any two vertices from the same connected component there always exists a walk. We say that they are strongly connected.

If direction of lines is not important (where we consider the network to be undirected), such a subset is called a ***weakly connected component***. Between any two vertices from the same weakly connected component there always exists a chain. We say that the two vertices are weakly connected.

5 COMMON MEASURES

Distance
Geodesic distance between two nodes is the length of the shortest path between them. Diameter of a network is the maximum of all possible distances in that network.

Centrality
The centrality of a node in a network is a measure of the structural importance of the node. A person's centrality in a social network affects the opportunities and constraints that they face. There are three important aspects of centrality: degree, closeness, and betweenness.

- **Degree** - Degree centrality is the number of nodes that a given node is connected to. In general, the greater a person's degree, the more potential influence they have on the network, and vice-versa.

- **Closeness** - Closeness centrality is defined as the total graph-theoretic distance to all other nodes in the network. When a node has a low closeness score (i.e., is highly central), it tends to receive anything flowing through the network very quickly.

- **Betweenness** - A node highly is central, if it lies on several shortest paths among other pairs of nodes. More precisely, if g_{ij} is the number of geodesic paths from *i* to *j* and g_{ikj} is the number of paths from *i* to *j* that pass through *k*, then g_{ikj}/g_{ij} is the proportion of geodesic paths from *i* to *j* that pass through *k*. The sum $c_k = \sum g_{ikj}/g_{ij}$ for all *i,j* pairs is betweenness centrality of node *k*.

Prestige measures
Prestige measures are usually computed for directed networks only, since for this measures the direction is important property of the relation. (Example: Persons, who are chosen as friends by many others have a special position - prestige in the group.) Prestige becomes salient especially if positive choices are not reciprocated, for instance if people tend to express positive sentiments towards prestigious persons but receive negative sentiments in return. In these cases, social prestige is connected to social power and the privilege not to reciprocate choices.

- **Input degree -** According to meaning of relation they represent support or influence.Degree is a very restricted measure of prestige because it takes into account direct choices only.

- **Influence domain -** The influence domain of a vertex in a directed network is the number or proportion of all other vertices which are connected by a path to this vertex. It is an extension of prestige to indirect choices. This measure is usefull for networks that are not strongly connected (in which case input closeness centrality is used) .

- **Mean distance -** Computing the mean distance of a vertex from vertices in it's influence domain gives a numeric index, so that direct choices contribute more to prestige than indirect. (Problem: vertices with small influence domains can have low average distance, but are not very influential)

- **Proximity prestige -** We compute proximity prestige (PP) of selected vertex by dividing the influence domain of a vertex (expressed as a proportion) by the average distance from all vertices in the influence domain. A larger influence domain and a smaller distance yield a higher proximity prestige score.

- **Hubs and authorities –** A measure of prestige commonly used for web graphs (directed network of homepages). In directed networks we can usually identify two types of important vertices: hubs and authorities. Each home page describes something (is an authority) and because of that other pages point to it. But on the other hand each page points to some other pages (is a hub). Vertex is a good hub, if it points to many good authorities, and is a good authority, if it is pointed to by many good hubs. For each vertex *v* we compute weights $0 \le x_v, y_v \le 1$, which tell us the strength of authority and hub of a given vertex. Weights are computed according to network by solving the eigenvector problem of matrices AA^T

(hubs) and AA^T (authorities), where A is the adjacency matrix.

Reach

Given an integer *k*, reach of node v is defined as number of nodes with the length of the shortest path to *v* less or equal to *k*. Some studies have shown that key paths in most social networks are one or two (rarely three) steps long.

Network Centralization

Network centralization is the variance of computed node centralities. Network, where a low number of nodes have much higher centrality than other nodes is highly centralized. A very centralized network is dominated by one or a few very central nodes. If these nodes are removed or damaged, the network quickly fragments into unconnected sub-networks. A highly central node can become a single point of failure. A network centralized around a well connected hub can fail abruptly if that hub is disabled or removed. Hubs are nodes with high degree and betweenness centrality.

Clustering coefficient

The clustering coefficient is a measure of the likelihood that two associates of a node are associates themselves. A higher clustering coefficient indicates a greater 'cliquishness'. Given a node *v*, it is calculated as the proportion between all triangles that contain *v* and all connected triplets (with *v* in the middle) in the network. Network clustering coefficient is defined as the arithmetic mean of clustering coefficients of every node.

Network cohesion

Refers to the degree to which actors are connected directly to each other by cohesive bonds. Groups are identified as 'cliques' if every actor is directly tied to every other actor, or 'social circles' if there is less stringency of direct contact. Structural cohesion level *k* corresponds to the mathematical term *k*-connectivity. A graph is *k*-connected if there exists a set of *k* vertices whose removal renders *G* disconnected, and which can not be achieved with a smaller set.

Modularity

Modularity is a property of a network and a specific proposed division of that network into communities. It measures when the division is a good one, in the sense that there are many edges within communities and only a few between them. For a division with *g* groups, we define a $g \cdot g$ matrix e whose component e_{ij} is the fraction of edges in the original network that connect vertices in group *i* to those in group *j*. Then the modularity is defined to be

$$Q = \sum_i e_{ii} - \sum_{ijk} e_{ij} e_{ki} = \mathrm{Tr}\,\mathbf{e} - \|\mathbf{e}^2\|,$$

where $||x||$ is the sum of all the elements of *x*. A value of $Q = 0$ indicates that the community structure is no stronger than would be expected by random chance and values other than zero represent deviations from randomness.

6 COMMUNITY STRUCTURE

Many networks are inhomogeneous, consisting not of an undifferentiated mass of vertices, but of distinct groups. Within these groups there are many edges between vertices, but between groups there are fewer edges, producing a structure like that sketched in Fig. 1. Such groups are called communities. Communities in a web graph for instance might correspond to sets of web sites dealing with related topics, while communities in a biochemical network or an electronic circuit might correspond to functional units of some kind.

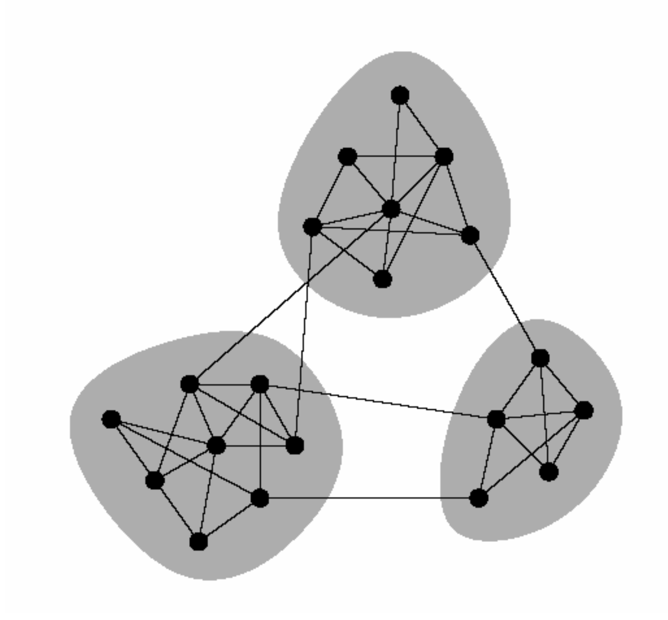


Figure 1: *Small network with strong community structure. The network breaks into three communities.*

7 ALGORITHMS FOR DETECTING COMMUNITY STRUCTURE

7.1 DIVISIVE METHOD BASED ALGORITHMS

Girvan Newman algorithm [3]

Algorithm progressively removes edges with highest edge betweenness from the original graph. If a network contains communities or groups that are only loosely connected by a few inter-group edges, then all shortest paths between different communities must go along one of these few edges. Thus, the edges connecting communities will have high edge betweenness. By removing these edges, we separate groups from one another and so reveal the underlying community structure of the graph. After removing an edge the algorithm recalculates betweenness centralities for every node which can be done in $O(n^2)$ on sparse networks (See Brandes [8]).

The algorithm of Radicchi et al. [4]
Algorithm removes edges that belong to a relatively low number of loops, for they are likely to be edges between communities.

7.2 AGGLOMERATIVE HIERARCHICAL CLUSTERING METHOD BASED ALGORITHMS

Modularity optimization algorithm [2]
Starting with a state in which each vertex is the sole member of one of n communities, we repeatedly join communities together in pairs, choosing at each step the join that results in the greatest increase (or smallest decrease) in modularity. This method can be applied to very large networks.

Single linkage methods
The idea behind this technique is to develop a measure of similarity between pairs of vertices, based on the network structure one is given. Many different such similarity measures are possible. Once one has such a measure then, starting with an empty network of n vertices and no edges, one adds edges between pairs of vertices in order of decreasing similarity, starting with the pair with strongest similarity. Structural equivalence is an example of a similarity measure. Two vertices are said to be structurally equivalent if they have the same set of neighbors.

7.3 OTHER METHODS

Spectral bisection algorithm [5]
A method based on the eigendecomposition of the Laplacian matrix (identity matrix minus adjacency matrix). Eigenvector, corresponding to the second lowest eigenvalue, determines a partition of nodes into two communities.

8 CONCLUSION

We have reviewed some of the basic indices for social network analysis and illustrated how we can apply some of them in more complex algorithms (GN algorithm, for example).

Acknowledgement
This work was supported by the Slovenian Research Agency and the IST Programme of the European Community under NeOn (IST-4-027595-IP) and PASCAL Network of Excellence (IST-2002-506778). This publication only reflects the authors' views.

References

[1] Stanley Wasserman, Katherine Faust, Social Network Analysis: Methods and Applications, *United Kingdom: Cambridge University Press, 1994*

[2] Aaron Clauset, M. E. J. Newman, and Cristopher Moore: Finding community structure in very large networks, *Phys. Rev. E 70, 066111 (2004)*

[3] M. Girvan and M. E. J. Newman, Community structure in social and biological networks. *Proc. Natl. Acad. Sci. USA 99, 7821{7826 (2002).*

[4] F. Radicchi, C. Castellano, F. Cecconi, V. Loreto, and D. Parisi, Defining and identifying communities in networks. *Preprint cond-mat/0309488 (2003)*

[5] A. Pothen, H. Simon, and K.-P. Liou, Partitioning sparse matrices with eigenvectors of graphs. *SIAM J. Matrix Anal. Appl. 11, 430-452 (1990).*

[6] M. E. J. Newman, The structure of scientific collaboration networks, *Proc. Natl. Acad. Sci. USA 98, 404-409 (2001)*

[7] R. Hanneman, Introduction to Social Network Methods. *University of California, Riverside: Department of Sociology, 2001.*

[8] Ulrik Brandes:A Faster Algorithm for Betweenness Centrality. *Journal of Mathematical Sociology 25(2):163-177, 2001.*

Loose Phrase String Kernels

Janez Brank
Department of Knowledge Technologies
Jozef Stefan Institute
Jamova 39, 1000 Ljubljana, Slovenia
e-mail: janez.brank@ijs.si

Abstract

When representing textual documents by feature vectors for the purposes of further processing (e.g. for categorization, clustering, or visualization), one possible representation is based on "loose phrases" (also known as "proximity features"). This is a generalization of n-grams: a loose phrase is considered to appear in a document if all the words from the phrase occur sufficiently close to each other. We describe a kernel that corresponds to the dot product of documents under a loose phrase representation. This kernel can be plugged into any kernel method to deal with documents in the loose phrase representation instead of the bag of words representation.

1 Introduction

When processing textual documents using data mining techniques (such as categorization, clustering, or visualization), each document must typically be represented by a feature vector. In this vector, each component indicates the number of occurrences of the feature in the document. (Various weighting and normalization schemes can be applied on top of that, such as the well-known TF-IDF weighting.) The features can be defined in various ways; the most common approach is to define one feature for each term that occurs anywhere in our corpus of documents. The corresponding component of the vector is simply the number of occurrences of the term in the document. This representation is known as the "bag of words" or the "vector space model".

However, several other kinds of features have also been proposed, for example n-grams, which are sequences of n adjacent words. An n-gram is said to have occurred in the document if all of its words occur one immediately after another in the correct order. n-grams have been shown to improve performance vis-a-vis the bag of words model for some text categorization tasks [5]. The motivation for using n-grams is that an n-gram, since it consists of several adjacent words, may correspond to a phrase, which can be more informative than if each of its individual words is considered in isolation of the others. As an alternative to n-grams, phrases defined on linguistic principles (e.g.ñoun phrases, adjective phrases, etc.; or subjects, objects, predicates, etc.) can be used if a suitable natural-language parser is available.

One possible criticism of n-grams is that they can be too rigid since they insist that the words must appear in a particular order and with no words intervening in between. This rigidity can be said to be at odds with linguistic reality. The occurrence conditions can be relaxed in various ways, for example by removing the requirement that the words of the phrase must occur in a particular order (thus the phrase is treated as a bag of words rather than a sequence of words), and by allowing the words of the phrase to be interspersed by other words that are not part of the phrase. These relaxed requirements lead to "loose phrases", sometimes also known as "proximity features" since the only remaining condition is that the words of the phrase must occur sufficiently close to one another.

A downside of both n-gram representation is the large number of possible features; the resulting vectors can be huge and are only tractable because they are also very sparse. Care must be taken to generate these vectors in an efficient manner [5]. The problem of such a representation is exacerbated if it leads to *non-sparse* vectors in the same (and very high-dimensional) vector space, which can easily happen during classification or clustering. If loose phrases are used instead of n-grams, the problem becomes even worse because the relaxed occurrence requirements mean that a lot more phrases now occur in a document than was the case under the stricter occurrence requirements of the traditional n-grams.

Thus, n-gram and loose phrase representations are good candidates to benefit from kernelization. Let X be the space of our documents and F be the vector space of our document representations (e.g. based on n-grams or loose phrases), in which a document $x \in X$ is represented by the vector $\phi(x) \in F$. A *kernel* is a function $K(x, \hat{x}) = \langle \phi(x), \phi(\hat{x}) \rangle_F$, where $\langle \cdot, \cdot \rangle_F$ is an inner product on F (e.g. the usual dot product of vectors). Many data mining methods, such as support vector machines [4], do not require us to be able to do anything more with the data except compute a kernel over it. They are collectively known as "kernel methods" [1]. This enables us to avoid the unwieldy explicit representations of very high-dimensional vectors $\phi(x)$ as long as we can compute a suitable kernel $K(x, \hat{x})$ without constructing $\phi(x)$ and $\phi(\hat{x})$ explicitly.

For the n-gram representation, a suitable kernel (the "string kernel") has been described by Lodhi et al. in [3]. Kernels for various other discrete structures besides strings have also been considered [2]. In this paper we present a kernel that corresponds to the loose phrase representation.

2 Definitions

Consider a *document* $d = d_1 \dots d_n$, where d_i is the i'th word. A number of *windows* are defined over the document, $W(d) = \{w_1, \dots, w_r\}$. For each window $w_k \in W(d)$ we have a set of indices, $I_k \subseteq 1..n$, and a set of *distinguished indices* $J_k \subseteq I_k$ such that the set $\{J_k : w_k \in W(d)\}$ is a partition of $1..n$. We will also impose the requirement that J_k must be disjoint with $\cup_{\kappa > k} I_\kappa$; this requirement will be helpful later when dealing with occurrences of phrases on a window-by-window basis while making sure that no occurrence is counted more than once. We will discuss some concrete examples of window families, and the corresponding distinguished index sets, at the end of the next section.

Given a *phrase* $t = \mathit{bag}(t_1, \dots, t_m)$, we define its *occurrences* thus:

$$\begin{aligned} \mathit{occurs}_d(t, I) \Leftrightarrow t = \mathit{bag}(d_i : i \in I) \\ \wedge \exists w \in W(d) : I \subseteq I_w. \end{aligned}$$

Then the *frequency* of t in d is

$$\phi_d(t) = |\{I \subseteq 1..n : \mathit{occurs}_d(t, I)\}|.$$

A document can now be represented by a vector $\phi(d) := (\phi_d(t))_{t \in T}$, where T is the set of all phrases of length at most M. We would like to compute the kernel $K(d, \tilde{d}) = \langle \phi(d), \phi(\tilde{d}) \rangle$ as efficiently as possible.

3 The Loose Phrase String Kernel

Each occurrence I of t in d must be wholly located in some window; but it may actually be wholly located in several different windows. In any case, we can find the first window such that not only is I contained in that window but it but also contains one of the distinguished indices of that window. This can be used to partition the occurrences of t in d.

$$\begin{aligned} \mathit{Occ}_d(t, w_k) := \{I : \mathit{occurs}_d(t, I) \wedge \\ k = \arg\min\{\kappa \in 1..r : I \subseteq I_\kappa \wedge I \cap J_\kappa \neq \emptyset\}\}. \end{aligned}$$

Each group of occurrences can be counted separately,

$$\phi_d(t, w_k) = |\mathit{Occ}_d(t, w_k)|.$$

Clearly, $\phi_d(t) = \sum_{k=1}^r \phi_d(t, w_k)$. Thus we get

$$\begin{aligned} K(d, \tilde{d}) &= \textstyle\sum_{t \in T} \phi_d(t) \phi_{\tilde{d}}(t) \\ &= \textstyle\sum_{t \in T} \sum_{k=1}^r \sum_{\tilde{k}=1}^{\tilde{r}} \phi_d(t, w_k) \phi_{\tilde{d}}(t, \tilde{w}_{\tilde{k}}) \\ &= \textstyle\sum_{k=1}^r \sum_{\tilde{k}=1}^{\tilde{r}} K(d, \tilde{d}, k, \tilde{k}) \end{aligned}$$

if we define

$$K(d, \tilde{d}, k, \tilde{k}) = \textstyle\sum_{t \in T} \phi_d(t, w_k) \phi_{\tilde{d}}(t, \tilde{w}_{\tilde{k}}).$$

It turns out that

$$\begin{aligned} I \in \mathit{Occ}_d(t, w_k) \;\Leftrightarrow\; t = \mathit{bag}(d_i : i \in I) \\ \wedge\, I \subseteq I_k \;\wedge\; I \cap J_k \neq \emptyset. \end{aligned}$$

Proof: ($\Rightarrow$) The fact that $I \in Occ_d(t, w_k)$ implies that k is the smallest κ such that $I \subseteq I_\kappa$ and $I \cap J_\kappa \neq \emptyset$, which means that $I \subseteq I_k$ and $I \cap J_k \neq \emptyset$. Additionally, $I \in Occ_d(t, w_k)$ implies $occurs_d(t, I)$, which implies $t = bag(d_i : i \in I)$. ($\Leftarrow$) From $t = bag(d_i : i \in I)$ and $I \subseteq I_k$ it follows that $occurs_d(t, I)$. To show that $I \in Occ_d(t, w_k)$, it remains to prove that k is the smallest κ such that $I \subseteq I_\kappa$ and $I \cap J_\kappa \neq \emptyset$. Clearly these two statements are true for $\kappa = k$. Suppose that they were true for some $\kappa < k$; but for such a κ, we know that $J_\kappa \cap I_k = \emptyset$; so I, being non-disjoint with J_κ, contains some element from J_κ, which (because J_κ is disjoint with I_k) cannot belong to I_k; but this contradicts our assumption that $I \subseteq I_k$. $\square$

Thus, we see that to compute $K(d, \tilde{d}, k, \tilde{k})$, we need look only at those phrases that occur entirely in the window w_k of d and contain some distinguished index from w_k. A similar condition can be stated regarding the occurrence of these phrases in $\tilde{d}$.

We will define the following bags:

$$A_k = bag(d_i : i \in I_k), \quad R_k = bag(d_i : i \in J_k),$$
$$\tilde{A}_{\tilde{k}} = bag(\tilde{d}_i : i \in \tilde{I}_{\tilde{k}}), \quad \tilde{R}_{\tilde{k}} = bag(\tilde{d}_i : i \in \tilde{J}_{\tilde{k}}).$$

For a phrase t to contribute towards $\phi_d(t, w_k)$, it must be a sub-bag of A_k and non-disjoint with R_k (and analogously regarding the other document).

Let $U = \{d_1, \ldots, d_n, \tilde{d}_1, \ldots, \tilde{d}_{\tilde{n}}\}$ be the set of all words appearing in the two documents. Let us order the set U in an arbitrary manner, writing it as $U = \{u_1, \ldots, u_S\}$. Now any bag B constructed over U can be thought of as a function $B : 1..S \to \mathbb{Z}_0^+$, where $B(s)$ is the number of times that the word u_s is an element of B.

This notation can be further generalized to count the number of times that a bag $\tilde{B}$ is a sub-bag of B: $B(\tilde{B}) := \prod_{s=1}^{S} \binom{B(s)}{\tilde{B}(s)}$.

For a phrase t, we will be interested in $\phi_d(t, w_k)$, which is the number of times that t is a sub-bag of A_k but excluding occurrences located wholly in $A_k - R_k$. Thus we see that $\phi_d(t, w_k) = A_k(t) - F_k(t)$, where $F_k = A_k - R_k$. This means that

$$K(d, \tilde{d}, k, \tilde{k}) = \sum_{t \in T} (A_k(t) - F_k(t))(\tilde{A}_{\tilde{k}}(t) - \tilde{F}_{\tilde{k}}(t)),$$

which can clearly be split into four sums $\sum_{t \in T} B(t)\tilde{B}(t)$, where B is either A_k or F_k and $\tilde{B}$ is either $\tilde{A}_{\tilde{k}}$ or $\tilde{F}_{\tilde{k}}$.

The remaining problem is how to compute, given two bags B and $\tilde{B}$, the sum

$$K(B, \tilde{B}) := \sum_{t \in T} B(t)\tilde{B}(t) = \sum_{t \in T} \prod_{s=1}^{S} \binom{B(s)}{t(s)} \binom{\tilde{B}(s)}{t(s)}.$$

Remember that T contains all phrases of at most M words. (Even if we set $M = \infty$ to avoid any explicit constraint on the word length, this will be equivalent to using $M = \min\{|B|, |\tilde{B}|\}$ since no phrase longer than that could possibly occur in both B and $\tilde{B}$.) T can be partitioned into several sets based on the number of occurrences of the first word: $T = \cup_{c=0}^{M} T_c$, where $T_c = \{t \in T : t(1) = c\}$.

$$\begin{aligned} K(B, \tilde{B}) &= \textstyle\sum_{c=0}^{M} \sum_{t \in T_c} \prod_{s=1}^{S} \binom{B(s)}{t(s)} \binom{\tilde{B}(s)}{t(s)} \\ &= \textstyle\sum_{c=0}^{M} \sum_{t \in T_c} \binom{B(1)}{c} \binom{\tilde{B}(1)}{c} \prod_{s=2}^{S} \binom{B(s)}{t(s)} \binom{\tilde{B}(s)}{t(s)} \\ &= \textstyle\sum_{c=0}^{M} \binom{B(1)}{c} \binom{\tilde{B}(1)}{c} \sum_{t \in T_c} \prod_{s=2}^{S} \binom{B(s)}{t(s)} \binom{\tilde{B}(s)}{t(s)}. \end{aligned}$$

In the last expression, the inner sum

$$\textstyle\sum_{t \in T_c} \prod_{s=2}^{S} \binom{B(s)}{t(s)} \binom{\tilde{B}(s)}{t(s)} = (\dagger)$$

does not make any use of the word u_1 whatsoever. If we remove all occurrences of u_1 from all the phrases of T_c, we obtain the set of all phrases containing at most $M - c$ words and using only $\{u_2, \ldots, u_S\}$ as the base set, rather than the entire $U = \{u_1, u_2, \ldots, u_S\}$. We will denote this set of phrases by $T^{M-c,2}$. The original T is actually $T^{M,1}$ in this new notation. In general, we will use $T^{m,s}$ to refer to the set of all bags of at most m elements constructed over the set $\{u_s, \ldots, u_S\}$. We thus see that ($\dagger$) remains unchanged if we sum over $t \in T^{M-c,2}$ rather than over $t \in T_c$. This leaves us with a problem very similar to the original one. Defining

$$K^{m,s}(B, \tilde{B}) := \textstyle\sum_{t \in T^{m,s}} B(t)\tilde{B}(t),$$

we see that

$$K^{m,s}(B, \tilde{B}) = \textstyle\sum_{c=0}^{m} \binom{B(s)}{c} \binom{\tilde{B}(s)}{c} K^{m-c,s+1}(B, \tilde{B}).$$

This recursive formula is useful for $s \leq S$, while the case for $s = S + 1$ is actually trivial: by then we are constructing bags over an empty set, therefore only an empty bag can be constructed, and it occurs exactly once in both B and $\tilde{B}$. Thus we have $K^{m,s}(B, \tilde{B}) = 0$ for $m < 0$ and

$K^{m,S+1}(B,\tilde{B}) = 1$ for $m \geq 0$. In this way we can compute $K(B,\tilde{B}) = K^{M,1}(B,\tilde{B})$ using dynamic programming in $O(M^2S)$ time. (But keep in mind that there is no need to use $M \geq \min\{|B|,|\tilde{B}|\}$.)

Note that we could also generalize our kernel by assigning length-dependent weights to the phrases. The difference

$$\hat{K}^{m,1}(B,\tilde{B}) := K^{m,1}(B,\tilde{B}) - K^{m-1,1}(B,\tilde{B})$$

is actually the sum of $B(t)\tilde{B}(t)$ computed over all phrases t with *exactly* m words (rather than *at most* m words). If we want the kernel to act as if all the frequencies $\phi_d(t)$ (and $\phi_{\tilde{d}}(t)$) for phrases t of exactly m words have been multiplied by some constant weight ω_m, we can compute this kernel thus:

$$K_\omega(B,\tilde{B}) := \sum_{m=0}^{M}\sum_{m=0}^{M}\omega_m^2\hat{K}^{m,1}(B,\tilde{B}).$$

(Alternatively, $\hat{K}^{m,s}$ could be obtained using the same recurrence as $K^{m,s}$, except that the trivial case $\hat{K}^{m,S+1}$ would be set to 1 only for $m = 0$, while for $m > 1$ it would be set to 0.)

Now that we know how to compute $K(B,\tilde{B})$, we can use this algorithm in the previously derived expressions for $K(d,\tilde{d},k,\tilde{k})$ and finally $K(d,\tilde{d})$. We can compute $K(d,\tilde{d})$ in $O(M^2Sr\tilde{r})$ time, where M need only be as large as the length of the longest window in the two documents d and $\tilde{d}$. As for S, it can in fact also be defined separately for each pair of windows, so that it needs only contain as many words as the combined length of the two windows. Some examples of practical interest include:

- Classical sliding windows of length l, i.e. $r = n$, $I_k = \{k, k+1, \ldots, \min\{k+l-1, n\}\}$, $J_k = \{k\}$. In this case we can use $M \leq l$, $S = l$, yielding $O(M^2ln^2)$. In practice one would typically not be interested in very small phrases, limiting M to e.g. 5 or less. Thus the time complexity is practically $O(ln^2)$.

- Ignoring proximity altogether. In this case we have one window of length n: $r = 1$, $l = n$, $I_1 = J_1 = 1..n$, and thus the time complexity is $O(M^2n^3)$. For quite long documents it would actually be more reasonable to assume $S \ll n$, because not all words will be different; $S = O(\sqrt{n})$ would be a typical observation in practice.

- Nonoverlapping windows of average length l (e.g. one sentence per window), with $J_k = I_k$ for all k. In this case we have $O(M^2l(n/l)^2) = O(M^2n^2/l)$.

- Sliding windows on the sentence level: each window consists of p contiguous sentences, each sentence being l words long on average. Words from the first sentence of the window are distinguished indices for that window. In this case we have $r = n/l$ windows, each being lp words long, for a time complexity of $O(M^2pn^2/l)$.

4 Conclusions and future work

In this paper we presented a kernel that computes the dot product of two documents under the loose-phrase representation. The kernel is a natural generalization of the string kernels that have been previously described in the literature. In future work, we intend to use this kernel in text classification tasks to compare the performance of the loose-phrase representation with that of the traditional bag-of-words model.

References

[1] J. Shawe-Taylor, N. Cristianini. *Kernel Methods for Pattern Analysis.* Cambridge University Press, 2004

[2] D. Haussler. *Convolution kernels on discrete structures.* Technical Report UCS-CRL-99-10, Dept. of Comp. Sci., Univ. of California at Santa Cruz, July 8, 1999.

[3] H. Lodhi, N. Christianini, J. Shawe-Taylor, C. Watkins. Text Classification using String Kernels. In *Advances of Neural Information Processing Systems 13*, 2000.

[4] C. Cortes, V. Vapnik. Support-Vector Networks. *Machine Learning*, 20(3):273–297, September 1995.

[5] D. Mladenić, M. Grobelnik. Word sequences as features in text-learning. In *Proceedings of ERK-98, Seventh Electrotechnical and Computer Science Conference*, pp. 145–148, Ljubljana, 1998.

IST WORLD – MACHINE LEARNING AND DATA MINING AT WORK

Jure Ferlež
Department of Knowledge Technologies and Center for Knwoledge Transfer, Jozef Stefan Institute
Jamova 39, 1000 Ljubljana, Slovenia
Tel: +386 1 477 3127; fax: +386 1 477 3315
e-mail: Jure.Ferlez@ijs.si

ABSTRACT

This paper is an overview of practical machine learning and data mining solutions used in the IST World portal (*http://www.ist-world.org/*). IST World portal is a customized data mining application for mining research related information. Machine learning and data mining methods are used to tackle the problem of data integration and data analysis. This includes automatic classification, unsupervised clustering, multi dimensional scaling, graph centrality measures and graph drawing algorithms.

1 INTRODUCTION

In this paper we overview the data integration and analysis functionality of IST World portal (http://www.ist-world.org/) [1]; which is a web application built on top of several machine learning and data mining algorithms.
The portal integrates information about research and technology development actors such as organizations and experts on a local, national and European level. The functionality of the portal [2] aims at providing the user with assistance on discovering competence and collaboration knowledge on researchers and research organizations. It also shows the context of their co-operation in the joint projects and publications.
To meet the described functionalities the portal is setup in the form of a data mining application specifically customized to discovering knowledge about *research projects*, *research papers*, *research organizations* and *researchers* [3] (In the rest of the paper we shall name all of these as *entities*). The typical scenario of usage of the application consists of two steps: (1) complex search and navigation step to retrieve relevant information from the data repository, (2) automated analytical and visualization step to present the results. So first, in a selection step the entities (organizations, experts, publications, projects) or subsets of the entities that represent the target of interest are to be specified by the user by making use of available search and navigation functionalities. Second, in an analysis step one of the analytical methods is applied upon the retrieved set of entities and the results are presented by a visualization technique.

In order to implement the described knowledge discovery functionality, data mining and machine learning approach proves necessary. We use it (1) to integrate the data imported from various data sources, (2) to perform an off-line time demanding data analysis and (3) to provide the efficient on-line analytic tools. The majority of the used machine learning algorithms can be classified in to the fields of either text mining or graph mining.
Section 2 of this paper describes the data integration process and the machine learning and data mining techniques which are used. Section 3 describes the offline time demanding analysis of the data providing information on the entities in the global context of all the data in the repository. Section 4 describes the on-line analytical tools which are used to discover knowledge on individual entities in the context of a selected set of entities.

2 DATA INTEGRATION

Multiple data sources of the IST World portal cause the problem of data integration. The data in the IST World portal repository is imported from different types of public data sources like national research databases, global research paper databases or other sources like web crawls [4]. Therefore the evident problem is identifying and linking of the records from different data sources that describe the same entity. The following content of this section describes the integration approach we think is best suited for the needs of the portal. This integration approach will be implemented in the near future.
This problem of finding and resolving duplicate records is also known as Record Linkage problem or Object Identification problem [5]. This is a well known problem and many solutions have already been suggested [5]. We plan to use the following standard approach to solve the problem: (1) we will produce a list of the candidate pairs of records for merging. This is a standard step of Record Linkage process also called blocking [5]. There exist many different solutions for it. (2) We will decide on a given candidate pair whether to merge it or not. This step of the Record Linkage process is called matching [5] and many solutions for it exist as well.

In the context of IST World portal we will seek for the solution that best fits in the context of the data to be integrated. The integration problem in IST World portal is a consequence of different data sources describing the same *entity*, which results in two or more database records about the one *entity*. The two records from the two data sources should therefore be combined into one record of the *entity*. What is important that the task at hand is about merging databases with mostly correctly typed names and therefore the biggest problem at hand is the blocking of the entities. Both of the Record Linkage steps in the context of the IST World portal are supported by the use of machine learning and data mining techniques customized to the context of IST World as described bellow.

2.1 Blocking

It is our belief that since the data to be integrated in the IST World Portal originates from well maintained databases, that the blocking part of the linking process is the heavier part of the problem. Therefore we try to exploit the full text indexing and full text querying of the records stored inside relational database in a novel way to identifying merge candidate pairs quickly and efficiently. The full text querying allows us to search for records that have approximately the same name. Thus we will produce a merge candidate record based on the full text indexing similarity of the names of *entities*. The full text indexing allows us to match records with the same words or same inflection of the words regardless of their order. However it does not allow us to match any records that may have been mistyped and therefore do not share exactly the same words. This technique is thus most suitable for records with the correct spelling. As said, most of the data in the IST World repository originates from well maintained databases. This makes the problem of merging of two entities with correctly spelled names much more frequent than problem of merging of records with spelling errors in their names. This later problem is mostly the problem of merging the data entered into the database by hand. This kind of data however only represents very small part of the data to be integrated and is therefore not the primary goal of the integration process. We will therefore use a full text query to the database for each of M entities in the database and produce a short list of length N, N << M of possible matches according to the query results. This will produce a merge list of size <= N*M. Which is a very good result in comparison to the full block merge list M*M.

2.2 Matching

For deciding on the given merge candidate we will try to implement several scoring algorithms and then use the semi supervised approach to create a merging decision function based on scores of the given merge candidate pair. We will use the following two merge candidate scoring algorithms:

- String edit distance algorithm for scoring how close two entity names are in terms of an edit distance [6].
- Cosine distance ranking of the fields associated with the two candidate entities [7].

Once the scores on the merge candidate pair are acquired a semi-supervised learning of the decision function will be implemented similar to [8]. Small set of training data will be acquired either from the users of the IST World portal or by the hand evaluation of the data.

3 OFF-LINE DATA ANALYSIS

The off-line part of the data analysis is performed to compute time and space demanding statistics and competence keywords of the *entities* in either the global context of all the data held in data repository or in the context of a single *entity*. This part of data analysis is therefore performed in advance in the data preparation phase.

The offline data analysis includes (1) supervised learning for automatic classification of the entities (2) graph mining for collaboration graph analysis and (3) multi dimensional scaling for global competence diagram computation. Please note that not all of the here mentioned analysis functionalities have been implemented yet.

3.1 Automatic Classification

We have decided to classify all the entities in the data repository into hierarchical classification scheme called Open Directory Project (DMOZ1).

DMOZ is the largest, most comprehensive human-edited directory of the Web. It is constructed and maintained by a vast, global community of more than 70 000 volunteer editors that actively classify the internet pages into hierarchical categories.

For the automatic classification we used the automatic classifier into DMOZ provided by the TextGarden library [9]. This classifier accepts as input textual description of an entity and outputs the list of most suitable categories for the input text.

For the purposes of the IST World we ran the classifier on all the entities in our database and assigned each entity the one most suitable category according to the constraint list of the allowed and disallowed categories. All together more than 200 000 entities were automatically classified into the science branch of the DMOZ classification hierarchy.

3.2 Entity Importance

We will try to capture the collaborative competence of researchers and research organizations in the context of all the data in the repository which constitutes a big collaboration graph. Scalable graph mining methods will be used to estimate different entity centrality measures [10]. A centrality measure gives an estimate of importance of a node in a social network. There exist many different centrality measures which capture different notions of node importance. We will compute the following centrality measures:

[1] The DMOZ page can be found at http://dmoz.org

- *Node Degree*. Node Degree measures the number of neighbours in the social network. It therefore captures the importance of an entity with regards to the process of communication that goes on in a social network.
- *Betweenes*. Betweenes measures the frequency with which a node in a social network falls between pairs of other nodes on the shortest paths connecting them. The measure suggests that an entity is important if it is strategically located on the communication paths linking pairs of others.
- *Closeness*. Closeness measures how close on average a node is to all other nodes in a connected graph. It therefore captures the notion of ease of communication with other nodes.

The centrality measures of the entities will provide different interpretations of the importance of the observed entity. Concern with communication activity will be answered best with a degree-based measure. Interest in control of communication requires a measure based upon betweeness. Finally, a concern on either independence or efficiency leads to the choice of a measures based on closeness.
Several standard algorithms exist for calculation of these measures [10]. We will try to exploit the SQL query language for its computation inside the relational database engine.

3.3 Global Competence Diagram

Competence Diagram [2] is a visualization technique of drawing the entity nodes in a two dimensional plane according to the similarity of their textual description [12]. The Multi Dimensional Scaling of all the entities in the IST World repository will be performed to project the entities from a hyper dimensional space of their textual description onto a two dimensional plane together with the most important keywords and relations between them.
The computed two dimensional coordinates of most important keywords together with the computed two dimensional coordinates of every entity represent the Competence Diagram which can be visualized on a screen. The competence of every entity is described by the position of the entity on the screen and by the relation of the entity to the displayed keywords.

The computation of a global competence diagram is time and space demanding [12]. It will be performed using the TextGarden's singular value decomposition and multi dimensional scaling functionalities as described in part in the Fortuna et al. [12] paper. The functionality is extended by adding the keywords coordinates and relationships. This is achieved by adding artificial documents to the analyzed document collection. The artificial documents are composed according to the singular vectors computed in the process of singular value decomposition. Another problem is scalability of the computation which has to work for more than 100 000 entities. This is resolved using only the acquired artificial documents in the multi dimensional scaling step and then computing the coordinates of the rest of the entities according to their cosine distance to the projected artificial documents. This work on extending existing Document Atlas functionality [12] will be described more thoroughly in the future papers.

4 ON-LINE DATA ANALYSIS

The on-line part of the data analysis is performed to analyze the *entities* in the context of other *entities* currently in the scope of the data selection step as described in section **1**. The analysis in the context of the subset of other entities allows more informative results. E.g. the keywords of an organization's role in a project can be computed according to other participants of the project. Another example is displaying of Collaboration sub Graph of only the authors of the certain paper. As this part of the data analysis depends on the data selected in the selection step, it can therefore not be performed in advance in the data preparation phase and must be done in real time as the user is on line and analyzing the data.
The online data analysis includes (1) Unsupervised learning to calculate the Context dependant Competence Diagram, (2) Unsupervised learning to calculate the clustering of the entities and their time dependant display, (3) Graph drawing algorithm for a nice display of Collaboration Diagrams.

4.1 Context Dependant Competence Diagram

The context dependant competence diagram which we present to our users is a visualization technique similar to the global competence diagram described in section **3.3**. The difference from the global competence diagram is in the selection of the entities to be visualized. The context dependant competence diagram calculates the keywords and the two dimensional coordinates based on the currently selected set entities. This causes the keywords to show the distinction in competence between the visualized entities. This is different form the global competence diagram which would take into an account the textual description of all the entities held in the repository to visualize the selected ones. It would therefore produce descriptive competence analysis. As the competence diagram computation is time demanding only a small subset of less than hundred entities can be analyzed this way in a timely fashion.

The context dependant competence diagram is already implemented. It is built on top of the Document Atlas [12] solution of the TextGarden library [11] as mentioned in the section **3.3**.

4.2 Clustering and Time graph Visualization

The IST World application will use an unsupervised machine learning technique called hierarchical clustering to produce hierarchical groups of selected set of entities which have similar textual description. The intensity of the groups' activity over time as read from the relational database will then is used to produce an interactive visualization called time graph [13]. This diagram will enable the user an interactive insight into how intensely different research topics were addressed during the past years.

4.3 Graph Drawing

The IST World web data mining application allows the user to visualize the collaboration graph of the selected set of entities. In order for the user to gain an insight into the collaboration patterns of the selected entities the graph has to be nicely visualized. We use the TextGarden's graph visualization utility [14] to perform graph visualization optimization in real time. The algorithm presents the drawing problem as an optimization problem, which is then solved using the gradient descent algorithm. The collaboration diagram is computed using a single SQL query to the relational database engine.

5 CONCLUSIONS

We are developing a data mining application that will allow its users to gain insight into competence and collaboration details of the individual researcher, research organizations, research projects and publications. In this paper we gave an overview of the different machine learning and data mining approaches for solving some of the problems of implementation of the system. As the data in the IST World repository has to be integrated, full text querying, string matching and semi supervised learning methods will be used to tackle the problem of blocking and matching. All the context independent data analysis is performed in advance. This includes automatic classification into DMOZ hierarchical classification scheme, graph mining to estimate different measures of importance of entities and global competence diagram for evaluating the competence of the entities in the scope of all the entities. The context dependant data analysis must be performed online. This includes context dependant competence diagram, clustering of the selected set of entities and graph drawing optimization algorithm. Not all of the approaches described in this paper have been implemented yet.

Acknowledgments

This work was supported by the Slovenian Research Agency and the IST Programme of the EC under IST-World (FP6-2004-IST-3-015823).

References

[1] Jörg B., Ferlež J., Grabczewski E, Jermol M. IST World: European RTD Information and Service Portal. 8th International Conference on Current Research Information Systems: Enabling Interaction and Quality: Beyond the Hanseatic League (CRIS 2006), Bergen, Norway, 11-13 May 2006

[2] Ferlež J. Public IST World Deliverable 2.2 – Portal Services and Functionalities Definition. http://ist-world.dfki.de/downloads/deliverables/ISTWorld_D2.2_PortalServicesAndFunctionalitiesDefinition.pdf

[3] Jörg, B., Jermol M., Uszkoreit H., Grobelnik M., Ferlež J.; Analytic Information Services for the European Research Area. To appear In Proceedings: eChallenges2006 e-2006 Conference, October 25-27, 2006. Barcelona, Spain.

[4] Grabczewski E. Public IST World Deliverable 3.2 – Base Set of Data http://ist-world.dfki.de/downloads/deliverables/ISTWorld_D3.2_BaseSetOfData.pdf

[5] Winkler E., Overview of Record Linkage and Current Research Directions. RESEARCH REPORT SERIES (Statistics #2006-2)

[6] Koudas, N., Marathe, A., and Srivastava, D. (2004), "Flexible String Matching Against Large Databases in Practice," Proceedings of the 30th VLDB Conference, 1078-1086.

[7] Newcombe, H.B. and Kennedy, J. M. (1962) "Record Linkage: Making Maximum Use of the Discriminating Power of Identifying Information" Communications of the Association for Computing Machinery, 5, 563-567.

[8] Winkler, W. E. (2001), "The Quality of Very Large Databases," Proceedings of Quality in Official Statistics '2001.

[9] Grobelnik M., Mladenic D. Simple classification into large topic ontology of Web documents. In Proceedings: 27th International Conference on Information Technology Interfaces (ITI 2005), 20-24 June, Cavtat, Croatia.

[10] Freeman L., Centrality in Social Networks Conceptual Clarification, Social Networks, 1 (1978/79) 215-239

[11] TextGarden software suite, http://kt.ijs.si/Dunja/textgarden/

[12] Fortuna B, Mladenič D, Grobelnik M. Visualization of text document corpus. Informatica journal, 29(4):497–502, 2005.

[13] Shaparenko B., Caruana R., Gehrke J., Joachims T., Identifying Temporal Patterns and Key Players in Document Collections. Proceedings of the IEEE ICDM Workshop on Temporal Data Mining: Algorithms, Theory and Applications (TDM-05), 165–174, 2005.

[14] Brank, J. Drawing graphs using simulated annealing and gradient descent. Zbornik C 7. mednarodne multi-konference Informacijska družba IS-2004, 67-70.

EXTENDING THE IST-WORLD DATABASE WITH SERBIAN RESEARCH PUBLICATIONS

Miloš Radovanović[1], Jure Ferlež[2], Dunja Mladenič[2], Marko Grobelnik[2], Mirjana Ivanović[1]

[1]University of Novi Sad, Faculty of Science
Department of Mathematics and Informatics
Trg D. Obradovića 4, 21000 Novi Sad, Serbia
e-mail: {radacha, mira}@im.ns.ac.yu

[2]Department of Knowledge Technologies
Jozef Stefan Institute
Jamova 39, 1000 Ljubljana, Slovenia
e-mail: {jure.ferlez, dunja.mladenic, marko.grobelnik}@ijs.si

ABSTRACT

This paper describes an effort of using knowledge technologies to gain insights into research activity, by exploiting publicly available information on research publications. The specificity of this paper is extending the existing IST World database with information on Serbian research publications. We describe the process of information extraction applied in order to fill in the database, based on publication references obtained from the textual repository maintained by the Secretariat for Science of the Serbian Province of Vojvodina. An example shows how we can gain insights into the collaboration and competence of authors.

1 INTRODUCTION

Information on research papers is available in different formats, for instance, a list of authors and the paper title. Electronic forms and large amount of such information naturally leads to development of different methods for enabling analysis of the data. In this paper we deal knowledge technologies for analyzing research publications.

The IST World portal [2] consists of innovative functionalities that help to promote RTD competencies and facilitate and foster the involvement of different research entities in joint RTD activities. It is based on the original idea of Project Intelligence [5]. The portal contains information about RTD actors on the local, national and European level (harvested from existing databases and with Web mining techniques), such as persons, research groups, organizations, projects, and their experience and expertise.

Vojvodina, the northern province of Serbia, is home to many educational and research institutions, most of which operate under the umbrella of the University of Novi Sad, and cover practically every field of science. In 2004, the Provincial Secretariat for Science and Technological Development of Vojvodina started gathering data from researchers employed at institutions within its jurisdiction. Every researcher was asked to fill in a form, provided as an MS Word document, with complete citations of all his/her authored publications, among other data. The gathered information is available in unmodified form on the Web site of the Secretariat: http://apv-nauka.ns.ac.yu.

We show how to obtain a collaboration graph based on this data, expressing coauthorship of papers. Competencies of the authors and organizations are analyzed using competence map based knowledge technologies [4]. The rest of the paper is organized as follows. In Section 2, we describe the data and the extraction process. Section 3 summarizes the functionalities of the IST World portal, while Section 4 illustrates collaboration and competence analysis of extracted data. The last Section concludes, and gives guidelines for possible future work.

2 INCORPORATING PUBLICATION DATA

The process of incorporating publication data consists of data preprocessing and importing into an existing database. This section provides the data description and details on the information extraction process.

2.1 Serbian Data Description

At the time of writing, the collection of documents (with the last update made on July 6, 2006) includes 2,278 researchers from 60 institutions, making the task of manually extracting bibliographical data infeasible for us. We resorted to programming an extractor in Java which, at this time, is able to automatically isolate every researcher's name, affiliation, and list of citations, and save the data in form of [3] compliant XML files, to enable quick import of the data into the existing IST World relational database. Furthermore, the extractor compares citations between different authors, detecting coauthorships between researchers who are included in the collection.

The form to be filled by every Serbian researcher consists of a sequence of tables starting with basic data (name, year of birth etc.), continuing with the tables corresponding to publication types as prescribed by the Serbian Ministry of Science and Environmental Protection. Publication types are labeled by a code of the form R*xx*, where *xx* is a two-digit number. The codes of interest have the first digit in {1,2,5,6,7}, which corresponds to published papers and book chapters, and excludes technical solutions (3) and patents (4). A sample entry is shown in Table 1. We observed that within the tables, the citations were usually entered enclosed in isolated paragraphs or numbered lists.

Spisak rezultata R52 - Rad u časopisu međunarodnog značaja. Međunarodne časopise i druge navode rangirati (koeficijent R) prema Science Citation *Index-u (Journal Citation Report) odnosno prema kategorizaciji radova, verifikovanih od strane odbora Ministarstva.	**Broj**	**10**
1. Bađonski, M., Ivanović, M., and **Budimac, Z.**, Software Specification using LASS. In *Proc. of ASIAN '97* (Kathmandu, Nepal), Shyamasundar, R. K. and Ueda, K, eds., Lecture Notes in Computer Science vol. 1345, Springer Verlag, Berlin, 1997, pp. 375-376. 2. **Budimac, Z.** Mašulović, D., Linda as an Abstract Data Type for Concurrent Programming, *Novi Sad J. Math* 28 (1998) 2, 173-186 (Publisher: Faculty of Science, University of Novi Sad, Novi Sad). . . .		

Table 1: *Example entry in the form. R52 corresponds to papers published in international journals of category 2.*

2.2 Information Extraction and Import

The present version of the extractor (2.0.2) is able to isolate a total of 101,672 bibliographic units, written in at least five different languages, from current data, and detect 24,262 binary coauthorships, making the total number of citations in the database 77,410. (A paper appearing in *n* researchers' forms can have a maximum *n*–1 detected coauthorships.) The researchers' names and affiliations are extracted from the HTML page on the Web site of the Secretariat in a straightforward fashion, which left the biggest challenge in processing the citation data from MS Word documents.

Parsing. Since the only reliable option for accessing the content of MS Word documents from computer programs at this time is to use the Visual Basic for Applications (VBA) macro language, we found it more convenient to use VBA only to bulk convert all documents to HTML format, and do all actual extraction from HTML. The HTMLParser open source library is used to process the generated HTML files, and isolate the DOM trees of <TABLE> tags corresponding to tables containing the citations of interest, as described in Section 2.1. Further extraction of citations is done using the following scheme: since it was observed that isolated paragraphs and numbered lists in Word documents correspond to <P> and list tags in generated HTML, the citations were "read out" from fixed positions in the DOM trees of <TABLE> tags, taking into account only the two above possibilities.

Somewhat surprisingly, this simple scheme turned out to be rather effective at retrieving strings containing valid citations, although we are unable to give precise figures for precision and recall of detection. After observing the isolated citations, we removed from the collection the 59 forms which were obviously not parsed correctly within this scheme (the citations were either divided up into several, or lumped together). We also removed 62 forms which were filled in using the Cyrillic alphabet, since we elected to leave the conversion of Cyrillic letters for a later date. From the remaining forms, the parser could not correctly process 444 tables (out of a total of 39,688), which roughly corresponds to 17 whole forms. All this amounts to 138 unprocessed forms, putting the upper bound on recall to around 94%. Considering that the average number of detected citations per researcher is 44.63, common sense suggests that true recall should not be an order of magnitude smaller. At the same time, directly observing the recognized citations led us to a conclusion that precision is not worse than about 97%. We consider these estimates of precision and recall to be completely satisfactory for such a simple extraction scheme.

Coauthorship Detection. In order to calculate the similarity of two citations, with the intention to determine a coauthorship relation, the extractor uses an optimized version of the algorithm given in [7]. The algorithm calculates the similarity between two strings by computing the ratio between the number of shared 2-grams (letter pairs) and the number of all 2-grams in both strings, disregarding whitespace, punctuation marks and capitalization. The described ratio is multiplied by two to keep the resulting measure between 0 and 1. The reason for using 2-grams instead of, for instance, whole words, lies in the observed "dirtiness" of manually entered citation data: typographical errors, different or missing information, various citation conventions used (resulting in different ordering of citation information) etc. After parsing a researcher's form and extracting a list of citations, every citation is compared to all citations already in the database which contain the researcher's last name (actually, its first word), retrieved using a maintained index. If the best match of a given citation does not exceed a predetermined similarity threshold (currently set at 0.63 after examining several test cases), the citation is entered as a new one into the database. Otherwise, a coauthorship relation is established, and the entry for the currently processed citation of the researcher is set to refer to the citation already in the database.

As with citation recognition, it is difficult to evaluate the detected coauthorships. Nevertheless, on a sample of the extracted data for colleagues from the Faculty of Science at the University of Novi Sad, we detected no wrongly assigned citation coauthorships, estimating precision close to 100%. As for recall, we can only state that the detected 24,262 coauthorships seems a reasonable number, considering that authors whose forms are not included in the collection are not taken into account, and that the figure exceeds our initial intuitive expectations.

3 THE IST WORLD PORTAL

IST World [1,2] system allows integration of different data sources into a common database. It currently includes data on research publication and RTD projects from several European countries using different languages. In this paper we describe the process of extending the database on an example of incorporating data on Serbian research publications. The IST World portal enables the following functionalities:

Data integration – the main goal is to integrate multiple data sources with similar but different structure into one data structure existing on several levels.

Central data structure – the central data base is organized in a big social network (graph structure) which is organized on several levels: countries, organizations, departments and individuals.

Cross Language Technologies – the data collected in the project is multilingual meaning it is possible to compare the documents written in different languages and be able to identify (despite different languages) the similarity of their contents.

Text mining – enables different analysis of textual data including multi dimensional scaling and latent semantic analysis.

Link analysis – enables community identification and analysis of temporal networks.

Visualization – enables fast graph drawing techniques developed recently at JSI and some text visualization techniques developed in collaboration with Microsoft Research and at SEKT project.

4 SERBIAN RTD ANALYSIS ILUSTRATION

Once the data is imported we can perform any of the analysis supported by the IST World portal. This section describes an example collaboration and competence analysis of Serbian researchers and organizations.

Collaboration. Figure 1a depicts the collaboration diagram of *organizations*, where weighed arcs represent the number of publications mutually coauthored by their affiliates. The diagram is configured to show only the strongest 10% of the arcs, allowing us to get an overview of the most important connections between organizations (at the research level). By far the strongest bond (512 publications) is between the Faculty of Agriculture (*Poljoprivredni fakultet*) and the Institute of Field and Vegetable Crops (*Institut za ratarstvo i povrtarstvo*), which is in tune with Vojvodina being a highly agricultural region with a long tradition of research in this area. The Faculty of Agriculture also has strong ties with the Veterinary Institute (naturally), and also with the Faculty of Science (*Prirodno-matematički fakultet*), a possible result of many graduates of the latter being employed by the Faculty of Agriculture, according to the authors' experience. The Faculty of Science, on the other hand, also collaborates strongly with the Faculty of Technical Sciences (*Fakultet tehničkih nauka*) via its Department of Physics and the Department of Mathematics and Informatics; with the Faculty of Technology (*Tehnološki fakultet*) through its Department of Chemistry; and with the Faculty of Medicine through the Departments of Biology and Chemistry. The most surprising link on the diagram, between Faculties of Medicine and Philosophy, upon closer inspection turned out to be due to an error in the original data: the faculties employ two different researchers with the same first and last name (Slobodan Pavlović), and in the collection they were mistakenly represented by identical forms, resulting in the extractor perfectly matching all 148 publications.

Figure 1b shows the collaboration diagram of *researchers*, where weighed arcs denote the number of coauthored publications. The graph is configured to include only the top 1% of arcs, revealing the cream of the Vojvodinian scientific community. The subgraph of five mutually cooperating researchers is the group of cardiologists and cardio surgeons gathered around Ninoslav Radovanović, the recently retired chief of the Institute of Cardiovascular Diseases in Sremska Kamenica (all researchers are also affiliated with the Faculty of Medicine). The most prominent cooperations also include Ratko Nikolić – Timofej Furman from the Faculty of Agriculture, Spasenija Milanović – Marijana Carić and Jasna Gvozdenović – Vera Lazić from the Faculty of Technology, and the already mentioned Slobodan Pavlović – Slobodan Pavlović, who are actually the same person.

Competence. The competence diagram consisting of researchers form the Faculty of Science is shown in Figure 2. The intention of the diagram is to cluster researchers around colored regions representing competencies, which are labeled by terms extracted from the titles of publications. Unfortunately, the current version of the extractor does not attempt to extract titles from the citation data, and thus whole citations are used instead of titles for producing competence labels. Nevertheless, the introduction of such noise words did lead to an interesting effect: researchers are now being placed around names of their prominent colleagues (Matavulj, Škrinjar, Budimac, Dalmacija...), who now represent another way of labeling competence.

5 CONCLUSIONS AND FUTURE WORK

It is important to note that, with the current state of the extracted data, no collaboration or competence analysis can be considered "the whole truth," since we are unable to give firm guarantees on the recall of extraction. Despite this, the general relationships that *are* observed between organizations and researchers do generally comply with our general picture of Serbian research, suggesting that precision of extraction is adequate.

Currently, the extractor processes only whole citations, with no attempts to isolate the author list, title, journal or conference name, publication date and similar information. Although the task is difficult, when considering the variety of used citation conventions and languages, it may be worthwhile to attempt in future work, because it would allow expressing many other relations beside coauthorship, for instance: being in the same conference/journal issue, same conference stream/journal, or similar conf./ journals [6]. It would also permit the generation of competence maps which are cleansed of noise words appearing in the whole citations. Performing a more comprehensive study in order to tune the similarity threshold and improve precision and recall of citation matching is another, more immediate area for exploration, as well as improving citation recognition by implementing more parsing schemes and Cyrillic letter conversion.

Besides illustrating how knowledge technologies can help gain interesting and useful insights into the relationships between people and organizations, we have also seen that they can help locate and eliminate errors in original data. Such cooperation of extraction and analysis will be beneficial to both phases in the process of further extending the IST-World database.

Acknowledgments

This work was supported by Slovenian Research Agency, Serbian Ministry of Science and Environmental Protection, and EC under IST World (FP6-2004-IST-3-015823).

References

[1] Jörg, B., Jermol M., Uszkoreit H., Grobelnik M., Ferlež J.; Analytic Information Services for the European Research Area. Proc.: eChallenges2006, Barcelona.

[2] Jörg B., Ferlež J., Grabczewski E, Jermol M. IST World: European RTD Information and Service Portal. 8th Int. Conf. on Current Research Information Systems: Enabling Interaction and Quality: Beyond the Hanseatic League (CRIS 2006), Norway, 2006.

[3] CERIF: the Common European Research Information Format. http://cordis.europa.eu/cerif/, 2000

[4] Fortuna B, Mladenič D, Grobelnik M. Visualization of text document corpus. Informatica journal, 29(4):497–502, 2005.

[5] Grobelnik, M., Mladenic, D. Analysis of a database of research projects using text mining and link analysis. In Data mining and decision support : integration and collaboration, Boston; Dordrecht; London: Kluwer Academic Publishers, 157-166, 2003.

[6] Klink, S. et al. Analysing social networks within biblio-graphical data. Proc. of DEXA06, Krakow, Poland, 2006.

[7] White, S. How to strike a match. http://www.devarticles. com/c/a/Development-Cycles/How-to-Strike-a-Match/, 2004

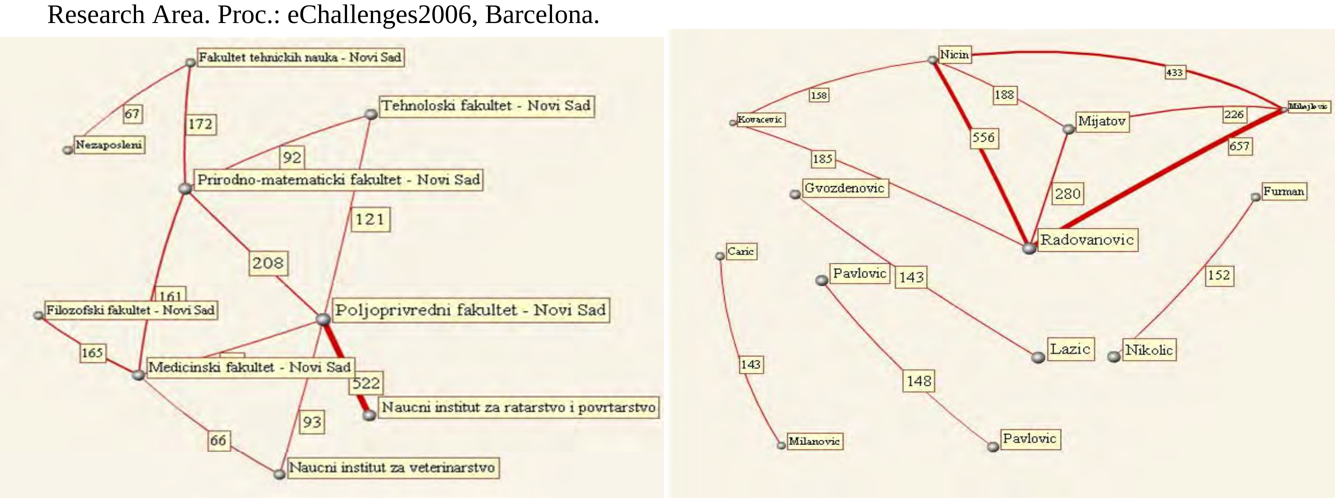


Figure 1: *Collaboration diagrams of Serbian organizations – left* (a) *and researchers – right* (b).

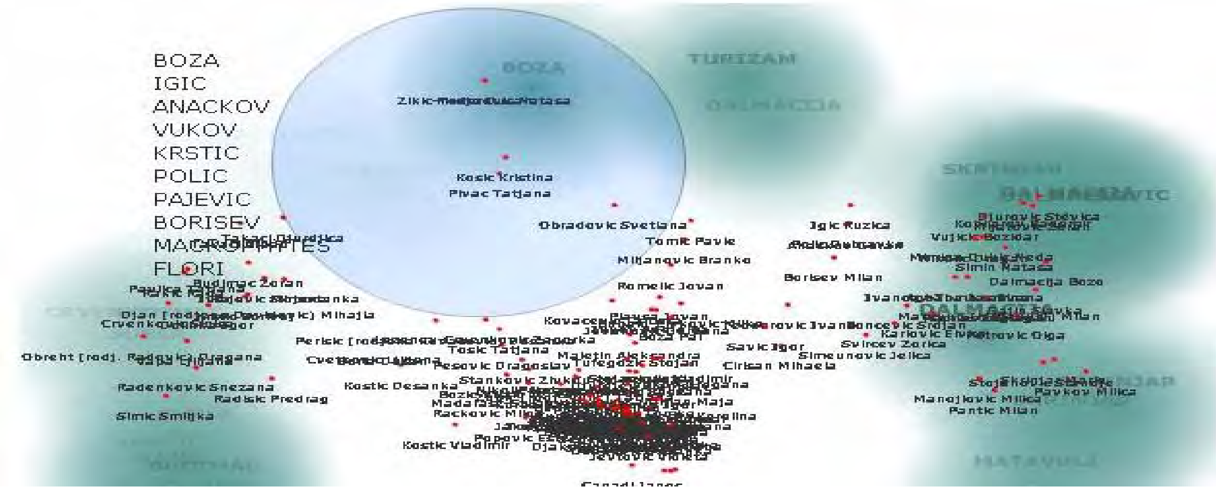


Figure 2: *Portion of a competence diagram of Serbian researches*

LEARNING TO PREDICT FOREST FIRES WITH DIFFERENT DATA MINING TECHNIQUES

Daniela Stojanova[1], Panče Panov[2], Andrej Kobler[1], Sašo Džeroski[2], Katerina Taškova[3]
[1]Slovenian Forestry Institute, Ljubljana, Slovenia
[2]Department of Knowledge Technologies, Jožef Stefan Institute, Ljubljana, Slovenia
[3]Faculty of Information Technology, European University, Skopje, Macedonia
E-mails: stojanovad@yahoo.com, pance.panov@ijs.si,
andrej.kobler@gozdis.si, saso.dzeroski@ijs.si, tkejt@yahoo.com

ABSTRACT

The motivation for this study was to learn to predict forest fires in Slovenia using different data mining techniques. We used predictive models based on data from a GIS (geographical information system), the weather prediction model - Aladin and MODIS satellite data. We examined three different datasets: one only for the Kras region, one for whole Primorska region and one for continental Slovenia. On these datasets we applied logistic regression and decision trees, as well as random forests, bagging and boosting of decision trees, in order to obtain predictive models of fire outbrakes. Best results in terms of predictive accuracy were obtained by bagging decision trees.

1 INTRODUCTION

Forest fires cause significant material damage in the natural environment. A large number of fires is caused by humans, although other factors like drought, wind, topography, plants etc., also have an important indirect influence on fire appearance and its spreading. The fire threat in Slovenia is increasing because of the processes of abandonment of farmland and spontaneous afforestation (increasing the fire fuel) and the increase of recreation in the natural environment.

Fire prevention is the first step in reducing the damage caused by fire and estimation of fire movement is very important for successful fire prevention, organization of prevention measures and optimal storage of firefighting resources. An important tool for fire movement estimation is modeling of the relations between the fire threat and the influence factors. Because these factors are more or less geograpicaly determined, these types of models are usually developed within GIS (Geographical Information System). GIS is a computer system capable of capturing, storing, analyzing, and displaying geographically referenced information; that is, data identified according to their location.

There are already two systems operating in Slovenia used for fire threat assesement in the natural environment. One is operated by the Forest Institute of Slovenia and the other by Slovenian environment agency. The main problem of these systems is that they are outdated and unreliable and tend to spatialy and temporaly over-generalize the results. It is possible to improve the models by enhancing the layers of the input data for the influence factors (GIS part), by increasing the thematic and spatial details, as well as including a database of past fires. The performance of these systems could be improved with employement of better data modeling techniques based on advanced machine learning methods.

The intention of this study is to improve the existing models by including additional data from GIS, ALADIN (**A**ire **L**imitée **A**daptation dynamique **D**éveloppement **I**nterNational), MODIS (Moderate-resolution Imaging Spectroradiometer) and the data on the forest stand height and canopy cover [12] . In addition, we extended the validity of the models to the whole territory of Slovenia.

The rest of the paper is structured as follows. In section 2 we explain the data used in this study. Section 3 describes the data mining techniques used to build the predictive models of fire outbreaks. In section 4 we explain the experimental setup and in section 5 we present and discuss the results. Section 6 gives the conclusions and future work.

2 DESCRIPTION OF THE DATA

In this study we apply data mining techniques and compare their performance (accuracy, precision, recall) to three datasets that contain data from different regions of Slovenia: Kras region in western Slovenia, whole Primorska region, and the continental Slovenia. The task is to predict the fire outbrakes.

The descriptive data is divided into 3 groups:

- GIS data (geographic data, part of the land with forest, field, urban part, distance from roads, highways, railways, cities etc.)
- Multi-temporal MODIS data: daily records for average temperature for specific quadrant and average net primary production. The data covers one year period.
- Meteorological ALADIN data (temperature, humidity, sum energy, evaporation, speed, direction and course of the wind, transpiration etc.)

The spatial measure used was 1x1 km^2 quadrant, and every spatial and time attribute was adjusted to this resolution.

The GIS data contains time independent attributes for every quadrant. The attributes describe the following GIS properties: ID for every quadrant in Slovenia, median of altitude above sea level, median of the grade of relief in gradients referred to DMR100 (Digital Relief Model), modus of exposition of the relief referred to DMR100, distance of roads, distance of cities, distance of railways (if the values are above 15.000 m, 15.000 m is assumed), share of specific land usage in a quadrant (e.g. fields, gardens, forests, buildings and others).

From NASA archives (MODIS satellite) we obtained public data of land temperature and net primary production of plants for the period of 5 years (2000 - 2004) with spatial resolution of 1 km and time resolution of 8 days. Multi-temporal satellite MODIS data, implicitly give information about the response of the vegetation in periods of drought and the types of fire fuels. The data is daily dependant. The MODIS attributes describe the following properties: average temperature in Kelvin for a specific quadrant for the day x of the year (we have 46 values and temperatures for every 8 days. x takes the values of 1, 9, 17, 25, ..., 361), average net primary production for a specific quadrant for the day x of the year.

The ALADIN data contains meteorological predictions of the weather. They are issued daily from the Environmental Agency of the Republic of Slovenia. The data includes weather predictions for every 3 hours (00.00-21-00 UTC) of 10 weather attributes. The attributes are: atmospheric precipitation, sun radiation energy, velocity and direction and gust of wind, evapotranspiration, transpiration, evaporation, relative humidity and temperature. For the three hours of weather data we decided to study the time interval from 12.30 to 15.30. This particular time interval was selected because of the great danger of fire at these hours, as shown from the Aladin data, given in UTC time (winter/summer season is not a factor). An average daily prediction is added to help in removing the noisy data. All of the 10 parameters were averaged for 1, 2, 4 and 14 days.

For the Kras region we also used 3D vegetation data from LIDAR and LANDSAT images. This data contains attributes that describe the height and structure of vegetation in the Kras region. The values of the attributes were calculated from the LANDSAT and were calibrated with LIDAR. All the data are aggregated to 1 km quadrants and have a resolution of 25 x 25 m. The LANDSAT based data describe the following forest properties: average tree canopy height, forest canopy cover, maximum height of the vegetation above the ground, height above the ground that reaches some percentage (99%, 95%, 75%, 50%) of forest biomass. For every attribute we obtain 4 statistic measures – minimum, maximum, average and standard deviation on 1km quadrant.

For building predictive models of forest fires we need positive and negative examples of fire occurrences. Positive examples of fires are locations in the past, where we have noticed the fire occurrence along with the date and hour. Negative examples are represented by an equal number of points with random time stamps and randomly located within the areas at least 15 km away from any positive example detected in timestamp ± 3 days [11]. This algorithm gives precedence to the area that had smaller probability of fire occurrence in a defined period. Locations of the positive and negative examples of fire occurrence were spatially and temporally linked to the descriptive data. The data for locations of fire occurrences (positive examples) were obtained from the Administration for Civil Protection and Disaster Relief of Slovenia and the Forestry Institute.

3 DATA ANALYSIS METHODOLOGY

The data were analyzed with several different data mining algorithms for classification implemented in WEKA data mining system [4].We used: logistic regression, random forests, decision trees (J48), bagging and boosting ensemble methods.

Logistic regression is part of a category of statistical models called generalized linear models [6]. Logistic regression allows prediction of a discrete outcome, such as group membership, from a set of variables that may be continuous, discrete, dichotomous, or a mix of any of these. Generally, the dependent or response variable is dichotomous, such as presence/absence or success/failure. There are two main uses of logistic regression. The first is the prediction of group membership. Since logistic regression calculates the probability or success over the probability of failure, the results of the analysis are in the form of an odds ratio. Logistic regression also provides knowledge of the relationships and strengths among the variables.

Random forest [10] is an ensemble of unpruned classification or regression trees, induced from bootstrap samples of the training data, using random feature selection in the tree induction process. Prediction is made by aggregating (majority vote for classification or averaging for regression) the predictions of the ensemble. Random forest generally exhibits a substantial performance improvement over the single tree classifier.

J48 algorithm [4] is an implementation of the C4.5 decision tree learner [5]. The algorithm for induction of decision trees uses the greedy search technique to induce decision trees for classification. There are many parameters which can be tuned in order to obtain better models with respect to the accuracy (or other parameters which can be used as measure for the quality of the model). These parameters allow greater control of the user in the process of learning the models.

Often multiple versions of a classifier give better results than the individual base classifier, because of combining the advantages of the individual classifiers in the final (aggregated) classifier. The simplest way to do the "aggregation" in the case of classification is to take a vote (perhaps a weighted vote); in the case of numeric prediction, to calculate the average (perhaps a weighted average).

Bagging predictors [7] is a method for generating multiple versions of a predictor (making bootstrap replicates of the learning set and using these as new learning set) and using them to get an aggregated predictor. In bagging all models receive equal weight. Bagging produces very accurate probability estimates from decision trees and other powerful, yet unstable, classifiers. However, a disadvantage is that bagged classifiers are hard to interpret.

Boosting is based on the observation that finding many rough rules of thumb can be a lot easier than finding a single, highly accurate prediction rule [8]. The boosting algorithm calls this "weak" or "base" learning algorithm repeatedly, each time feeding it a different subset of the training examples (or, to be more precise, a different distribution or weighting over the training examples). A widely used method for boosting is AdaBoost [9]. AdaBoost calls a given weak or base learning algorithm repeatedly in a series of rounds. The algorithm maintains a distribution or set of weights over the training set. Initially, all weights are set equally, but on each round, the weights of incorrectly classified examples are increased so that the base learner is forced to focus on the hard examples in the training set. At the end predictions of all weak rules are combined into a single prediction with weighted voting.

4 EXPERIMENTAL SETUP

As it was described in Section 2 the purpose of this study is to learn predictive models of forest fires outbreaks. The experiments are performed on three datasets for different regions of Slovenia: Kras, Primorska and continental Slovenia. The Kras dataset contains 159 attributes and has 1439 examples. The Primorska dataset has 129 attributes and 2442 examples. The third dataset for continental Slovenia has 129 attributes and 8476 examples. For all datasets the target attribute is nominal and predicts the possibility of fire occurrence (0-no, 1- yes). For conducing the experiments we used WEKA [4] data mining system. Several algorithms were used in the experiments: logistic regression, random forests, J48 (WEKA's implementation of decision trees), bagging and boosting of trees.

All of the methods were used with the default parameters. Ensemble methods were run in 10 iterations. The validation of the models was done using 10 fold cross – validation.

5 RESULTS AND DISCUSION

In this section, we present the results we obtained from the experiments. In Tables 1-3 we present the performances of the experiments in terms of precision, recall, accuracy and kappa statistics for each of the datasets respectively. Precision and recall in this case are calculated for the class 1 (fire occurrence=yes). Kappa statistics is used to evaluate the agreement between predicted and observed nominal values in one dataset, while correcting for agreement that occurs by chance.

Algorithm	Precision	Recall	Accuracy	Kappa
Logistic reg.	0.696	0.563	0.772	0.461
Random F.	0.751	0.585	0.797	0.517
J48	0.639	0.652	0.761	0.465
Bagging	**0.754**	0.652	**0.812**	**0.560**
Boosting	0.725	**0.658**	0.790	0.520

Table 1 Performances of DM algorithms on Kras data

Algorithm	Precision	Recall	Accuracy	Kappa
Logistic reg.	0.826	0.849	0.834	0.668
Random F.	0.820	**0.903**	0.852	0.703
J48	0.810	0.810	0.809	0.618
Bagging	**0.850**	0.878	**0.860**	**0.721**
Boosting	0.839	0.867	0.856	0.712

Table 2 Performances of DM algorithms on Primorska data

Algorithm	Precision	Recall	Accuracy	Kappa
Logistic reg.	0.831	0.855	0.840	0.679
Random F.	0.823	**0.877**	0.843	0.703
J48	0.809	0.819	0.812	0.624
Bagging	**0.846**	0.856	**0.849**	**0.698**
Boosting	0.842	0.855	0.844	0.688

Table 3 Performances of DM algorithms on continental Slovenia data

From the results we can conclude that Bagging of decision trees shows the best results in terms of predictive accuracy, precision and kappa statistics compared to the other algorithms.

5 CONCLUSION AND FUTURE WORK

In this work we built predictive models of forest fires. The models were based on GIS, MODIS and Aladin data. The experimental results showed that bagging of decision trees gives the best results in terms of accuracy for all three datasets. In further work we would like to use some feature selection algorithms and try to extract the relevant features and try to further improve the accuracy of the models.

References

[1] SFS Slovenian Forestry Service. Slovenian forest cover statistics 2004, unpublished manuscript. Zavod za gozdove RS, Ljubljana, Slovenia, 2006.

[2] FAO-Food and Agriculture Organization of the United Nations. Global Forest Resources Assessment Update 2005, Slovenia Country Report. 2005.

[3] R.M. Measures. Laser remote sensing: fundamentals and applications. Malabar, Fla., Krieger Pub. Co., 1992. 510 p. G70.6M4, 1992.

[4] I. Witten and E. Frank. Data Mining: Practical machine learning tools and techniques. Morgan Kaufmann, 2005. 2nd Edition.

[5] J. R. Quinlan. C4.5: Programs for machine learning. Morgan Kaufmann, 1993.

[6] A. Agresti. An Introduction to Categorical Data Analysis. John Wiley and Sons, Inc., 1996.

[7] L. Breiman. Bagging Predictors. Machine Learning, 26, 123-140, 1996.

[8] R. E. Schapire. The Boosting Approach to Machine Learning – An Overview. MSRI Workshop on Nonlinear Estimation and Classification, 2002.

[9] Y. Freund and R. E. Schapire. A decision-theoretic generalization of on-line learning and an application to boosting. Journal of Computer and System Sciences, 55, 119–139, 1997.

[10] L. Breiman. Random Forests. Machine Learning, 45, 5-32, 2001.

[11] A. Kobler, P. Ogrinc, I. Skok, D. Fajfar, S. Džeroski. Končno poročilo o rezultatih raziskovalnega projekta: Napovedovalni GIS model požarne ogroženosti naravnega okolja

[12] S. Džeroski, A. Kobler, V. Gjorgijoski, P. Panov. Using Decision Trees to Predict Forest Stand Heght and Canopy Cover from LANDSAT and LIDAR data. 20th International Conference on Informatics for Environmental Protection - Managing Environmental Knowledge – ENVIROINFO 200

Predicting Forest Stand Properties from Satellite Images with Different Data Mining Techniques

Katerina Taškova[1], Panče Panov[2], Andrej Kobler[3], Sašo Džeroski[2], Daniela Stojanova[3]

[1]Faculty of Information Technology, European University, Skopje, Macedonia
[2]Department of Knowledge Technologies, Jožef Stefan Institute, Ljubljana, Slovenia.
[3]Slovenian Forestry Institute, Ljubljana, Slovenia
E-mails: tkejt@yahoo.com,
{Pance.Panov, Saso.Dzeroski}@ijs.si,
Andrej.Kobler@gozdis.si, stojanovad@yahoo.com

Abstract

This paper work is focused on the comparison of different data mining techniques and their performances by building predictive models of forest stand properties from satellite images. We used the WEKA data mining environment to implement our numeric prediction experiments, applying linear regression, model (regression) trees, and bagging. The best results (with regard to correlation) we obtained by bagging model trees for considered target attributes.

1 Introduction

The main idea for this study is to supply more consistent and more accurate supporting information to the forest monitoring system, in order to predict the accumulated forest biomass. The Slovenian Forestry Service operates such a monitoring system [2], which periodically provides a wide range of forestry related information using an extensive network of permanent field sample plots throughout Slovenia. This system is tested and it is proven to be reliable, but it is also very labor-intensive and costly. Furthermore, some of the forest stand attributes, such as canopy cover, can only be roughly estimated by visual observation. Other items, such as forest stand height, can be monitored only seldom due to technical difficulties of field measurements.

The work in this paper is focused on the comparison of different data mining techniques and their performances by building predictive models of forest stand properties from satellite images. These predictive models were formed on multi–temporal Landsat data, calibrated with remotely sensed data, acquired by very high resolution airborne laser scanning (ALS), also termed LIDAR (Light Detection and Ranging).

LIDAR is one of many laser remote sensing techniques [3] that is used in forestry for estimation of different parameters. Because of its immediate generation of 3D data, high spatial resolution (in the order of a few centimeters) and accuracy, ALS data is becoming popular for detailed measurements of forest stand height and estimating other forest stand parameters [1]. By model-based extrapolation from a lidar-scanned spatial sample to a wide area coverage conventional optical remote sensing products such as those from the Landsat Enhanced Thematic Mapper Plus (Landsat ETM+) sensor can play an important role in bringing lidar into main-stream forestry practice.

Landsat Thematic Mapper (TM) is a multispectral scanning radiometer that was carried on board Landsats 4 and 5. The Landsat Enhanced Thematic Mapper (ETM) was introduced with Landsat 7. ETM data cover the visible, near-infrared, shortwave, and thermal infrared spectral bands of the electromagnetic spectrum.

The description of the data together with the main target attributes used in our prediction analyses are presented in Section 2. Overview of the data mining algorithms we used in the analyses for generating predictive models is given in Section 3. In Section 4 we give the experimental setup. In Section 5 we present and discuss the experimental results and in Section 6 we present the conclusions and give pointers to future work.

2 Data description

The study area encompassed 72226 hectares of the Kras region in western Slovenia. It is covered by a highly fragmented landscape of forests, shrubs and pastures. The forests contain mostly oak (Quercus pubescens) and pine (Pinus nigra) of various ages and stand compositions. Multi spectral Landsat ETM+ data were acquired on August 3rd 2001, May 18th 2002, November 10th 2002, and March 18th 2003, thus capturing the main phenological stages of forest vegetation in the area. The Landsat imagery was first geometrically corrected by orthorectification. Each of the 4 Landsat images was then segmented at two levels of spatial detail. The average image segment sizes were 4 ha for the fine segmentation and 20 ha for the coarse segmentation. Based on the data within each image segment 4 statistics (minimum reflectance, maximum reflectance, average reflectance, standard deviation of reflectance) were computed for each date, for each segmentation level, and for each of the Landsat image channels (2, 3, 4, 5, 7) and this way 160 explanatory variables were derived for forest modeling. As the borders of individual segments were not identical between dates and segmentation levels, all 160 variables values were attributed back to individual image pixels.

The 11 target variables describing the forest were computed at the level of 25 m by 25 m squares from the LIDAR data set, corresponding to Landsat pixels. For the purposes of our analyses we used only two target variables - canopy cover and forest stand height. Therefore, we will mention and describe them briefly in the rest of this section.

The forest stand height (FSH) for each square (or Landsat pixel) was computed by averaging the heights of the LIDAR-based normalized digital surface model (nDSM) within the 25 m square. A nDSM is a high resolution raster map showing the relative height of vegetation above the bare ground.

The canopy cover (CC) within this study is defined as the percentage of bare ground within a 25 m square (or a Landsat pixel), covered by a vertical projection of the overlying vegetation, higher than 1 m.

3 Data mining methodology

According to our motivation for this study, our aim was to see how other/different data mining techniques would apply to the given dataset in order to improve the results gained from previous analyses [7] with the same data.

This time the analyses were made only in the WEKA environment, concentrating on the learning schemes and their performances that would best fit to our problem. Because of the numeric nature of the data, we used linear regression, model and regression trees, and bagging.

3.1 Linear Regression

When we are dealing with numeric prediction problem, as is the case in this study, linear regression is the most natural technique to consider. The idea is simple: to represent the class (target attribute) x as linear function of the attributes $a_1,\ldots,a_k$ with predetermined weights $w_0,\ldots,w_k$

$$x = w_0 + w_1 a_1 + w_2 a_2 + \ldots + w_k a_k = \\ = w_0 a_0 + w_1 a_1 + w_2 a_2 + \ldots + w_k a_k \,,$$

if we assumed $a_0 = 1$.

The method of linear regression is basically the appropriate choice of the weight coefficients, w_j j=0,..,k, from the given training data. Corresponding ones should minimize the sum

$$\sum_{i-1}^{n}\left(x^{(i)} - y^{(i)}\right) \,,\ y^{(i)} = \sum_{j=0}^{k} w_j a_j^{(i)}$$

of the squares of the differences between the actual $x^{(i)}$ and the predicted $y^{(i)}$ values of the class of the i-th instance over whole training set. [6]

Linear regression is simple and basic numeric predictive scheme, which fits very good in many statistical analyses for decades. Because of the linear representation of the class value, is obviously that even this model is very simple, it has the disadvantage of suffering from linearity. Not every dataset can follow linear dependency. In that case the best-fitting line that can be found in order of least mean-squared difference will represent the class.

3.2 Regression and model trees

Regression and model trees [4] both derive from the basic divide-and-conquer method for decision tree construction. Once the basic tree has been build, consideration is given to backward tree pruning from each leaf as with ordinary decision trees [6]. Exception from the ordinary decision trees is the value stored at each terminal node (leaf). If the leaf is represented with single predicted numeric value-average value of the class value of the instances that reach the leaf, we have described regression trees. If we combine regression trees with the simple linear regression method (subsection 3.1), we get a more sophisticated representation of regression trees called model trees. These trees include linear regression model for class value prediction of the instances that reach the particular leaf. Model trees are smaller, more comprehensible and perform better prediction accuracy compared with regression trees.

3.3 Bagging

Combining multiple models outputs, in order to make decisions more reliable, is very logical approach in data mining methodology that has been used very widely. Several machine learning techniques, among them bagging, apply this approach by learning an ensemble of models and using them in combination. Despite the disadvantage of being difficult to analyze, often their improvements in the predictive performances compared to single model ones, is one of the key-reasons for their successful employment both in numeric prediction and classification tasks.

Bagging (stands for “bootstrap aggregating”) is complex learning method that combines two concepts: bootstrapping [9] and aggregating presented by Breiman [5]. Bootstrapping is a sampling procedure based on random selection with replacement. When applied to the original training set $X = (X_1, X_2, \ldots, X_n)$ with n instances, it alters it by deleting some instances and replicating others in order to create a new one $X^b = (X_1^b, X_2^b, \ldots, X_n^b)$ with the same size. Bagging then learns predictive models over these artificially derived training sets and uses them to generate an aggregated predictor. Aggregating actually means combining of classifiers. The aggregation averages over the models outcome when predicting a numeric target attribute and does plurality vote when predicting a class [5].

The bootstrap procedure is obviously a significant factor that contributes in bagging performances, because in this way can be avoided the possible outliers (instances that misrepresent the real data distribution) in the original training set. Therefore, bagging is helpful for building better classifiers on training sets with outliers. In bagging, bootstrapping and aggregating techniques are implemented in the following way:

1. Repeat for $b = 1, ..., B$

   a) Take a bootstrap replicate X^b of the training dataset X.

   b) Construct a base classifier $C^b(x)$ on X^b.

2. Combine base classifiers $C^b(x)$, $b = 1, \ldots, B$, by the simple majority vote (or by averaging their outcomes) to a final prediction.

Considering Breiman's analyses, bagging could give substantial accuracy improvements when applied on unstable prediction methods as classification and regression trees are.

4 Experimental setup

As described before, we learn to make predictions about the forest stand properties by using Landsat images. The prediction task consists of building predictive models by using data mining algorithms and validating the models by using standard validation techniques.

The WEKA [6] workbench includes a wide collection of machine learning algorithms and provides an environment that enables WEKA users to test and compare different learning techniques over their performances. Due to our main idea, we used the WEKA data mining environment to implement our numeric prediction experiments for comparison of the learning algorithms described in previous section.

All experiments we made were on the dataset described in detail in Section 2. The dataset consisted of 160 descriptive attributes and 11 target attributes of which two (forest stand height (FSH) and canopy cover (CC)) were used for the prediction task. All descriptive and target attributes were numeric. The dataset has 64000 examples of which 60607 describe the vegetation outside a settlement and were used for building the predictive models.

We used WEKA's Linear Regression algorithm, as a baseline method, to build linear regression model for CC and FSH with default parameters. We compared the baseline method with WEKA's implementation of the M5 algorithm for learning model (regression) trees. In order to prevent trees from over fitting the data, we employed pruning during tree construction. We altered different values (2^n, n=2…10) of the pruning parameter (minimal number of instances per leaf) in order so see how this affects the correlation and the size of the models.

The last experiment involved building predictive models with WEKA's implementation of the bagging algorithm. As base-level algorithms we used M5 regression and model trees.

Because of the large dimensionality of the analyzed dataset (160 descriptive attributes), considered learning algorithms were very time consuming. Hence we considered attribute selection by employing the instance-based attribute evaluator Relief to rank the descriptive attributes and lower the dimensionality of the data.

The performance of all models was validated using 10-fold cross-validation.

5 Results and discussion

In this section, we present the results we obtained from the experiments. As it was explained previously, our main target attributes, canopy cover (CC) and forest stand height (FSH), are numeric; therefore we used WEKA's implementation of linear regression, model and regression trees and bagging algorithms to obtain the predictive models. In Table 1 we present the correlation measure for the obtained predictive models for both target attributes.

Data Mining Method	Correlation			
	Canopy Cover		Forest Stand Height	
	All attributes (160)	Attribute selection (50)	All attributes (160)	Attribute selection (50)
Linear regression	0.836	0.819	0.814	0.7699
Regression tree (default)	0.858	0.852	0.877	0.864
Model tree (default)	0.863	0.857	0.886	0.875
Bagging of regression trees	0.876	0.869	0.893	0.884
Bagging of model trees	**0.882**	**0.871**	**0.902**	**0.891**

Table 1. Correlation measure for the obtained prediction models of Canopy Cover and Forest Stand Height

The first column is the WEKA's models we build. The next four represent the correlation coefficients obtained for canopy cover and forest stand height prediction models respectively. From the results we can conclude that linear regression model with default parameters has the lowest correlation compared to M5 model and regression trees for both attributes. The best results (with regard to correlation) we obtained by bagging model trees for both target attributes. Obviously, application of attribute selection over original dataset leads to slightly smaller correlation values compared to ones obtained from the same learning methods applied to the original dataset. This could be very important approach when analyzing large dataset in order to speed up used learning algorithms without substantial affection on the model accuracy.

The results in Table 2 present the dependency of the correlation of the M5 model trees and the number of leaves (number of rules) by applying different degrees of pruning. This is also presented graphically in Figure 1. From the results we can see that if we increase the pruning parameter (minimal number of instances in a leaf) the correlation is constant to some degree of pruning and then starts to decrease. By increasing the pruning parameter the size of the trees is also decreasing. If we want our models to be smaller we have to compensate with the accuracy of the model.

Minimal number of instances per leaf	Canopy Cover		Forest Stand Height	
	Correlation	Num. of Leaves	Correlation	Num. of Leaves
4	0.863	1036	0.886	1220
8	0.863	1263	0.886	1199
16	0.863	1221	0.886	1110
32	0.861	1025	0.882	974
64	0.858	770	0.878	753
128	0.853	545	0.871	493
256	0.847	314	0.860	256
512	0.841	92	0.849	121
1024	0.836	44	0.836	49

Table 2. Correlation and number of leaves in the M5 model trees obtained by different degrees of pruning

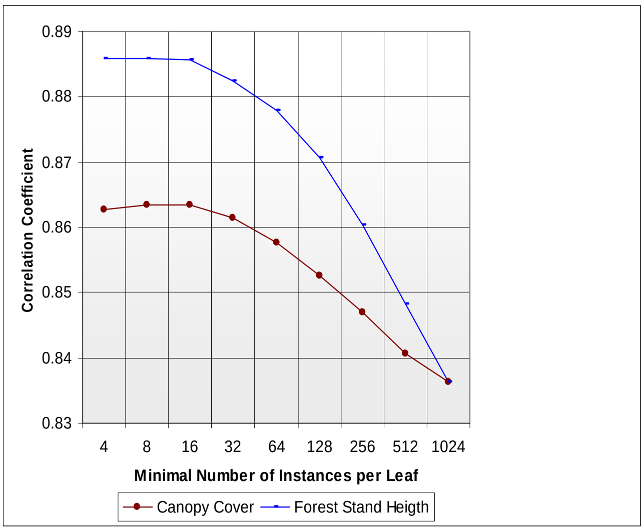


Figure 1. Graphical representation of the dependency of the correlation of M5 model trees from the degree of pruning

6 Conclusions and Future Work

In this paper we compared a number of predictive methods: linear regression, regression and model trees and bagging of regression and model trees. To lower the dimensionality of the data and to try to improve the results obtained in the previous study [7] we applied feature selection algorithms. From the results of the performed experiments we can conclude that linear regression gives the worst results and that bagging of model tress improves the results obtained in [7]. Also performed feature selection of the data doesn't help to improve the performances of the models.

References

[1] Hyyppa, H. (et al.): Algorithms and Methods of Airborne Laser-Scanning for Forest Measurements. International Archives of Photogrammetry and Remote Sensing, Vol XXXVI, 8/W2, Freiburg, Germany, (2004)

[2] SFS Slovenian Forestry Service: Slovenian forest and forestry. Zavod za gozdove RS, 24 pp (1998)

[3] Raymond, M. (et al.): Measures. Laser remote sensing: fundamentals and applications. Malabar, Fla., Krieger Pub. Co. 510 p. G70.6.M4 (1992)

[4] Quinlan, J. R.: Learning with continuous classes. In Proceedings of the 5th Australian Joint Conference on Artificial Intelligence, pages 343–348. World Scientific, Singapore, (1992).

[5] Breiman, L.: Bagging Predictors. Machine Learning Vol. 26(2) 123–140, (1996)

[6] Witten, I. (et al.): Data Mining: Practical machine learning tools and techniques with Java implementations. Second Edition, Morgan Kaufman, (2005)

[7] Džeroski, S. (et al.): Using decision trees to predict forest stand height and canopy cover from LANSAT and LIDAR data. In: Managing environmental knowledge: EnviroInfo 2006: proceedings of the 20th International Conference on Informatics for Environmental Protection, Aachen: Shaker Verlag, pg. 125-133, (2006)

[8] Efron, B. (et al.): An Introduction to the Bootstrap. Chapman and Hall, New York, (1993)

PROPER VERSUS AD-HOC MDL PRINCIPLE FOR POLYNOMIAL REGRESSION

Aleksandar Pečkov, Ljupčo Todorovski, Sašo Džeroski
Department of Knowledge Technologies
Jožef Stefan Institute
Jamova 39, 1000 Ljubljana, Slovenija
Tel: +386 1 4773144 fax +386 1 4773315
e-mail: aleksandar.peckov@ijs.si

Abstract

The paper deals with the task of polynomial regression, i.e., inducing polynomial that can be used to predict a chosen dependent variable based on the values of independent ones. As in other induction tasks, there is a trade-off between the complexity of the induced polynomial and its predictive error. One of the approaches for searching an optimal trade-off is the Minimal Description Length principle (MDL). In our previous papers on polynomial regression, we proposed an ad-hoc MDL principle. The focus in this paper is on developing a proper encoding scheme for polynomials that leads to a proper MDL principle for polynomial regression. We implemented the developed MDL principle as a search heuristic in CIPER, an algorithm for inducing polynomials from data. We present an empirical comparison between the heuristics based an the ad-hoc and the proper MDL principle. The results show that the proper MDL principle leads to simpler polynomials with comparable predictive error. Finally, we also propose a lower bound for the proper MDL principle that allows branch-and-bound pruning of the CIPER search space and evaluate the benefits of pruning.

1 Introduction

Regression models predict the value of a dependent numerical variable from the values of independent (predictor) variables. Typical regression models include linear equations (the task is then refered to as linear regression) [2] (pages 41-75) and regression trees [2] (pages 266-278). This paper deals with the task of polynomial regression, i.e., inducing polynomial equations for regression. Using polynomials for regression (just like using piecewise models, e.g., regression trees) can easily lead to overfitting. Namely, from interpolation theory it is known that a data set of n points can be perfectly interpolated with a polynomial of $(n-1)$-th degree. A consequence of this fact is that in the space of polynomials of an arbitrary degree, we can always find a polynomial with error 0 on the training data. Many approaches for model selection have been proposed in the literature, which more or less successfully avoid the overfitting problem [2] (pages 193-222). The minimal description length (MDL) principle is one of them.

Following the MDL principle, the quality of a model is estimated by the complexity of the model and the errors it makes on training data. The complexity of the model and the errors are measured in terms of the number of bits necessary for encoding them. Therefore, MDL measures always depend on the encoding scheme chosen. While encoding schemes have been proposed for linear equations and regression (model) trees [7], to our knowledge no encoding scheme has been proposed for polynomials. The developed MDL measure is implemented within CIPER [8], an algorithm for inducing polynomials. The evaluation of the proper MDL on standard regression data sets show that it leads to simpler equations compared to the ad-hoc MDL used in the previous version of CIPER. Furthermore, we also experimented with using lower bound of the MDL measure for branch-and-bound pruning of the CIPER search space. The experimental evaluation of the branch and bound pruning shows that the lower error does not lead to much pruning for complex noisy domains.

The paper is organized as follows. In Section 2, we introduce CIPER and the ad-hoc MDL measure for polynomial regression. Section 3 presents the developed encoding of polynomials based on a proper MDL principle. We also introduce a lower bound for the MDL measure that allows branch-and-bound pruning of the search space. Section 4 presents the results of the empirical evaluation. Section 5 concludes the paper and proposes directions for further research.

2 Polynomial Regression with CIPER

Every polynomial can be written in the form:
$P = C + \sum_{i=1}^{m} T_i$
where $T_i = C_i \cdot \prod_{j=1}^{n} {x_j}^{a_{i,j}}$, C_i , $i = 1..m$ and C are constants and $C_i \neq 0$. We say T_i is a *term* or *monomial*

in P. The length of P is $Len(P) = \sum_{i=1}^{m} \sum_{j=1}^{n} a_{i,j};$, the size of P is $Size(P) = m$; and the degree of P is $Deg(P) = Max_{i=1}^{m} \sum_{j=1}^{n} a_{i,j};$

An example polynomial equation is $P = 1.2x^2y + 3.5xy^3$. This equation has size 2, degree 4 and length 7.

CIPER stands for Constrained Induction of Polynomial Equations for Regression. The algorithm heuristically searches through the space of possible equations for solutions that satisfy a given set of constraints. The output of CIPER consists of the polynomial equations, that satisfy the constraints and fit the data best.

In CIPER we have language and complexity constraints:

- *Language constraints* are in the form of sub/super polynomial. With them, we are fine tuning the structure of the model. Formally, a polynomial P is a sub polynomial of a polynomial Q if for every term X in P there exists a term Y in Q such that the degree of every attribute in Y is higher than or equal to the degree of the same attribute in X.

- *Complexity constraints* specify the maximum length, the maximum degree, or the maximum number of terms of the polynomial.

A top-level outline of the search algorithm is shown in Table 1. First, the beam is initialized either with a constant polynomial $P = C$, or with a given initial polynomial. In every search iteration, a set of polynomials is generated from the beam using the refinement operator. The coefficients before the terms are fitted using linear regression. For each of the polynomials, the MDL value is calculated. The ones with the smallest MDL values are placed in the beam. The evaluation stops when no polynomial can be generated from the beam or no polynomial is placed in the beam.

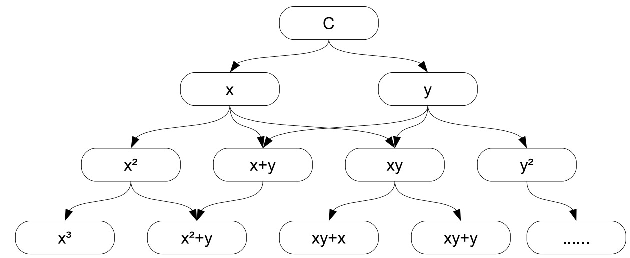
Table 1: A top-level outline of the CIPER algorithm.

procedure CIPER($Data, InitialPolynomial, Constraints$)
$InitialPol$ = FITPARAMETERS($InitialPolynomial, Data$)
$Q = \{InitialPolynomial\}$
repeat
  $Q_r = \{$refinements of all equation structures in Q
    that satisfy the constraints $Constraints\}$
  foreach equation structure $E \in Q_r$ **do**
    E = FITPARAMETERS($E, Data$)
  endfor
  $Q = \{$best b equations from $Q \cup Q_r\}$
until Q unchanged during the last iteration
print Q

We are potentially dealing with large amounts of data that we think of as a table or as a dataset. The data can be represented in a matrix X, where the number of rows is the number of instances, and the number of columns is the number of attributes plus one (the first column is a vector with ones). We calculate the coefficients c_i of the equation as

$$c = (X^T \cdot X)^{-1} \cdot (X^T \cdot y)$$

Figure 1: Overview of the refinement operator



where y is the vector of values that we are trying to predict. In this equation the multiplication is computationally expensive because of the large number of rows. If we have terms T_1,T_2, T_3 and T_4 such that $T_1 \cdot T_2 = T_3 \cdot T_4$, then the appropriate elements in their matrices are equal. We store all generated elements from the matrices in an array. We use it later to calculate the matrix of the subsequently generated polynomials. This optimization considerably lowers the amount of calculations.

The refinement operator increases the length of an equation by one, either by adding a first degree term or by multiplying an existing term by a variable. This operator has several properties:

- In this way all possible equations can be generated.

- The complexity of the equations is slowly increased.

- The squared error is reduced when adding a term [10].

- Every newly generated polynomial using this operator is super polynomial of the one that it is generated from.

Because of the commutativity of addition and multiplication, one equation can be generated in more than one way (Figure 2). However, in our algorithm we avoid this problem.

We use minimum description length theory for calculating the complexity of a models. We tested two approaches for MDL, the ad-hoc MDL and the proper MDL. The ad-hoc MDL heuristics is

$$MDL(P) = len(P) \cdot log(m) + m \cdot log(MSE(P))$$

where P is the polynomial equation being evaluated, $len(P)$ is its length, $MSE(P)$ is its mean squared error, and m is number of training examples.

The best way of combining the complexity and the error is with a proper theoretical MDL heuristic. MDL is based on two ideas:

- The model can be used to compress the data

- The better we are able to compress the data using the model, the better is the model we have induced

This gives us two ways of comparing polynomial models. The first based on the Ad-Hoc MDL heuristics and the second based on the theoretical MDL.

3 Proper MDL for Polynomial Regression

The Minimum Description Length (MDL) Principle [1], [5], and [6], is a method for inductive inference that provides a generic solution to the model selection problem. It chooses a model that makes a trade off between fitting the data well and the complexity of the model. There are two approaches for applying MDL. The first one is called a two-part code version of MDL. Here is the definition [1]:

Let $H_1, H_2, ...$ be a list of candidate models, each containing a set of point hypotheses (a model in our case is identified by the degrees of the terms of an polynomial, and a point hypothesis is an exact polynomial chosen from the model). The best point hypothesis $H \in H_1 \cup H_2 \cup ...$ to explain the data D is the one which minimizes the sum $L(H) + L(D|H)$, where

- $L(H)$ is the length, in bits, of the description of the hypothesis;
- $L(D|H)$ is the length, in bits, of the description of the data when encoded with the hypothesis.

This approach is problematic. It is often impossible to make an ordering of the models according to the requirements of the problem. This led to the second approach called refined MDL. Here we are minimizing the sum $COMP(H') + L(D|H)$ where H' is the model (which contains more point hypotheses), $COMP$ is the complexity.

As mentioned before, MDLCiper has heuristic function based on MDL theory. We are coding the polynomial and the errors. The length of this code is the complexity of the model.

For coding the errors we use the approach of Rissanen [4] and [7] for coding a sequence of integers. The universal code for an integer x is

- $UIC(0) = 1$
- $UIC(x) = 1 + log_2(2.86...) + log_2(x) + log_2(log_2(x)) + ...$

The sum stops when we encounter a negative number (the negative number is not taken).

For a given precision ϵ the code of a real number x is $L(x) = UIC([\frac{x}{\epsilon}])$.

The actual coding algorithm is not given. It is only proved that the length of the function has the desired properties. The intuition behind the formula is that in order to code the integer n with a self contained prex code we need, besides $log_2(x)$ bits, also the preamble of the code, which contains the information about the length of the code ($log_2(log_2(x))$ bits), and since this preamble also needs to be coded we need $log_2(log_2(log_2(n)))$ bits for coding its length and so on. Since this code was developed on the basis of the universal prior probabilities for integers it requires $log_2(2.865064)$, which guarantees that the sum of probabilities for all positive integers equals 1. Additional 1 bit represents the bounds between the encoding.

For the coding of the structure, we first partition all polynomial structures in groups, such that the structures in one group have same degrees for every term. The intuition behind this is that the structure of these polynomials should have same complexity. We are actually choosing one structure from some group. If the number of all polynomials in this group is N, using the refined MDL principle, this structure has complexity $log_2(N)$. The number N can be easily calculated, for more details see [10]

For a given polynomial, we code the errors, the structure, the degrees of the polynomial, the number of terms (using UIC), and the coefficients (using fixed code), for more details see [10] The length of this code is the complexity of the model.

The new MDL heuristics has several nice properties. It enables us to use branch and bound pruning, but we will show in Section 4 that this is useful only when we have very accurate models. We are calculating the complexity in a formal way, and with this avoiding the problem with ad-hoc heuristics. There is a simple way of generating more complex or simpler models, by resizing the data [10].

For the calculation of the coefficients we do a simple linear regression. Linear regression minimizes the square error. We have proved that UIC is an almost convex function (there are some extreme points where UIC is not convex). This means that we are minimizing MDL, (or almost minimizing it) which allows the use of linear regression.

If we want to apply branch-and-bound pruning we need a lower bound for the heuristic measures of the models. We proved that with the ad-hoc MDL we do not have lower bound [10]. However, with the proper MDL heuristic we can find a lower bound. Before fitting the coefficients of a generated equation, we can easily calculate the code length of the equation structure, and use this as a lower bound for the structure. The lower bound of the code for the errors is $\sum UIC(0) = N$ where N is the length of the data. Such a lower bound is very small, but we try to use it.

We have implemented the proper MDL in CIPER, and we present the results obtained with pruning in Section 4.

4 Empirical Evaluation

We used the same settings for the experiment as in our previous work [8].

First we present the errors (relative root mean squared error) of the models generated with the ad-hoc and the proper MDL CIPER (Table 2) as well as those of the model trees and regression trees.

We noticed that in some cases the error of MDL CIPER decreased, and in some increased (Table 2). We also present the search space complexity, i.e the number of generated equations by MDL Ciper. From Table 3 we notice that, generally, proper MDL generates simpler polynomials than ad-hoc MDL.

Table 2: Ad-Hoc and proper MDL, relative errors

Data set	Ad-hoc CIPER	Modal Trees	Regres. Trees	MDL CIPER	Search space
autoprice	0,4012	0,3676	0,5382	0.4434	3138
baskball	0,7959	0,7959	0,9139	0.8279	480
bodyfat	0,1679	0,1612	0,3201	0.1393	5583
cal-housing	0,5386	0,4874	0,5161	0.6004	3595
elusage	0,5216	0,5755	0,6948	0.4083	274
fried-delve	0,3196	0,2766	0,3566	0.4176	4569
house-8l	0,6159	0,5954	0,6270	0.6820	7394
housing	0,4205	0,4177	0,5050	0.4785	9853
kin-8nm	0,6025	0,6060	0,6864	0.8054	73
mbagrade	0,9167	0,9167	1,0104	1.0000	114
pw-linear	0,6273	0,3236	0,5713	0.5177	5900
quake	1,0000	1,0017	1,0051	1.0000	42
vineyard	0,7312	0,8605	0,8489	0.7197	235

The complexity of the induced polynomial is smaller in almost all cases, and in some cases a lot smaller. This generally results in increased relative error, but the general complexity of the model is always smaller.

Table 3: Ad-Hoc and proper MDL, size of the polynomial

	Ad-hoc CIPER			MDL CIPER		
Data set	Size	Len	Deg	Size	Len	Deg
autoprice	5	5	2	2	5	5
baskball	3	2	1	3	4	3
bodyfat	8	11	3	4	4	2
cal-housing	24	81	17	8	7	1
elusage	3	3	2	3	3	2
fried-delve	7	7	2	7	7	2
house-8l	35	163	13	5	13	4
housing	15	32	4	8	9	2
kin-8nm	13	16	2	3	2	1
mbagrade	3	2	1	1	0	0
pw-linear	10	12	2	6	5	1
quake	2	1	1	1	0	0
vineyard	4	4	2	2	4	4

All the experiments were done with and without branch and bound pruning. Only in one case (bodyfat) ciper searched smaller number of equations. We proved that pruning only has effect when the models make small error [10]. Even small amounts of noise can totally reduce pruning. This is however expected.

5 Conclusion

We have presented a theoretical MDL based procedure for induction of polynomial models. We have compared it with an ad-hoc based MDL and showed that the equations that are produced with the theoretical MDL are simpler. We also showed that branch and bound pruning of equations has effect only when the generated model is very accurate.

Future work involves applying MDL heuristic using Rissanen's approach for calculating the complexity of a linear regression model [6]. In his work, the error is not coded using the universal integer codding but instead knowing that the errors are normally distributed he obtains the exact formula for the complexity of the model together with the data. For this to work, the target variable also has to be normally distributed. But we already supposed this, because we are using the method of least squares for minimization of the squared error. This makes the Rissanen approach perfect for our task.

We have successfully reduced the complexity of the modes, but on the cost of increasing the error. Supposing a prior distribution for codding the model may ultimately lead also to more accurate models, what will be the focus of our future work.

References

[1] P. Grunwald. *A Tutorial Introduction to the Minimum Description Length Principle.* Avalible online at http://homepages.cwi.nl/∼pdg/

[2] T. Hastie, R. Tibshirani, and J. Friedman. *The Elements of Statistical Learning*, Springer, 2001.

[3] M. Li and P. Vitnyi. *An Introduction to Kolmogorov Complexity and Its Applications*, Springer, 1997.

[4] J. Rissanen. A universal prior for integers and estimation by minimum description length. *The Annals of Statistics 11(2)*, page 416-431, 1983.

[5] J. Rissanen. *An Introduction to the MDL Principle.* Available online at http://www.mdl-research.org.

[6] J. Rissanen. *Lectures on statistical modeling theory*, August 2005. Available online at http://www.mdl-research.org.

[7] M. Robnik - Šikonja, and I. Kononenko. Pruning regression trees with MDL. *European Conference on Artificial Intelligence*, page 455-459, 1998.

[8] L. Todorovski, P. Ljubič, and S. Džeroski. Inducing polynomial equations for regression. *Proc. Fifteenth International Conference on Machine Learning*, pages 441-452. Springer, 2004.

[9] N. Vereshchagin and P. Vitanyi. Kolmogorovs Structure Functions and Model Selection. Available online at http://www.cwi.nl/∼paulv/papers/.

[10] Ciper appendix. Avalible online at http://www-ai.ijs.si/∼aco/research/CIPER/CIPER.html.

SIMILARITY CONSTRAINTS IN BEAM-SEARCH INDUCTION OF PREDICTIVE CLUSTERING TREES

Dragi Kocev [1], *Sašo Džeroski* [1] *and Jan Struyf* [2]

[1]Jožef Stefan Institute, Department of Knowledge Technologies, Jamova 39, SI-1000, Ljubljana, Slovenia, {Saso.Dzeroski, Dragi.Kocev}@ijs.si
[2]Katholieke Universiteit Leuven, Department of Computer Science, Celestijnenlaan 200A, 3001 Leuven, Belgium, Jan.Struyf@cs.kuleuven.be

ABSTRACT

We investigate how inductive databases (IDBs) can support global models, such as decision trees. We focus on predictive clustering trees (PCTs). PCTs generalize decision trees and can be used for prediction and clustering, two of the most common data mining tasks. Regular PCT induction builds PCTs top-down, using a greedy algorithm, similar to that of C4.5. We propose a new induction algorithm for PCTs based on beam-search. This has three advantages over the regular method: (1) it returns a set of PCTs satisfying the user constraints instead of just one PCT; (2) it better allows for pushing of user constraints into the induction algorithm; and (3) it is less susceptible to myopia. In addition, we propose similarity constraints for PCTs, which improve the diversity of the resulting PCT set.

1. INTRODUCTION

Inductive databases (IDBs) [1][2] represent a database view on data mining and knowledge discovery. IDBs contain not only data, but also models. In an IDB, ordinary queries can be used to access and manipulate data, while inductive queries can be used to generate, manipulate, and apply models. For example, "find a set of accurate decision trees that have at most ten nodes" is an inductive query.

IDBs are closely related to constrained based mining [3]. Because the inductive queries can include particular constraints, the IDB needs constrained based mining algorithms that can be called to construct the models that satisfy these constraints. The above example query includes, for example, the constraint that the trees can contain at most ten nodes.

Much research on IDBs focuses on local models, i.e., models that apply to only a subset of the examples, such as item sets and association rules. We investigate how IDBs can support global models. In particular, we consider predictive clustering trees (PCTs) [4]. PCTs generalize decision trees and can be used for both prediction and clustering tasks. We define PCTs in Section 2.

Regular PCT induction builds PCTs top-down using a greedy algorithm similar to that of C4.5 [5]. This has three main disadvantages w.r.t. inductive databases: (1) it returns only one PCT. This is incompatible with the IDB view that inductive queries should return the set of all models satisfying the constraints in the query. (2) many useful constraints cannot be pushed into the induction algorithm. Size constraints, such as the one in our example query, must be handled partly during post-pruning [6]. (3) because the algorithm is greedy it is susceptible to myopia: it may not find any tree satisfying the constraints even though several exist in the hypothesis space.

In this paper, we propose a new induction algorithm for PCTs that addresses these three problems to a certain extent. The algorithm employs beam-search. Beam-search considers at each step of the search the k best models according to a particular evaluation score. Therefore, it trivially returns a set of models instead of just one model. Beam-search also supports pushing of size constraints into the induction algorithm, as we will show in Section 3. Finally, beam-search is known to be less susceptible to myopia than regular greedy search.

An important disadvantage of using beam-search is that the beam tends to fill up with small variations of the same PCT, such as trees that differ only in one node. To alleviate this, we propose similarity constraints for PCTs. We show that these constraints improve beam diversity.

2. PREDICTIVE CLUSTERING TREES

PCTs [4] are generic decision trees that can be used for a wide variety of data mining tasks including different types of prediction and clustering. PCTs have been applied to multi-objective classification and regression [7], hierarchical and multi-label classification [8], and clustering of time series [9].

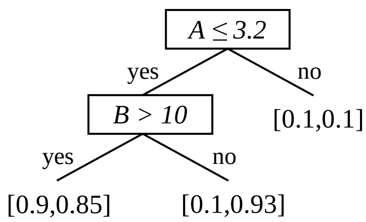


Figure 1: A PCT predicting two numeric attributes.

An example of a multi-objective PCT predicting two numeric attributes is show in Figure 1. Each leaf stores a vector with as components the predictions for the different target variables.

PCTs can be constructed with a greedy top-down induction algorithm. The algorithm is similar to that of C4.5 [5], except that the heuristic for selecting the tests in the internal nodes and the procedure for computing the labels in the leaves is different. For example, to construct the PCT in Figure 1, the heuristic for selecting the tests is minus the intra-cluster variation (ICV) summed over the subsets induced by the test and the label of a given leaf is the average of the target vectors of the examples sorted in the leaf. Intra-cluster variation is defined as $ICV(D) = N \cdot \sum_{t=1}^{T} Var\left[y_t\right]$, with N the number of examples in the subset D, T the number of target variables, and $Var\left[y_t\right]$ the variance of target variable t in D. Minimizing ICV results in homogeneous leaves, which in turn results in accurate predictions.

PCTs are implemented in the CLUS system. CLUS supports various types of PCTs. CLUS implements syntactic constraints and constraints on the size and/or accuracy of the trees [7]. More information about PCTs and CLUS can be found at: http://www.cs.kuleuven.be/~dtai/clus/.

3. BEAM-SEARCH

Fig. 1 shows the beam-search algorithm that we propose. The beam is a set of PCTs ordered by their heuristic value. The algorithm starts with a beam that contains precisely one trivial PCT: a leaf covering all the training data D.

Each iteration of the main loop creates a new beam by refining the PCTs in the current beam. That is, the algorithm iterates over the trees in the current beam and computes for each PCT its set of refinements. A refinement is a copy of the given PCT in which one particular leaf is replaced by a depth one sub-tree (i.e., an internal node with a particular attribute-value test and two leaves). Note that a PCT can have many refinements: a PCT with N leaves yields N × M refined trees, with M the number of possible tests that can be put in a new node. In CLUS, M is equal to the number of attributes. That is, CLUS considers for each attribute only the test that maximizes the heuristic value. This approach limits the number of refinements of a given PCT and increases the diversity of the trees in the beam[1].

CLUS computes for each generated refinement its heuristic value. If this value is larger than the value of the worst PCT in the beam or if there are fewer than k trees (k is the beam-width), then it adds the new PCT to the beam and, if this exceeds the beam-width, removes the worst tree from the beam.

The algorithm ends if a given stopping-criterion is met, such as the beam no longer changes. Note that this occurs if none of the trees in the beam yields any valid refinements. A refinement is valid in CLUS if it does not violate any of the constraints imposed by the user, such as maximum depth, maximum size, or minimum number of examples in each cluster.

```
procedure Beam-Search(D,k) returns Beam
i := 0
leaf := create-leaf(D)
H := heuristic(leaf, D)
beam_0 := { (H, leaf) }
while not stop-criterion(beam_i)
   beam_i+1 := beam_i
   for each tree ∈ beam_i
      R := refinements(tree, D)
      for each  ref-tree ∈ R
         H := heuristic(ref-tree, D)
         H_min := min-heuristic(beam_i+1)
         if H > H_min or |beam_i+1| < k then
            beam_i+1 := beam_i+1 ∪ { (H, ref-tree) }
         if  |beam_i+1| > k then
            beam_i+1 := remove-min(beam_i+1)
   i := i + 1
return beam_i
```

Figure 2: The beam-search algorithm of CLUS.

The heuristic value computed for a tree in beam-search mode differs from the heuristic used in the top-down algorithm from Section 1. The heuristic value in the latter is local, i.e., computed only based on the examples in the node that is being constructed. In beam search mode, the heuristic is global, measuring the quality of the entire tree. The heuristic that we use is:

$$H(T) = -\frac{1}{|D|} \cdot \left(\sum_{leaf_i \in T} ICV(D_i)\right) - \alpha \cdot size(T),$$

with T the given tree, D all training data, and D_i the examples sorted into $leaf_i$. It has two components: the first one is minus the intra-cluster variation of the PCT and the second one is a size penalty. The latter biases the search to smaller trees.

4. SIMILARITY CONSTRAINTS

So far, the heuristic value only takes the error (ICV) and the size of the PCT into account (Section 3). In this section, we define soft similarity constraints, which can be included in the heuristic and bias the search to a set of trees that is less similar.

To quantify the similarity of two trees, we define a distance metric between trees. The distance metric is computed based on the predictions of the trees. We first define a distance metric for single-objective regression and classification. For regression, we have:

$$d\left(T_1, T_2\right) = \frac{1}{M\text{-}m} \sqrt{\frac{\sum_{j=1}^{N} \left(p\left(T_1, t_j\right) - p\left(T_2, t_j\right)\right)^2}{N}}$$

[1] The number of possible tests on a numeric attribute A is typically huge: one test A < a_i, for each possible split point a_i. Clus only constructs one refined tree for the split that yields the best heuristic value.

with $d(T_1,T_2)$ the distance between tree T_1 and T_2, $p(T_i,t_j)$ the prediction of tree T_i for instance t_j, N the number of instances in the training set, M the maximum value of $p(T_i,t_j)$, and m the minimum value of $p(T_i,t_j)$. This corresponds to the mean normalized Euclidean distance between the predictions. The normalization ensures that the distance will be in the interval (0,1).

For classification, we use:

$$d(T_1,T_2) = \sqrt{\frac{\sum_{j=1}^{N} \delta\left(p(T_1,t_j), p(T_2,t_j)\right)}{N}}$$

with $d(T_1,T_2)$ the distance between tree T_1 and T_2, $p(T_i,t_j)$ the prediction of tree T_i for instance t_j, N the number of instances in the training set, and

$$\delta(a,b) = \begin{cases} 0 \; if \;\; a = b \\ 1 \; if \;\; a \neq b \end{cases}.$$

The heuristic value for a new candidate tree is modified by adding the average of the distances to all trees in the beam as follows:

$$H(T) = -\frac{1}{|D|}\cdot\left(\sum_{leaf_i \in T} ICV(D_i)\right) - \alpha \cdot size(T) - \beta \cdot SIM(T)$$

with $SIM(T) = 1 - \frac{d(T,T_{cand}) + \sum_{j=1}^{k} d(T,T_j)}{k}$ the average similarity to the trees in the beam and the candidate tree, and k the beam-width.

This heuristics is recomputed for each tree in the beam and the candidate tree. If the candidate tree has score greater than the minimal then it enters the beam and the tree with minimal score is left-out.

5. EXPERIMENTAL SETUP

We have implemented the beam-search algorithm and the similarity constraints in the CLUS system. We compare CLUS with the regular top-down induction algorithm (TD) for PCTs to CLUS with beam-search (BS) and beam-search with similarity constraints (BS-s) on 9 regression and 8 classification data sets from the UCI machine learning repository [10]. We set the parameters of the beam-search algorithms ad-hoc to the following values $k = 10$, $\alpha = 0.1$, and $\beta = 1$. For TD, we set a size constraint so that the trees can contain at most 7 nodes [6]. This value is set such that the trees are approximately the same size as the trees obtained with beam-search.

Note that the heuristics defined in Section 2-3 are designed for regression data. For the classification data sets, we use different heuristics that are obtained by replacing in the regression variants *ICV*(D_i) by $|D_i| \cdot Entropy(D_i)$ with $Entropy(D_i)$ the class entropy of the set D_i.

For each algorithm, we measure the predictive performance of the resulting PCT and its size. For classification data we report accuracy and for regression data the Pearson correlation coefficient. The values listed for the beam-search algorithms are those of the best scoring model.

To quantify the effect of the similarity constraints, we report for the two beam-search algorithms the *Beam Similarity*, which is the average similarity of the trees in the beam. *Beam Similarity* is computed as follows:

$$Beam\ Similarity = \frac{\sum_{i=1}^{k} S(T_i)}{k},$$

with $S(T_i) = 1 - \frac{\sum_{j=1}^{k} d(T_i,T_j)}{k}$ the similarity of tree T_i w.r.t. the other trees in the beam, $d(T_1,T_2)$ the distance between tree T_1 and T_2, and k the beam-width.

6. RESULTS AND DISCUSSION

Table 1 and Table 2 present the results. For most data sets, the results are accuracy or correlation-wise comparable. The most noticeable differences are obtained for the datasets pyrim, pollution and segment. Here the correlation or the accuracy of beam-search with similarity constraints is considerably better than that of top-down tree induction.

The effect of including the similarity constraints can be seen from the reported beam similarity. For all data sets, beam similarity reduces by using the similarity constraints.

7. CONCLUSIONS AND FURTHER WORK

We propose a new algorithm for inducing predictive clustering trees (PCTs) that employs beam-search. The main advantages of this algorithm are that it induces a set of PCTs instead of just one PCT, that it supports pushing of user constraints, and that it is less susceptible to myopia. Furthermore, we propose soft similarity constraints based on the predictions of the PCTs. The similarity constraints improve beam diversity.

A preliminary experimental evaluation illustrates some of the advantages of the approach. In the future, we plan a more extensive evaluation, among others, quantifying the influence of the similarity constraints on the heuristic value (the effect of the β parameter).

Note that diversity, which is obtained by means of our heuristic, has been shown to increase the predictive performance of classifier ensembles. Therefore, we plan to investigate if beam-search with the similarity constraints can be used to construct an ensemble of PCTs.

Table 1. *Results for the regression data sets (TD is regular top-down induction, BS is beam-search, and BS-s is beam-search with similarity constraints).*

	No. of Attributes	Correlation			Size			Beam Similarity	
		TD	BS	BS-s	TD	BS	BS-s	BS	BS-s
autoPrice	16	0.8839	0.8464	0.7965	7	3	5	0.8408	0.7247
bodyfat	15	0.9366	0.8748	0.8748	7	5	5	0.9004	0.7803
cpu	8	0.9240	0.8438	0.8438	7	5	5	0.9387	0.9290
housing	14	0.7960	0.7496	0.7496	7	5	5	0.8261	0.7902
pollution	16	0.5012	0.5647	0.9910	7	5	5	0.7296	0.6771
servo	5	0.8885	0.9104	0.9104	7	7	7	0.8933	0.8161
cpu_act	22	0.9568	0.9431	0.9443	7	5	5	0.9482	0.9293
pyrim	28	0.6752	0.6146	0.9021	7	5	3	0.9540	0.6728
machine_cpu	7	0.8395	0.8335	0.7356	7	5	3	0.9324	0.9181

Table 2. Results for the classification tasks *(TD is regular top-down induction, BS is beam-search, and BS-s is beam-search with similarity constraints).*

	No. of Attributes	Accuracy			Size			Beam Similarity	
		TD	BS	BS-s	TD	BS	BS-s	BS	BS-s
car	7	0.7917	0.7917	0.7922	7	5	9	0.6175	0.5824
mushroom	23	0.9941	0.9941	0.9941	5	5	5	0.9741	0.8105
segment	20	0.5558	0.8108	0.8095	7	11	11	0.9256	0.4367
vowel	14	0.2515	0.2818	0.2747	7	9	5	0.4111	0.2677
vehicle	19	0.5118	0.6017	0.6028	7	7	7	0.9101	0.3449
iris	5	0.9400	0.9600	0.9600	7	5	5	0.8978	0.6438
ionosphere	35	0.8860	0.8718	0.8718	7	5	5	0.6824	0.5851
kr-vs-kp	37	0.9043	0.9309	0.8833	7	9	7	0.5663	0.4248

REFERENCES

[1] T. Imielinski and H. Mannila. A database perspective on knowledge discovery. Communications of the ACM, 39(11):58-64, 1996.

[2] L. De Raedt. A perspective on inductive databases. SIGKDD Explorations, 4(2):69-77, 2002.

[3] J-F. Boulicaut, B. Jeudy. Constraint-based data mining. The Data Mining and Knowledge Discovery Handbook, O. Maimon and L. Rokach (Eds.), Springer, pp. 399-416, 2005.

[4] H. Blockeel, L. De Raedt and J. Ramon. Top-down induction of clustering trees. In Proceedings of the 15th International Conference on Machine Learning, p. 55-63, 1998.

[5] J. R. Quinlan. C4.5: Programs for Machine Learning. Morgan Kaufmann series in Machine Learning. Morgan Kaufmann, 1993.

[6] M. Garofalakis, D. Hyun, R. Rastogi and K. Shim. Building decision trees with constraints. Data Mining and Knowledge Discovery, 7(2):187-214, 2003.

[7] J. Struyf and S. Dzeroski, Constraint based induction of multi-objective regression trees. In proceedings of the 4th International Workshop on Knowledge Discovery in Inductive Databases, p. 110-121. 2005.

[8] H. Blockeel, L. Schietgat, J. Struyf, S. Dzeroski, and A. Clare, Decision trees for hierarchical multilabel classification: A case study in functional genomics, Proceedings of the 10th European Conference on Principles and Practice of Knowledge Discovery in Databases, p. 18-29, 2006.

[9] S. Dzeroski, I. Slavkov, V. Gjorgjioski and J. Struyf, Analysis of time series data with predictive clustering trees. In proceedings of the 5th International Workshop on Knowledge Discovery in Inductive Databases, p. 47-58. 2006.

[10] D.J. Newman, S. Hettich, C.L. Blake and C.J. Merz. UCI repository of machine learning databases. http://www.ics.uci.edu/~mlearn/MLRepository.html.

FAST CONVEGENCE CLUSTERING ENSEMBLE

Javad Azimi
Iran University of Science and Technology
Farjam , Tehran , Iran
Tel: +98-2177341148
Fax: +98-2133868481
Email: Ja_azimi@comp.iust.ac.ir

S.Reza Davoodi
Iran University of Science and Technology
Farjam , Tehran , Iran
Tel: +98-2177341148
Fax: +98-2133868481
Email: SR_davoodi@comp.iust.ac.ir

Morteza Analoui
Iran University of Science and Technology
Farjam , Tehran , Iran
Tel: +98-2177341148
Fax: +98-2133868481
Email: Analoui@iust.ac.ir

ABSTRACT

Clustering ensemble combines some clustering outputs to obtain better results. High robustness, accuracy and stability are the most important characteristics of clustering ensembles. Previous clustering ensembles usually use k-means to generate ensemble members. The main problem of k-means is initial samples which have high effect on final results. Refining initial samples of k-means increases the complexity of algorithm significantly. In this paper we try to predict initial samples, especially for clustering ensemble, without any increasing in time complexity. In this paper we introduce two approaches to select the initial samples of k-means intelligently to generate ensemble members. The proposed methods increase both accuracy and the speed of convergence without any increasing in time complexity. Selecting one sample from each cluster of previous result and selecting k samples which have minimum similarity to each other from co-association matrix are the two proposed method in refining initial samples of k-means. Clarity, simplicity, fast convergence and higher accuracy are the most important parameters of proposed algorithm. Experimental results demonstrate the effect of proposed algorithm in convergence and accuracy of common datasets.

Keywords

Clustering ensembles, K-means, Initial samples, Fast convergence.

1. INTRODUCTION

Clustering is used to divide data into similar groups. The members of each group have maximum similarity with each other and have maximum dissimilarity with the ensemble members of other groups. Because of the characteristic of each data set, there is not a perfect clustering algorithm which performs well in all conditions. Therefore, clustering ensembles is used as a powerful method which can obtain better accuracy that a single clustering algorithm. Clustering ensembles mainly consist of three steps: generating some bootstrap samples or sub samples of input data, applying different clustering algorithms on these bootstrap samples to obtain partitions as the results and using a consensus function to obtain a final partition. Clustering ensembles can offer better solutions in terms of robustness, novelty and stability [1, 2, and 3].

Previous studies mainly focused on 4 approaches to improve the results, using different clustering algorithms to produce partitions for combination [4] , changing initialization or other parameters of a clustering algorithm [3,5], using different features via feature extraction for subsequent clustering [1,6,7] and partitioning different subsets of the original data [8,9,10,11,12,13].

All above introduced mechanisms try to produce higher accuracy and faster convergence from different aspects. But these mechanisms usually can not gather both high accuracy and fast convergence. In this paper we introduce an algorithm which has both high accuracy and fast convergence.

Previous clustering ensemble algorithms usually use k-means as first clustering algorithm which generates the ensemble members. The simplicity and clarity of k-means made it popular in clustering.

The major problem of k-means algorithm is initial samples. It has been reported that the solutions obtained from the k-means are dependent on the initial samples [14, 15]. In the first step of k-means algorithm, we must select k initial samples which k is the number of clusters. There are many methods which select the initial samples intelligently [14, 16, 17]. They study the whole feature spaces to select k initial samples. They usually study the feature space and select the initial samples using probabilistic method. Therefore, they increase the complexity of their algorithms considerably. In this paper we try to predict initial samples, especially for clustering ensemble, without any increasing in time complexity. We try to combine simplicity and accuracy with each other. We think that the simplicity of each algorithm make it popular between algorithms.

Two algorithms which select the initial samples intelligently are introduced in this paper. Clustering ensemble consists of two major steps, generating partitions (ensemble members) and consensus function which obtains the final partition. Previous clustering ensemble algorithms usually use some independent runs of k-means in generating partitions and the initial samples of the k-means runs are selected at random. The result of each k-means has not any effect in others. In previous study the ensemble members obtained completely independent. The propose methods in this paper use the previous result of ensemble members to generate the next ensemble members. Selecting one sample from each cluster of previous result and selecting k samples which have minimum similarity to each other from co-association matrix are the two proposed method in this paper.

Clarity, simplicity, fast convergence and higher accuracy are the most important parameters of proposed algorithm.

Experimental results demonstrate that clustering ensemble results based on these ensemble members are more accurate and faster than standard k-means with random initial samples in common datasets.

2. Fast Convergence Clustering Ensemble

In k-means algorithm; after each execution of k-means loop, if there is not a sample whose cluster has been changed during the previous loop, we stop k-means algorithm. The number of loops of each execution of k-means algorithm has a high effect on the speed of k-means algorithm. One of the most important parameters which effects on the speed of k-means is initial samples of k-means. The experience demonstrates that the initial samples of k-means have a great effect not only in the number of k-means loops but also in the accuracy of clustering.

It has been reported that the solutions obtained from the k-means are dependent on the initialization of cluster centers [14,15]. In the first step of k-means algorithm, we must select k initial samples which k is the number of clusters. If there are k real clusters, then the chance of selecting one sample from each cluster is small. The chance is relatively small when the number of the clusters is large.

If k clusters have equal samples (n), then the chance of selection of one sample from each cluster is:

$$p = \frac{\alpha}{\beta} = \frac{k!n^k}{(kn)^k} = \frac{k!}{k^k} \qquad (1)$$

Where α , is the number of ways to select one samples from each cluster and β is the number of ways to select k samples.

There are many methods which select the initial samples intelligently [14, 16, 17]. They study the whole feature spaces to select k initial samples. In previous studies, they tried to refine initial samples for one execution of k-means algorithm. They should study the feature space and select the initial samples using probabilistic method. Therefore, they increase the complexity of their algorithms considerably.

In proposed algorithm we introduce two methods for selecting the initial samples of k-means intelligently. The proposed methods can only be used in clustering ensembles methods. In clustering ensembles, some independent execution runs of k-means are done, which are named as ensemble members, and the final partitions are obtained from the ensemble by using some deterministic algorithms, such as majority vote or average linkage.

Clustering ensemble has a higher accuracy than single clustering algorithm, such as k-means. The most negative aspect of clustering ensemble is time complexity. Previous studies tried to decrease the time complexity by decreasing the number of ensemble members. The method which has a high accuracy with lower number of ensemble members is the goal of researches.

The two proposed method support both high accuracy and high speed without decreasing the number of ensemble members and without increasing the complexity time in clustering ensembles.

The proposed methods refine the initial samples of k-means algorithm without any increasing in time complexity. Using previous k-means results and using co-association values are the two proposed method.

2.1. Selecting initial samples from previous results

Clustering ensemble consists of two major steps, generating partitions (ensemble members) and consensus function which obtains the final partition. Previous clustering ensemble algorithms usually use some independent runs of k-means in generating partitions. They usually use k-means to generate partitions. The initial samples of the k-means runs are selected at random. We introduce the method which selects the initial samples according to the previous k-means results.

In generating ensemble members, the first ensemble member uses the standard k-means with random initial samples. But other ensemble members use the previous result of k-means algorithm to select the initial seed points. The initial points for execution i is selected from the results of execution i-1 of k-means result. The initial points are selected from different clusters of previous result. After each execution of k-means we select one sample from each cluster at random for next k-means.

Experimental results demonstrated that higher accuracy and higher speed are obtained by proposed algorithm.

Input: *Di (Data points) , K (Number of Cluster) and N(The Number of Partitions)*

Output: *N Ensemble Members*

For i=i , i <N

  if i = 1 **then**

   begin

    seed points = select K initial samples at random;

    do standard k-means;

   end

  else

   begin

    seed points = select K initial points from previous k-means results;

    do standard k-means;

   end

end

Figure 1.The proposed algorithm.

2.2. Selecting initial samples from co-association matrix

The last step of clustering ensembles is consensus function. There are many types of consensus function such as *hypergraph partitioning* [1, 6], *voting approach* [8, 18, 19], *quadratic mutual* *information algorithm* [20] *and co-association based functions* [2, 21, 22].

*In co-association based functions (*also pair wise approach) the consensus function operates on the co-association matrix. Let *D* be a data set of *N* data points in *d*-dimensional space. The input data can be represented as an *N* × *d* pattern matrix or *N* × *N* dissimilarity matrix, potentially in a non-metric space. Suppose that *X*={*X1*… *XB*} is a set of bootstrap samples or sub samples of input data set *D*. A chosen clustering algorithm is run on each of the samples in *X* that results in *B* partitions *P* = {*P*1,…, *PB*}. Each component partition in *P* is a set of clusters $P_i = \{C_1^i, C_2^i, ... C_{K(i)}^i\}$, $X_i = C_1^i \cup C_2^i .... \cup C_{k(i)}^i$ and k(i) is the number of clusters in the i-th partition .

$$\text{Co-association }(x, y) = \frac{1}{B}\sum_{i=1}^{B}\varphi(P_i(x), P_i(y))$$

$$\varphi(a,b) = \begin{cases} 1 \text{ if } a = b \\ 0 \text{ if } a \neq b \end{cases} \qquad (2)$$

Similarity between a pair of objects simply counts the number of clusters shared by these objects in the partitions {*P*1,…, *PB*}. Numerous hierarchical agglomerative algorithms (criteria) can be applied to the co-association matrix to obtain the final partition, including Single Link (SL), Average Link (AL), Complete Link (CL) and voting k-means.

As mentioned above, after each execution of k-means, the co-association matrix is updated. High value in co- association matrix means more similarity and vise versa. Therefore we select k samples which have low similarity with each other. The low similarity or low value in co-association matrix guaranties that the selective samples are not in same clusters. Experimental results demonstrated that higher accuracy and higher speed are obtained by proposed algorithm.

3. Experimental results

The experiments were performed on several data sets, including, three data sets from the UCI repository, “Iris”, “Wine”, “Soybean”. A summary of data set characteristics is shown in Table1.

Table-1 (Datasets which use in our article)

Dataset	Number of samples	Number of cluster	Feature count
iris	150	3	4
Soybea n	47	4	35
Wine	178	3	13

In this step, the standard k-means is run for 100 times with random initial samples and intelligent initial samples. The number of loops and the number of misclassified samples of each execution are saved. Table 2 shows the experimental results of the standard k-means on proposed data sets. The total number of k-means loops and the average error rate of k-means for 100 independent executions when initial samples has been selected at random or when initial samples has been selected from previous results (SIPR) are reported in Table 2.

The results in Table 2 are individual accuracy of k-means results in both situations. Table 2 shows that not only the ensemble members in SIPR are more accurate than standard k-means but the ensemble members’ loops are less than standard k-means. For example in Iris data set the loop count has been reduced to 37.5 from 46.2.

Table2.the average of miss classification samples and loop count of 100 individual ensemble members

Dataset		Standard k-means	SIP R
Iris	Loop count	46.2	37.5
	Miss classification Samples	34	18
Wine	Loop count	46.1	40.2
	Miss classification Samples	59	50
Soybean	Loop count	24.8	22.6
	Miss classification Samples	17	13

Therefore it can be expected that the clustering ensemble based on these ensemble members is more accurate than previous models.

Table 3 shows both the number of loops and the number of miss classification samples in proposed data set when clustering ensemble is applied to different ensemble members. Three different ensemble members are proposed, standard k-means which generates the ensembles members with random initial samples, the k-means whose initial samples are selected from previous results (SIPR) and the k-means whose initial samples are selected from co-association matrix (SICM). Co-association matrix along with average linkage has been used as consensus function.

Table 3 shows that the clustering ensemble with SICM members is more accurate than others and clustering ensemble with SIPR ensemble members is more accurate than standard k-means. This means that we have obtained more accurate and faster clustering. Since SICM uses all previous results to select the initial samples, the SICM has the better results than previous proposed methods.

Clarity, simplicity, fast convergence and higher accuracy are the most important parameters of proposed algorithm. Time complexity in large data sets with high dimension and real time systems is the vital parameter. Therefore, the proposed algorithm can be applied to these data sets in different situations to improve the final results significantly. The proposed algorithm can only be used in clustering ensemble algorithms

Table3. The results of proposed method

Dataset		Standard k-means	SIPR	SICM
Iris	Loop count	46.2	37.5	31.3
	Miss classification Samples	33.33	17.66	14.33
Wine	Loop count	46.1	40.2	35.2
	Miss classification Samples	52	49	44
Soybean	Loop count	24.8	22.6	14.3
	Miss classification Samples	15	12.66	11

4. REFERENCES

[1] A. Strehl & J. Ghosh,. Cluster ensembles—a knowledge reuse framework for combining partitionings, in: Proc. of 11-th National Conf. on Artificial Intelligence, Edmonton, Alberta, Canada, 2002, pp. 93–98.

[2] A.L.N. Fred & A.K. Jain : Data Clustering Using Evidence Accumulation, Proc. of the 16th Intl. Conf. on Pattern Recognition, ICPR 200, Quebec City ,2002,pp.276 – 280.

[3] A. Topchy & A.K. Jain, & W. Punch.: Combining Multiple Weak Clusterings, Proc. 3d IEEE Intl. Conf. on Data Mining, 2003, pp.331-338.

[4] X. Hu, I. Yoo.: Cluster ensemble and its applications in gene expression analysis, in: Y.-P.P. Chen (Ed.), Proc. 2-nd Asia-Pacific Bioinformatics Conference, Dunedin, New Zealand, 2004, pp. 297–302.

[5] X.Z. Fern & C.E. Brodley.: Random projection for high dimensionaldata clustering: a cluster ensemble approach, in: Proc. 20thInternational Conference on Machine Learning, ICML, Washington,DC, 2003, pp.186–193.

[6] A. Strehl & J. Ghosh.: Cluster ensembles a knowledge reuse framework for combining multiple partitions. Journal on Machine Learning Research, 2002, pp. 583-617.

[7] D. Greene & A. Tsymbal & N. Bolshakova & P. Cunningham.: Ensemble clustering in medical diagnostics, in: R. Long et al. (Eds.), Proc. 17th IEEE Symp, on Computer-Based Medical Systems, 2004, pp. 576– 581.

[8] S. Dudoit & J. Fridlyand.: Bagging to improve the accuracy of a clustering procedure, Bioinformatics 19, 2003, pp.1090–1099.

[9] B. Fischer & J.M. Buhmann.: Bagging for path-based clustering,IEEE Transactions on Pattern Analysis and Machine Intelligence, 2003, pp.1411–1415.

[10] A.L.N. Fred & A.K. Jain.: Robust data clustering, in: Proc. IEEEComputer Society Conference on Computer Vision and PatternRecognition, CVPR ,USA, 2003, vol. II, pp. 128–136.

[11] B Minaei & A. Topchy & W. F. Punch.: Ensembles of Partitions via Data Resampling , in Proc. Intl. Conf. on Information Technology, ITCC 04, Las Vegas, 2004.

[12] S. Monti & P. Tamayo & J. Mesirov & T. Golub.: Consensus clustering: a resampling based method for class discovery and visualization of gene expression microarray data, Machine Learning 52, 2003, pp.91–118.

[13] A. Topchy & B. Minaei-Bidgoli & A.K. Jain & W. Punch.: Adaptive Clustering ensembles In Proc. Intl. Conf on Pattern Recognition,ICPR'04, Cambridge, UK, 2004, pp.272-275.

[14] P. Bradley, U. Fayyad, "Refining initial points for k-means clustering", Proceedings 15th International Conf, on Machine Learning, San Francisco, CA, 1998, pp. 91-99.

[15] J. Pena, J. Lozano and P. Larranaga, "An Empirical comparison of four initialization methods for the k-means algorithm", Pattern Recognition Letters Vol. 20, 1999, pp. 1027-1040

[16] G. Babu and M. Murty, "A near optimal initial seed value selection in k-means algorithm using a genetic algorithm", Pattern Recognition Letters Vol. 14, 1993, pp. 763-769.

[17] Y. Linde, A. Buzo and R. Gray," An algorithm for vector quantizer design", IEEE trans. Comm. Vol. 28, 1980, pp. 84-95.

[18] X.Z. Fern, C.E. Brodley, Random projection for high dimensionaldata clustering: a cluster ensemble approach, in: Proc. 20thInternational Conference on Machine Learning, ICML, Washington,DC, 2003, pp. 186–193.

[19] A. Weingessel& E. Dimitriadou & K. Hornik.: An ensemble method for clustering, working paper, 2003.

[20] A. Topchy & A.K. Jain & W. Punch.: A mixture model for clustering ensembles, in: Proceedings of SIAM Conference on Data Miningpp, 2004, pp.379–390.

[21] R.O. Duda & P.E. Hart & D.G. Stork.: Pattern Classification. 2nd Edition, John Wiley & Sons Inc. New York NY, 2001.

[22] A. FredF & Roli & J. Kittler: Finding consistent clusters in data partitions, in: (Eds.), Proc. 2nd International Workshop on Multiple Classifier Systems, MCS_01, Lecture Notes in Computer Science, vol. 2096, Springer-Verlag, 8, Cambridge, UK, 2001, pp. 309–31.

Zbornik 9. mednarodne multikonference
Proceeding of the 9th International Multiconference

INFORMACIJSKA DRUŽBA IS 2006

INFORMATION SOCIETY IS 2006

Sodelovanje in informacijska družba

Collaboration and Information Society

Uredil / Edited by

Marjan Heričko

http://is.ijs.si

11. oktober 2006 / 11th October 2006
Ljubljana, Slovenia

PREDGOVOR

Osnovna značilnost informacijske družbe je možnost sodelovanja in vključenosti v dogajanja ne glede na oddaljenost in omejitve, ki jih pogojujejo lokalna kulturna in tehnološka okolja. V zborniku prispevkov konference »CIS'2006 - Sodelovanje in informacijska družba« so predstavljena spoznanja, povezana s komunikacijskimi, organizacijskimi, pravnimi in tudi tehničnimi izzivi, ki jih je potrebno razrešiti za uspešno sodelovanje tako na nivoju posameznikov, kot na medorganizacijskem in širšem družbenem nivoju.

V prispevkih so predstavljeni rezultati raziskav in projektov, katerih namen je omogočiti učinkovito organiziranje in upravljanje z znanjem ter in uspešno sodelovanje posameznikov in podjetij v porazdeljenih in/ali virtualnih organizacijah, projektnih skupinah in skupnostih. Razen metodoloških pristopov so v prispevkih podane konkretne izkušnje iz raznovrstnih okolij in projektov. Rezultati kažejo, da je potrebno za uspešnejše sodelovanje na vseh nivojih in področjih odstraniti še kar nekaj ovir. Vsekakor pa razvijanje in vzpostavljanje novih in naprednih oblik sodelovanja prispeva tudi k napredku informacijske družbe.

dr. Marjan Heričko
predsednik konference Sodelovanje in informacijska družba

PREFACE

The main characteristic of an information society is the ability to collaborate across organizational, geographic and professional boundaries and to overcome the constraints caused by cultural and technological differences. The papers in the CIS’2006 conference proceedings present actual research and projects related to the communicative, organizational, legal and technical aspects of collaboration. Authors have focused on issues that are crucial for successful knowledge management and collaboration on the individual and corporate levels with a special focus on distributed and/or virtual teams and communities. New techniques, approaches and methods have been proposed. Experiences indicate that there are still some obstacles to overcome in order to achieve successful and efficient collaboration. However, by developing and implementing new and advanced forms of collaboration we contribute to the progress and prosperity of the information society.

dr.Marjan Heričko
CIS’2006 - Collaboration and Information Society Conference Chairman

PROGRAMSKI ODBOR / PROGRAMME COMMITTEE

Dr. Marjan Heričko
University of Maribor, Faculty of Electrical Engineering and Computer Science

Dr. Kimmo Salmenjoki
University of Vaasa, Department of Computer Science

Dr. Adel Taweel
University of Manchester, Department of Computer Science

Dr. Gabriele Gianini
University of Milano, Faculty of Mathematical, Physical and Natural Sciences

Dr. Lorna Uden
Staffordshire University, School of Computing

Dr. Mateja Podlogar
University of Maribor, Faculty of Organizational Sciences

Dr. Aleš Živkovič
University of Maribor, Faculty of Electrical Engineering and Computer Science

Dr. Tomaž Domajnko
SRC.SI d.o.o

Mag. Urška Kežmah
University of Maribor, Faculty of Law

DESIGNING USABLE COLLABORATIVE E-MAIL USING ACTIVITY THEORY

Aravind Kumaresan[1], *Lorna Uden*[1], *Kimmo Salmenjoki*[2]
[1] Staffordshire University, UK
The Octagon,
Beaconside, Stafford, ST18 OAD. UK
[2] Department of Computer Science
University of Vaasa
Box 700, 65101 Vaasa, Finland
e-mail: L.Uden@staffs.ac.uk, ksa@uwasa.fi

ABSTRACT

Email has become an important tool in all organizations for effective collaboration. Although the use of email is popular and common, it has not evolved to meet users' collaborative work practice. This is particularly true when it comes to usability and information management. For effective collaborative work, email must be designed that meet users' needs and their experiences. The traditional approach to designing interfaces has been increasingly criticised because of the gaps between research results and practical design especially concerning requirements. Requirements elicitation is a key to the success of the development of all email applications.

Activity theory incorporates the notions of intentionality, history, mediation, motivation, understanding, culture and community into design. In particular, it provides a framework in which the critical issue of context can be taken into account. This paper describes the use of activity theory for the requirements analysis of a collaborative email system.

1 INTRODUCTION

There are various collaboration tools available such as Email, List Servers, Newsgroups, Web Conferencing, Internet Relay Chat (IRC), Internet Phone, Internet Radio, and Desktop Video Conferencing. Each of these tools has advantages and disadvantages for collaborative use. Among these collaborative tools, email is the most commonly used tool for electronic collaboration because of its asynchronous information sharing capability. Another reason is, virtually everyone who has ever touched a computer understands email. Email has become an important tool for communication in our modern life. Despite its popularity and widespread use, existing email systems have several defects like spam; security; accessibility; usability and information management.

Spam has become a major problem on the internet. In the past, researchers have addressed this problem as a text classification or categorization problem. Security is the major factor for any system. Developing systems that are assured to be secure requires precise and accurate descriptions of specifications, designs, implementations, and security properties. There are number of associated security issues within it. Crucial to the spam, security and accessibility issues are those of usability and information management. Email is a major means of personal and corporate communication. When it comes to corporate communication, it is important to know about usability. Usability is concerned with how easy it is to use and learn to use the system as well as how efficient and effective is the application. Users would only use the system if it is easy to use that allows them to carry out their tasks effectively and efficiently. Although spam, security and accessibility are important issues, this paper only concerned with the design of application, i.e., usability and information management.

People use emails to carry out tasks especially when users work collaboratively. The flow of tasks by the users in collaboration should be easily managed, shared and monitored. Another role of email is task management. However, current email systems are not effective in managing tasks by Whittaker et al [17]. Central to the design of usable email applications that meet users' needs is requirements analysis. Effective and efficient requirements elicitation is absolutely essential if software systems are to meet the expectations of their customers and users, and are to be delivered on time and within budget Al-Rawas, Easterbrook [1]. Most established techniques, however, do not adequately address the critical organisational and 'softer', people-related issues of software systems. In this context, activity theory would appear to have much to offer. This paper argues that activity theory provides an appropriate framework for elucidating requirements. Activity theory is a socio-cultural, socio-historical lens through which we can analyse human activity systems. It focuses on the interaction of human activity and consciousness within its relevant environmental context. In this paper, we present a case study involving the use of activity theory in requirements elicitation for the design of a collaborative email application for A SSIL organisation. This paper begins with a brief review of activity theory and requirements analysis. This is followed by the description of the requirements analysis of the SSIL application with special attention paid to the contradictions of the different stakeholders. The paper concludes with further research suggestions.

2 A BRIEF REVIEW OF ACTIVITY THEORY

Human Activity Theory is based on the work of the anthropological/psychological theory of A.H. Leontev [12] and L.S. Vygotsky [16]. It is a general philosophical framework for understanding the development of human culture and individual personality based on dialectical materialism. The basic unit of analysis in activity theory is human activity. Human activities are driven by certain needs where people wish to achieve certain purposes. The activity is mediated by one or more instruments or tools. The basic principles of activity theory include object orientedness, internalisation/externalisation, mediation, hierarchical structure and development.

It is obvious that activity cannot exist as an isolated entity. The very concept of activity implies that there is an agent who acts (an individual or collective 'subject'). An activity is directed at something, so there should be things the agent is interacting with. According to activity theory terminology, activity mediates interaction between subjects (agents) and objects (things). In activity theory, the human mind emerges, exists and can only be understood within the context of human interaction with the world and this interaction, i.e., activity, is socially and culturally determined by Kaptelinin et al [9]. The basic structure of an activity can be illustrated as in Figure 1.

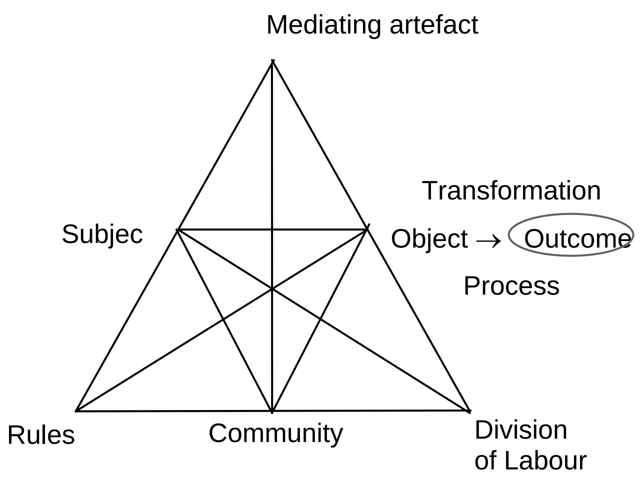


Figure 1: *Basic structure of an activity*

Activity theory helps structure analysis, but does not prescribe what to look for. It does not offer ready-made technologies and procedures for research by Engeström [5]. Its conceptual tools must be concretised according to the specific nature of the object under study. Engeström in [4] recommends three methodological principles for activity theory. Firstly, a collective activity system is taken as the unit of analysis, giving context and meaning to seemingly random individual events. In activity theory, activity and context cannot be separated. The activity system itself is the context. What takes place in an activity system composed of object, actions and operations, is the context. Context is constituted through the enactment of an activity involving person (subject) and artefacts. Context is therefore the activity system and the activity system is connected to other activity systems. People consciously and deliberately generate contexts (activities) in part through their own objects. Context is not an outer container or shell, inside of which people behave in certain ways. Context is both internal to people involving specific objects and goals, as well as external to people, involving artefacts, other people and specific settings. In activity theory, both external and internal are fused, unified. Context cannot be reduced to an enumeration of people and artefacts. Instead, the specific transformation relationship between people and artefacts, embodied in the activity theory notion of functional organ is at the heart of context or activity by Nardi [14]. Therefore contexts are activity systems incorporating both the object-oriented productive aspect and the person-oriented communication aspects of human activities. Production and Consumption are inseparable by Engeström [4]. In activity theory, context is not persistent and fixed information. Continuous construction is going on between the components of an activity system. Humans not only use tools, they also continuously renew and develop them either consciously or unconsciously. They not only use rules, but also transform them.

Secondly, historically analyse the activity and it constituent components and actions. History is the basis of classification. This means that the activity system and its components shall be understood historically. An activity is not a homogeneous entity. It is comprised of a variety of disparate elements, voices and viewpoints [4]. The multiplicity can be understood in terms of historical layers. Activities are not static or rigid, they are constantly evolving. To understand a phenomenon means to know how it is developed into its existing form by Kaptelinin [10]. This applies to all the elements of an activity. The current relationship between subject and object includes a condensation of the historical development of that relationship by Kuutti [11].

Thirdly, inner contradictions of the activity systems shall be analysed as the source of disruption, innovation, change and development of that system. Activities are not isolated units; they are like nodes in crossing hierarchies and networks. They are influenced by other activities and other changes in their environment. According to [11], external activities change some elements of activity, causing imbalances between them. Contradictions are used to indicate a misfit between elements, between different activities or different development phases of the same activity. Contradictions manifest themselves as problems, ruptures, clashes and breakdown. Activity theory sees contradictions as a source of development. Activities are always in the process of working through some of these contradictions.

3 REQUIREMENTS ANALYSIS FOR COLLABORATIVE EMAIL DESIGN USING ACTIVITY THEORY

Designing email based up on activity requires in-depth understanding of tasks associated with collaboration. The best way to identify these tasks list is to observe observing the way people work with the email system. The shared tasks users perform are also affected by factors such as their environment, experiences and culture et. . So, addressing these issues is very important.

According to Bellotti [2], task management system in email should have the properties of differentiating important or outstanding items, indication for updated information, keeping track of threads of activity and discussions, methods to manage deadlines and reminders, embedding task features with in email and gathering related items. Based on her work, it is important the following should be considered when designing a task-based email system:

1. There should be easy way to differentiate important and outstanding items.
2. Days left indicator should be properly shown.
3. Use of conversation thread based system
4. Mentioning the deadline and remainders.
5. Documents or files should be correlated accordingly with the email message.
6. Task-generated to-do list.

Current models do not provide a theoretical basis for understanding 'regularly patterned' human activity, see Probert [15]. In order to overcome this, it is necessary to have a methodology and tools that can support the continuous evaluation of a statement of requirements as these evolve against a highly complex and dynamic problem situation. What is needed is to shift the focus from fixed and final requirements to those of a more dynamic nature. In particular, it is necessary to consider human information which, in social terms, does not have a physical reality and is not objective like physical information. Instead, it is based on individual, group or organisational needs. Such information informs action in organisations and is thus closely related to organisational activity and organisational form.

Activity Theory offers the possibility of seeing use and system design as a multitude of change cycles, where computer applications as well as other parts of the work activity are constantly reconstructed using more or less well-known materials, design tools and techniques, with a more or less clear understanding of the product. An explicit awareness of these cycles may change our way of doing design, see Floyd [7]. Also in activity theory, conflicts can be acknowledged and taken seriously in design. Subsequent sections give a brief review of the requirement analysis using the principles of activity theory.

Step 1 Clarify the purpose of the activity system

The purpose of this step is twofold: (a) to understand the context within which activities occur and (b) to reach a thorough understanding of the motivations for the activity being modelled, and any interpretations of perceived contradictions. Engeström [3] emphasises clarification of the motives and goals of the activity system. What are stakeholders' goals and motives? What are their expectations about the outcome? We consider this stage to be the most important step of the process. Several techniques can be used at this initial stage, including the analysis of formal and informal documentation, user observations and interviewing. Given that the application developed must meet users' needs, a thorough understanding of the intentional dynamics of the activity system is critical

Step 2 Analyse the activity system.

This step involves defining, in depth, the components of the given activity, namely, the subject, object, community, rules and division of labour. This study began by interpreting the various components of the activity triangle (Figure 1.) in terms of the situation being examined.

Step 3 Produce an activity system of the application

The above information gathered enables us to acquire basic knowledge about the situation. This is necessary for the purposes of mapping Engeström's model (Figure 1.) onto the situation in order to produce an activity system of that situation. This approach helps us to identify areas to be focused on during the investigation and also in deciding what resources would be necessary during the analysis.

Step 4 Analyse the activity structure

It is necessary at this stage to analyse the activity structure (all of the activities that engage the subject) that defines the purpose of the activity system. The hierarchy of activity, actions and operations describe the activity structure.

Step 5 Analyse tools and mediators

Components of activity systems (subject, community, object) do not act on each other directly. Instead, their interactions are mediated by tools that provide direct and indirect communication between the objects. Mediators can be instruments, signs, procedures, machines, methods, languages, formalism and laws.

Step 6 Decompose the situation's activity system

The activity system produced so far can be very complex because it incorporates the various sub-activities that together make up the main activity system being analysed. An activity notation can be used to aid the process of breaking down the situation's activity triangle system into smaller manageable units or sub-activity triangles (Mwanza, 2001).

Step 7 Generate questions for each activity notation

Questions that are specific to a particular combination within the activity notation and also representing a sub-activity triangle are then generated. The questions generated can be general or specific to a particular situation.

Step 8 Analyse the context

Analysing context is essential for defining the larger activity systems within which activity occurs (subject, community, object) and the dynamics that exist between the subject and the mediators. The designer is seeking information in order to describe "how things get done in this context". Why? Because different contexts impose distinctly different practices.

Step 9 Identify the different types of contradictions

According to [3], any activity system has four levels of contradictions that must be attended to in analysis of a working situation. Level 1 is the primary contradiction. It is the contradiction found within a single node of an activity.

Secondary contradictions are those that occur between the constituent nodes. Tertiary contradiction arises between an existing activity and what is described as a more advanced form of that activity. This may be found when an activity is remodelled to take account of new motives or ways of working. Quaternary contradictions are contradictions between the central activity and the neighbouring activities, e.g. instrument producing, subject-producing and rule producing activities.

Contradictions are present in every collective activity. They indicate emergent opportunities for the activity development. Contradictions are not weakness, but signs of richness, and of mobility and the capacity of an organisation to develop rather than function in a fixed and static mode. They are not points of failure or deficits within the activity system in which they occur. They reveal the growing edge of the activity system – the place where growth buds are able to expand and expansive development takes place,see Foot [8], and are starting places, not ending points. Contradictions are not problems to be fixed, and they cannot quickly transcend through technical solutions. Engeström [6] defines contradictions as historically accumulating structural tensions within and between activity systems (p. 137). Contradictions demand creative solutions. The contradictions identified for the SSIL email application are shown in Figure 2.

4 CONCLUSIONS

The development of effective email applications is a socio-cultural activity. A technical solution is not adequate to address the complexity of the system. To design collaborative email systems without consideration of the different needs of the users' social processes is a recipe for disaster. Email systems are inevitably groupware systems that either connects people to people directly or indirectly through sharing knowledge. To support effective collaborative email systems, it is necessary to understand the interrelationship of cultural, technical and organisational elements. Although activity theory can provide a structured account of work and cooperative work to understand context and development, it is rather limited because of its descriptive role. While this is beginning to change, there remains a substantial research challenge in developing activity theory and tools to apply in the design of applications to support work such as such email.

Activity theory principles are ideal for making visible the structure and dynamics of work situations, especially with respect to contradictions. Contradictions provide a systematic way of modelling and reasoning about breakdowns and opportunities for email design. The strength of the activity theoretical perspective is the recognition that work systems are inherently dynamic. However, further work is still needed for activity theory to be used as a robust requirement or design method. More research would be needed. The authors are currently working on making the principles of activity theory concrete so that anyone without activity theory knowledge can use the proposed guidelines for requirements analysis.

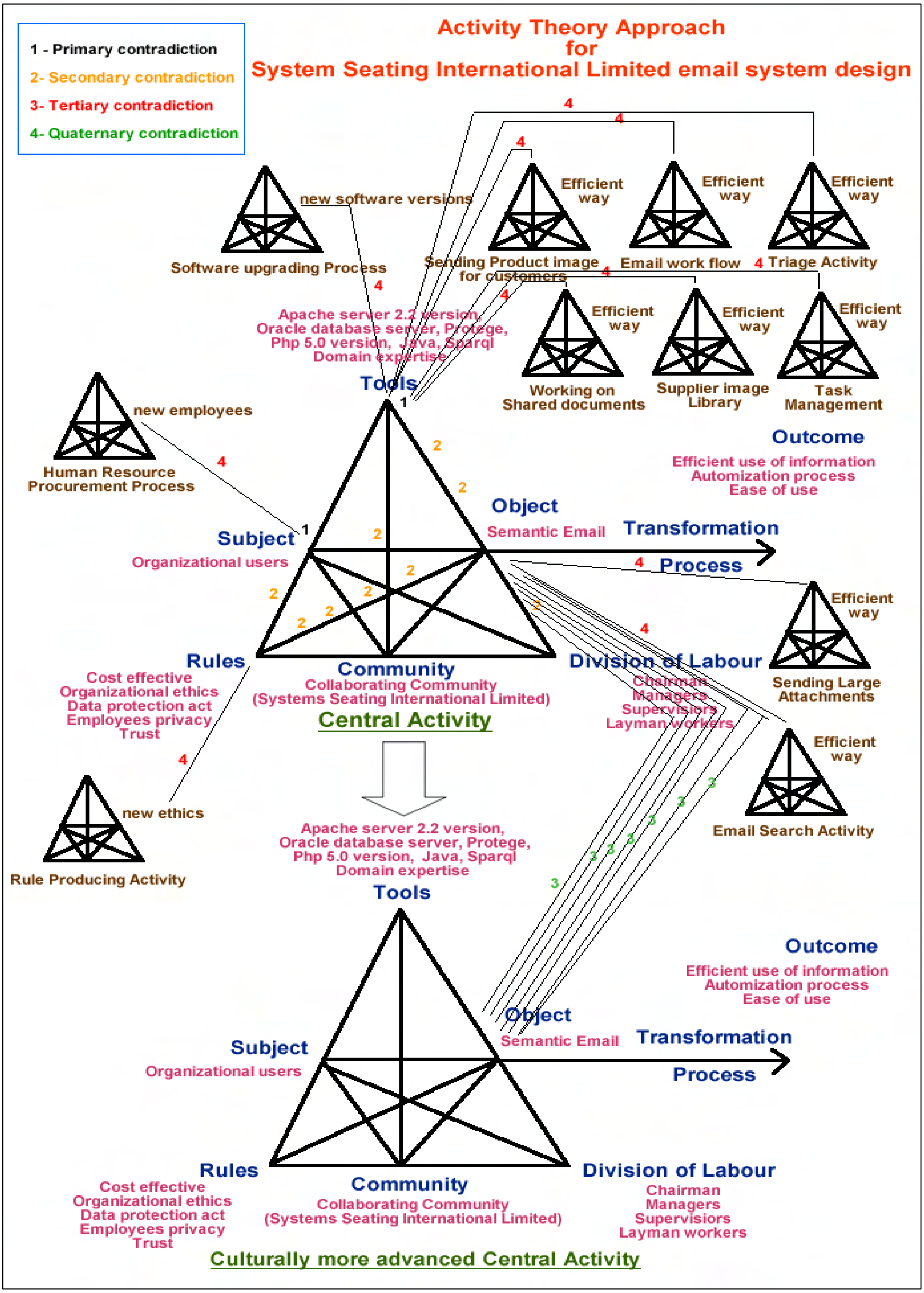


Figure 2: *Contradictions identified by SSIL email system*

References

[1] Al-Rawas, A. and Easterbrook, S. (1996). Communications Problems in Requirements Engineering: A Field Study. Proceedings of he First Westminster Conference on Professional Awareness in Software Engineering (The Royal Society, London, 1-2 February.

[2] Bellotti, V., Ducheneaut, N., Howard, M., Smith, I. (2003). Taking Email to Task: The Design and Evaluation of a task management centered email tool. Florida, USA April 5-10.

[3] Engeström, Y. (1987). Learning by Expanding. Helsinki: Orienta-Konsultit OY.

[4] Engeström, Y. (1990). Developmental work: Research as activity theory in practice: Analysing the work of general practitioners. In Y. Engeström, Learning, Working and imaging: Twelve studies in activity theory, Orienta-Konsultit OY, Helsinki.

[5] Engeström, Y. (1993). Developmental studies of work as a testbed of activity theory. In C. Chaiklin & J. Lane (eds.), Understanding Practice: perspectives on activity and context. Cambridge: Cambridge University Press, pp 64-103.

[6] Engeström, Y. (2001). Expansive Learning at work: towards an activity theoretical reconceptualisation. Journal of Education and Work, Vol 14 no 1.

[7] Floyd, C. (1987). Outline of a paradigm change in software engineering. In G. Bjerknes, P. Ehn, & M. Kyng (Eds.), Computers and democracy – A Scandinavian challenge (pp. 191-212). Aldershot, UK: Avebury.

[8] Foot, K.A. (2001). Cultural-Historical Activity Theory as Practical theory: Illuminating the development of a Conflict Monitoring Network. Communication Theory Vol. 11, Feb 2001, pp 56 – 83.

[9] Kaptelinin, V., Nardi, B. A., Macaulay, C., 1999. The Activity Checklist: A tool for representing the “space” of context. Interactions, 6 (4), 27-39.

[10] Kaptelinin, V., (1996). Activity Theory: Implications for Human-Computer Interaction, In Context and Consciousness: Activity Theory and Human-Computer Interaction. B. Nardi, (ed.), Cambridge, Mass.: MIT Press.

[11] Kuutti, K. (1996). Activity Theory as a Potential Framework for Human Computer Interaction Research. In B.A. Nardi (ed.), Context and Consciousness: Activity Theory and Human-Computer Interaction. MIT Press, Cambridge, MA.

[12] Leontiev, A.N. (1978). Problems of the Development of the Mind. Moscow, Progress.

[13] Mwanza, D. (2001). Where theory meets practice: A case for an Activity Theory based methodology to guide computer system design. Proceedings of INTERACT 2001: Eighth IFIP TRC13 conference on Human-computer interaction, Tokyo, Japan, July 9-13, 2001.

[14] Nardi, B.A. (ed.), (1996). Context and consciousness: Activity Theory and human-computer Interaction. Cambridge, MA: MIT press.

[15] Probert, S.K. (1999). Requirements engineering, soft system methodology and workforce empowerment. Requirements Engineering, 4, Springer-Verlag, London, 85-91.

[16] Vygotsky, L.S. (1978). Mind in Society. Harvard University Press, Cambridge, MA

[17] Whittaker, S., & Sidner, C. (1996). Email overload: exploring personal information management of email. In Proceedings of CHI’96, Conference on Human Factors in Computing Systems, ACM, NY, 276-283.

NETWORKED KNOWLEDGE: STIMULATING CREATIVITY BY COLLABORATION

Vili Podgorelec, Luka Pavlič
Institute of Informatics
University of Maribor, FERI
Smetanova 17, 2000 Maribor, Slovenia
Tel: +386 2 220 7353
e-mails: {vili.podgorelec, luka.pavlic}@uni-mb.si

ABSTRACT

In this paper we argue about a unified methodology to support collaboration strategies of researchers and research teams based on knowledge. It is our belief that a defined methodology together with an efficient technological system supporting the methodology should improve the creativity and consequentially also the development of research teams. Based on the required functionalities of such a system, we propose the semantic web as the underlying technology. It is indicated how the semantic web technologies could provide the necessary solutions to the integration of data resources, the transformation of data into valuable knowledge, the effective use of knowledge by intelligent information services and knowledge sharing both within an organization and inter-organizationally.

1 INTRODUCTION

Creativity is a complex cognitive activity for the performing of which both motivation and knowledge are required. A motivation is partially provided by a working environment in which a researcher or a research team performs its activities. The most important aspects for a high motivation are:

- effective fulfillment of conditions required for creativity, in which the researchers are able to optimally put into practice their potentials, and
- efficient support system that enables researchers to solve their problems and/or overcome obstacles, which they may experience during the creativity process.

Naturally, for the successful solving of problems the second factor of creativity process is of vital importance, namely knowledge. If the researchers are supposed to be creative, they need to possess the knowledge that will enable the creativity. Many organizations performed various studies which confirmed that their research staff is professionally highly skilled, however, their creative results were not comparable with the leading teams. The reason could be an inadequate or an ineffective approach to collaboration between single researchers and/or research teams when performing more complex research projects.

It is hard to believe and yet true that researchers within an organization usually do not know the knowledge and skill profiles of their peer researchers. Consequentially, the problem occurs when individual researchers, who possess a good amount of individual knowledge, face a problem they are not able to solve by themselves and that could be effectively solved by some of their peers. Many a time a solution is not reached because of an inadequate or even non-existing knowledge sharing. On the other hand, the researchers who can not put their knowledge and skills into practice become less and less motivated.

In both situations the consequence is a lower creativeness and in the worst cases even the total suppression of the creative energy. And without creativity there can not be any real development. Knowledge sharing and collaboration is deficient within organizations, even within research departments and institutes. On the inter-organizational level, there is almost the total lack of systematically organized and planned collaboration. Regarding this, the definition and development of a proper methodology supporting collaboration of researchers, effectively initiated into research and development departments, could importantly contribute towards higher creativity and consequentially to faster and more efficient development.

2 KNOWLEDGE- BASED COLLABORATION BETWEEN RESEARCHERS

Based on the awareness of how important creativity is for the efficient development and the vital part of knowledge within this process, a lot of researchers studied different aspects of knowledge management and assets management systems for knowledge capturing, representation and sharing [Art06]. Various theories on exploitation of knowledge sources within organizations and workgroups are being introduced by scientists; however, they are not technically and technologically supported. On the other hand many companies decide to set up a knowledge management system that is not efficiently used to their advantage, because of the lack of adequate methodology.

From the technological point of view, the necessity of transition from software products to services has been globally recognized. In this manner, there are many attempts to set up a knowledge-based system based on ontologies and semantically annotated data. Nevertheless, usually the ontologies are used primarily for statically describe data repositories. In the very near future we predict the intelligent approaches to more complex information services which will need to make advantage of semantically annotated repositories.

The literature search showed that presently there is no completely defined and technologically supported methodology to support researchers collaboration strategies based on knowledge. However, a set of single approaches and solutions gives evidence of a possibility to define and develop such a methodology. In our opinion, there are several attempts which individually provide a sound base for further development.

An interesting approach to bridging communities of practice with information technology in pursuit of global knowledge sharing is presented in [Pan03]. A similar approach to knowledge sharing in an emerging network of practice is presented in [Baa05]. They both suggest a use of knowledge portals, which are an extension of well known and recently much used business portals for managing all important business data. An interesting framework for stimulating innovation is presented in [Bre05] that gives evidence for the importance of properly technologically supported methodology of collaboration to improve the creativity. The importance of collaboration based on knowledge is recognized also in [Lom06], where the authors suggest a framework to manage formalized exchanges during collaborative design. The inter-organizational resource sharing decisions in collaborative knowledge creation is especially emphasized in [Sam06]. We also proposed a possible solution to build project teams based on knowledge with the use of information technology [Pod06].

3 METHODOLOGY TO SUPPORT COLLABORATION OF RESEARCHERS

The research problem that needs to be addressed is the definition and development of a proper methodology to support strategies of collaboration between researchers based on knowledge management and assets management. Such a methodology should contribute to a more optimal access to knowledge and competences within a research area. Furthermore, it should improve the creativity of researchers and lead towards more efficient development, both from the organizational and the technological point of view.

3.1 Outline of collaboration methodology based on knowledge sharing

We plan to achieve the proposed methodology by using one of the most vibrant of today's information technologies, namely semantic web. In our opinion the semantic web is a proper technology to bridge the technological gaps, outlined in the present approaches to a unified knowledge-based collaboration methodology.

The most important aspect of semantic web technologies is the semantics of data, which allow efficient integration of information resources and a possibility of automatic, intelligent inferring on the knowledge, retrieved from those information resources.

Having the technology for the efficient integration of information resources and the technology for semantically annotate these data, a step to transform the data into knowledge becomes possible. Having a unified access to knowledge resources of an organization (i.e. a logical organizational unit, like a department) an information service that uses this knowledge becomes reasonable. Having the information services which use the knowledge resources of an organization to provide the useful functionalities a system to share knowledge within an organization and also inter-organizationally exceeds mere theories and hoped-for ideas. The outline of the proposed collaboration methodology based on knowledge sharing is presented on Figure 1.

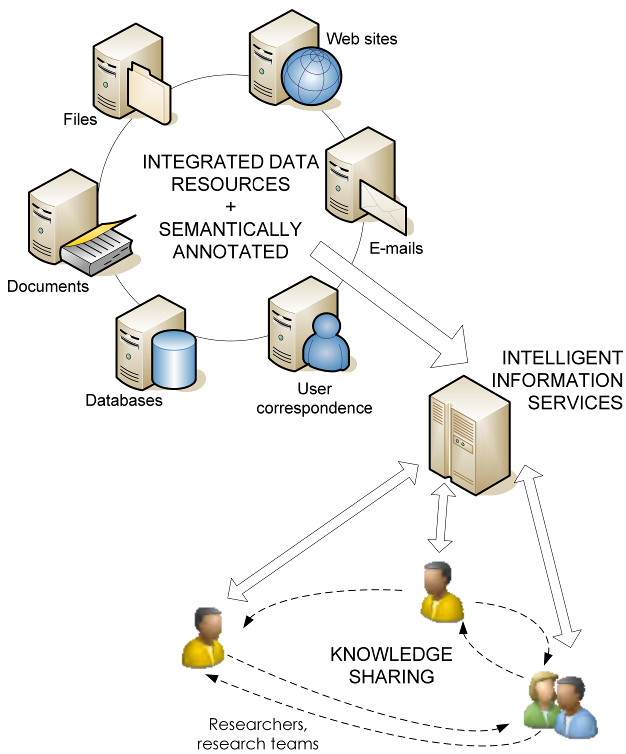


Figure 1: *Collaboration based on knowledge sharing.*

3.2 Managing individual knowledge competences to improve organizational development

Additionally to sharing organizational knowledge in order to improve the overall creativity and development within an organization, it is also important to manage individual knowledge competences in order to establish a knowledge map of an organization [Col03]. In this case a researcher or a research group within an organization is able to locate those who possess the required expertise for solving a specific task or performing a special activity. In this way not only the creativity could be considerably increased, but also the knowledge and skills of individual researchers are improved, because they learn at first hand from colleagues that master a specific issue.

On the other hand, when performing research projects, a project leader or team members can easily recognize which colleagues are appropriate for performing some project tasks. Also the hidden skills, not directly stated in a profile of an individual researcher, can be discovered by a proper skills matching approach. Again, this is possible by having all the data integrated and semantically annotated, what allows the support system to automatically infer on the stored data. A part of the knowledge portal for managing individual profiles is presented on Figure 2.

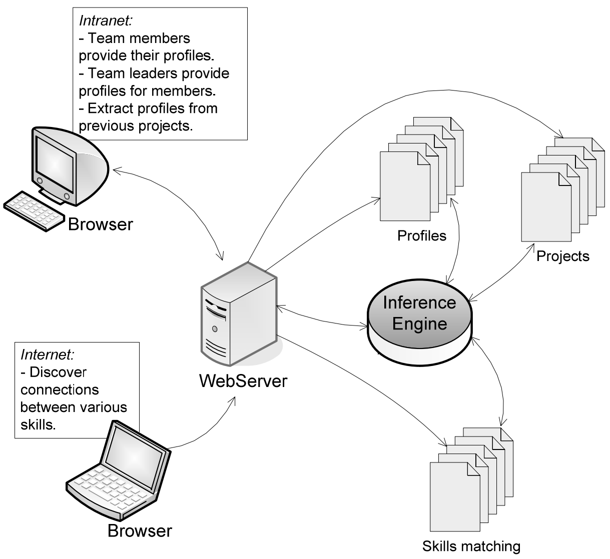


Figure 2: *Semantic knowledge portal for managing personal profiles.*

3.3 Semantic web as the underlying technology

In order to fulfill the requirements, which are necessary to achieve the proposed methodology, semantic web technologies are in our opinion a very sound choice.

The basic idea of semantic web is a different organization and storage of data and consequentially new possibilities to use this data [Ber01]. Although the idea of semantic web is based on well established concepts, such as machine learning and automatic reasoning, the semantic web community has given these areas fresh new move by introducing web-based solutions. The web is still very primitive and actually provides quite useless organization of knowledge, especially when one want to do some searching or knowledge discovery. The barrier that prevents more advanced usage of the web is believed to be semantic poorness of today's world wide web. Data, documents, images and all other kinds of content on the web are presented as very simple, non structured human readable and human understandable materials. The result is the inability to make a real use of the web's enormous amount of "knowledge". Because it can be understood as a huge cross-referenced library, all we have is by default a weak tool called keyword search.

In order to overcome those difficulties the concept of meta-data is introduced on the web. Using meta-data, so called smart agents can be used for searching by content. As a foundation, there has been a lot of work done about common formats for interchange of data and common understanding of common concepts. That allows a person or a machine to browse, understand and use knowledge on the web in a more straightforward way. All those activities and technologies are known by the term "semantic web".

Furthermore, the semantic web ideas and technologies can be used in other areas also, not only on globally available web. They can be used in the enterprise information systems for knowledge management in a different way to introduce new intelligent services.

As already mentioned, we want knowledge (with its meaning!) to be accessible to both people and machines. It is obvious that we need to represent knowledge in a more formal way. There are quite a lot of possibilities. The most appropriate for semantic web were chosen semantic nets. They are very simple nets, consisting of linked concepts. The question is what we need to represent distributed knowledge, such as we have on the web? We need a standardized way of naming things. Two different things should have different names and vice versa, when we talk about the same thing we need to use the same name. Furthermore, we need a standardized way of saying something about things – we need a standardized way of describing things. Also we need common vocabularies. If we talk about coin and bank note, for example, we should automatically know that we are talking about money. And finally, we also need a standardized way of giving semantics to data, or said more technically, we need a standardized technology to connect data with some meta-data.

In semantic web, knowledge is represented as nets, written down in XML-based language called RDF (Resource Description Framework). RDF is dealing with URIs (another W3C standard for naming resources globally unique). Advanced use of semantically annotated data can only be accomplished by using ontologies represented as a RDFS or OWL documents.

3.4 Issues that need to be resolved

In order to achieve the proposed methodology, a number of present challenges and aspects need to be addressed. Semantic web technologies as an underlying technological framework represent a vibrant new technology with high potential, and yet as a complex approach require several scientific and technological solutions. The semantic web potentials as a technique for integrating existing and forthcoming information solutions with semantics need to be addressed. Also the approaches to automatic annotation of data and the intelligent web services (like automatic discovery of hidden knowledge, project teams building) are an issue. Because the intention is to provide efficient bridging of research communities with information technology based on knowledge, the possibilities of automatic construction of knowledge from data need to be studied, as well as the linkage of ontologies and semantic repositories.

Finally, as of our knowledge, the challenge of reducing complexity by systematic linkage of research groups has not been adequately answered yet. It is our belief that the defined methodology can contribute a great deal to answering also this important question.

4 CONCLUSIONS

Our view of a unified methodology to support collaboration strategies of researchers and research teams based on knowledge has been presented in the paper. In order to improve the creativity and consequentially also the development of research teams a defined methodology together with an efficient technological system supporting the methodology could be the right way.

Based on the required functionalities of such a system, the semantic web can be used as the underlying technology. It has been indicated how the semantic web technologies can provide the necessary solutions to the integration of data resources, the transformation of data into valuable knowledge, the effective use of knowledge by intelligent information services and knowledge sharing both within an organization and inter-organizationally.

When a proposed methodology is developed, it could be used to semantically describe the competence profiles of researchers, involved in research groups of various organizations. In this way a considerably better collaboration of researchers would be achieved within a scope of scientific, research and development activities. Furthermore, the researchers from academic institutions and industry could be efficiently inter-connected, what would in turn lead towards higher creativity and faster industrial development. In fact a lot of data, needed for the operation of such a system, is already available and stored within different databases (researchers' profiles, publications and research activities, project data and project teams data, description of research projects and their results, …) All this data only needs to be appropriately annotated and integrated, which is an inherent property of the proposed methodology. The existing information services, although not semantically annotated, could be used in efficiently integrated within the system by implementing the required interface wrappers.

References

[Art06] H.A. Artail, Application of KM measures to the impact of a specialized groupware system on corporate productivity and operations, *Information & Management*, 43(4), 2006

[Baa05] P. van Baalen et al., Knowledge Sharing in an Emerging Network of Practice:: The Role of a Knowledge Portal, *European Management Journal*, 23(3), 2005

[Ber01] T. Berners-Lee, Business Model for the Semantic Web, http://www.w3.org/DesignIssues/Overview.html , 2001.

[Bre05] A. Brennan, L. Dooley, Networked creativity: a structured management framework for stimulating innovation, *Technovation*, 25(12), 2005

[Col03] S. Colucci, T. Di Noia, E. Di Sciascio, F.M. Donini, M. Mongiello, M. Mottola, A Formal Approach to Ontology-Based Semantic Match of Skills Descriptions, *Journal of Universal Computer Science*, Springer Verlag, 9(12), pp. 1437-1454, 2003.

[Lom06] M. Lombard, L.G. Yesilbas, Towards a framework to manage formalised exchanges during collaborative design, *Mathematics and Computers in Simulation*, 70(5-6), 2006

[Pan03] S.L. Pan, D.E. Leidner, Bridging communities of practice with information technology in pursuit of global knowledge sharing, The *Journal of Strategic Information Systems*, 12(1), 2003

[Pod06] V. Podgorelec, L. Pavlič, M. Heričko, Using semantic web technologies for project team building, *Proc. of International Conference on Knowledge Management in Organizations KMO-2006*, June 2006

[Sam06] S. Samaddar, S.S. Kadiyala, An analysis of interorganizational resource sharing decisions in collaborative knowledge creation, *European Journal of Operational Research*, 170(1), 2006

WEB MINING WITH PIGGYBANK FOR AUTOMATED DESCRIPTION OF THE BALTIC SEA OPEN UNIVERSITY

Siew Kheng Lee[1], *Yaroslav Tsaruk*[1], *Kimmo Salmenjoki* [1], *Lorna Uden*[2]
[1] Department of Computer Science
University of Vaasa
Box 700, 65101 Vaasa, Finland

[2] Staffordshire University, UK
The Octagon,
Beaconside, Stafford, ST18 OAD. UK
e-mail: sqara@yahoo.com, {yats, ksa}@uwasa.fi L.Uden@staffs.ac.uk

ABSTRACT

The amount of information in Internet grows rapidly. It is difficult for human being to process all time changing information. There is a high demand of creation tool, which allows to make easier process of web page parsing. The task of analyse and extraction information from the document should be automated. This paper presents result of work on automated extraction of information. As example of automated extraction information been used web pages of educational institutions, which comes to BSOU.

1 INTRODUCTION

Baltic Sea Network (BSN) is a collaboration formed by higher education institutions, regional development organizations and other organizations of the Baltic Sea Region. The countries that are situated in this region consist of Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, Russia and Sweden. Laurea Polytechnic from Finland is the founder and coordinator of BSN. BSN started through invitations from Laurea since Autumn 2003. Since then, many activities have been organized within the Baltic Sea region. Since August 2005, the IT maintenance of the BSN is moved to Kiel, Germany. The rationale behind BSN is to build clusters between the Baltic Sea regions to boost development, education and research through shared networking, joint projects and enhanced mobility. The cooperation brings higher competence for these participants to face stiffer competition internationally. Its purpose is to develop the Baltic Sea Region in accordance with the EU policy. Currently, the BSN makes use of any programmes, funding opportunities running at the EU level, any Nordic Council or Ministries or any countries' own national support. The network promotes international cooperation focusing in the areas of Welfare, Business Skills and Management, Tourism as well as Information and Communication Technology (ICT.

In Baltic Sea Open University (BSOU) 27 BSN educational institutions form the basis for the creation of the BSOU. BSOU aims to provide joint degrees within the resources from its participating education institutions. With this also, BSOU promotes more flexible mobility for studies and research operations. These partner days would carry out conferences and workshops in the focus areas. The present and upcoming activities of the BSOU can be found at http://www.balticseanetwork.org/ and [1].

There are nine countries in the Baltic Sea Region speaking nine different languages. This also means that there are different customs, culture, operational habits as well as systems. One of the main purposes of the BSN set up is to bring these countries together for a joint development boost in areas of competence, for which education is one crucial field. All countries in the Baltic Sea Region has already long established their own education system, for which upon following the emergence of the Bologna process in the EU policy, every country copes for a conversion towards a unification of the education system. Foremost in the BSOU plan is to draw all the information from existing participating institutions together and to organize them in a logical manner. The challenges lie ahead of BSOU in finding this common bond, extracting them and there on forming new structures that fits amongst them. There are language barriers, different systems, separate priorities, maintenance and efficient organization to overcome for this BSOU to be called functional. Like a jigsaw puzzle, scattered parts of data need to be pieced together in order to be translated into meaningful forms, comprehensible information and presentation for public use.

2 SEMANTIC WEB BASED MINING WITH PIGGYBANK FOR BSOU

2.1 Raw data analysis for the related web sites

Data mining was introduced for the BSOU network to investigate on the large number of data available in the partner universities and higher education institutes. It was also required to know and to outline the similarities and differences, to spot the odds and other end extremes between these different contributors. The analysis results would reveal of what quality does the web structure of these websites are in the state of, in order to progress with the implementation of a semantic web solution. Through data mining, meaningful data links and information can be discovered to construct a mental model structure before the integration of the semantic web solution. The base structure would guide the flow of data that has to be extracted and of which has to be eliminated. The analysis provides a better overview of to what extend assumptions has to be taken made for these websites to create the general framework. The data collected from all the websites was compiled in a huge comparison spreadsheet (equivalent to 4 times of A0 size paper). The fields in this spreadsheet that were compared and listed horizontally (from left to right) in the spreadsheet are presented in Table 1 and Table 2. Table 1 shows structure formed based on paper information. Table 2 shows results of web-site analysis.

Field names	***Description***
Country	*Name of the country*
City	*Name of the city that the institution is located, main and other campuses*
Name of Organization	*Full name of institution translated in English*
URL	*Official / main web site for the institution*
Fields of Studies / Collaboration	*The areas that the institution has agreed to collaborate as stated in the BSN details' sheet*
Contact Person	*Person-in-charge between institution and BSN*
Email of Contact Person	*Email of the person-in-charge*

Table 1: *The structure of BSOU partners paper raw data analysis*

The analysis comments and full results are further elaborated later when the need of data mining becomes clearer before implementation of the semantic web solution.

2.2 Information structure analysis of underlying web sites

With relevance to our case study the information architecture is the core towards integration of semantic web solution. For this, the base information structure requires solid well-formed HTML data. It is because semantic web is based on XML and one of the ground requirements of the targeted semantic web solution requires data encoded with a minimum standard HTML. To obtain the least information-loss, every single unit of the contributor's website should have a decent HTML structure. This would help to eliminate prior pre-processing processes all in the effort to just obtain the data in HTML format. This is where the importance of data mining is crucial towards finding out the quality of HTML codes is on the web pages. An analysis report is drawn to form a general idea on the quality of the web information structure of each and every page that the contributor has to offer. These few assumptions are being considered for the analysis. Every participating institution has only one domain. Only English web pages are considered in this case study. Sites are distinguished for their page type that is if they contain actual information in HTML or merely a HTML 'masked' page (consisting of links to .doc, .pdf, .ppt files).

Field names	***Description***
Faculties	*Responsible faculty for the course offered*
Departments	*Specific department in the faculty conducting the course*
Course / Field / Specialization	*Type of specialization course offers*
Subject Titles	*Title of the subject(s) for the specialization / course*
Level	*e.g. masters, doctoral, degree, diploma, open*
Prerequisite	*Requirements to fulfill before enrolling*
Mode of Course	*How the course is conducted, i.e. distance learning, full time or part time, etc.*
Type of Course	*Single course, entire degree, joint degree, etc.*
Objectives of Course	*What are the aims of the course*
Content of Course	*What the course is about*
Additional Information	*Provisional information about the course, special notices in relation to course*
Start Date	*Commencement date for subject*
End Date	*Last date of study for subject*
Duration	*Length of study for the subject*
ECTS	*Credit points obtained for entire course*
Tuition Fee	*Fees for course or subject*
Language of Instruction	*Language taught for the subject*
Screenshot	*Sample screenshot of the main page for English site*
Comments	*Author's comments on the findings of the information obtained*

Table 2: *The structure of BSOU partners web sites raw data analysis*

Out of 27 contributors, only 15 institutions have decent HTML web pages in their respective domain which is ready for semantic web type processing. The other 45% of the contributors which did not make the cut is mainly due to poor content aggregation in their own websites itself. Many of the pages are firstly, poorly translated, meaning there is little or almost no information inside its English pages, compared to its local language. Secondly, some pages have deep web information hierarchy which makes is rather impossible to even manually locate a piece of valuable information. These websites too have very little structure in their HTML code, making it a poor site for semantic tasks to navigate and build upon.

2.3 Semantic information design

For mining the web sites of the partner universities, we have established for BSOU its own composed ontology. The BSOU ontology is organized in a hierarchical manner, assimilating the extension of a parent-child node tree graph. The ontology is based on the results of data mining analysis of section 2.1. The results provide a general idea of the BSOU initial information organization initiative. Following from the data analysis, the structure of the BSOU ontology is illustrated as the triangle below. In the BSOU ontology, the specific subjects or courses (instance elements) form the base of the triangle. These courses are the information that is obtained from the participating institutions. They are classified according to their departments (class). Every department is assigned to a certain faculty (class) with a specific course coordinator or staff in charge. The ‘faculties’ class has four predefined instances that is, faculty of technology, faculty of humanities, faculty of natural sciences and faculty of social sciences. The staff sub-class lists the contact information and is grouped according to their departments. All the faculties and staff (elements) belong to their respective institutions.

Institutions (class) have subclasses, different categorizes, depending on their type of institution – academy, university, college or polytechnic. The parent class of institution is the countries. Every institution would be categorized following their operating location, and they are obviously the predefined nine participating countries surrounding the Baltic Sea. The pinnacle of the triangle states the main node of the BSOU ontology.

To enable easier handling of the bulk information, the above BSOU ontology structure is divided into two parts, one is the BSOU courses ontology and the other is the BSOU contact information ontology. Both were described in the notation3 (N3) format. The choice of the encoding language follows the requirements of the semantic web solution. The N3 format is a subset of the RDF syntax [3]. It is aimed to reduce the weight of programming RDF. Hence this ‘lite’ version is made highly readable for humans as well as compatible as a semantic web ontology language with the rest of the W3C based standards.

Data mining is employed to discover knowledge from its depository. It was important as the unidentified depository consists of scattered information and resources placed on the web. It was done through a cross-technique between the traditional data mining and web mining methodology.

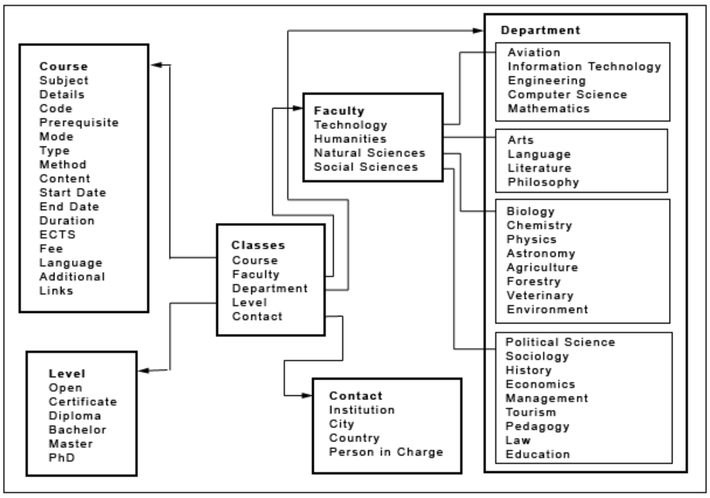


Figure 1: *The Summarized BSOU Courses Ontology*

3 WEB INFORMATION HARVESTING WITH PIGGYBANK

Using PiggyBank, and scriptlets , we used the PiggyBank application [6] to automated the information collection related to our BSOU collaboration enhancement. Without going to the details of PiggyBank usage, we only show here its internal structure for describing the modern approaches for web based mining using semantic web.

The main challenge for the scraping process was to filter the pages with poor HTML quality coding. The approach is to use a scriptlet to test against the page if any information proves to be scrappable. This can lessen laborious tasks of checking every page with the browser’s DOM inspector prior to web scraping. Using this basic scriptlet enabled us to gauge if the HTML page quality is fit for further scraping. When there are no results, or errors popping up from this basic scriptlet we try to customize the generic scriptlet site specifically and align to our common ontology of Section 2.3 with very precise landmarks of the page being identified. If no further results are obtained, a quick check with the browser’s DOM inspector is taken for the specific location in the page to confirm the HTML tagging. Then the page can be ignored for it is considered not worth scraping with the scriptlet technique. If there are results obtained, then a more refined scriptlet is further scrutinized to guarantee enhanced mining results. If these results have similarity with other pages of that same domain, the site specific scriptlet is pushed towards the scraping process. It is left to the refined stage if there are no common matches to be found.

After scraping each and every participating institutions web domain, the results are integrated according to country grouping. Table below shows a distribution of scrapped domains and the number of information items scrapped from these domains.

The ‘country-grouping’ integration process ran smoothly except partial results from Vytautas Magnus University (Kaunas, Lithuania) that failed to be integrated into the merged country results. It is found that the information as encoded in HTML inside the page contains unnecessary extra spaces in between words to break a line, thus creating the similar spaces for which the Piggy Bank could not handle. It is an example of poor HTML coding to suit a page design and not the context.

Country	No. of Scrapped Domains Using		No. of Scrapped Domains (Institutions)	No. of Information Items Scrapped
	Case 1	Case 2		
Denmark	-	-	0	-
Estonia	0	3	3	292
Finland	1	0	1	132
Germany	2	0	2	26
Latvia	1	2	3	167
Lithuania	1	4	5	105
Poland	-	-	0	-
Russia	0	1	1	50
Total	**5**	**10**	**15**	**772**

Table 3: *Distribution Table of Scrapped Items and Domains according to Country*

Additionally, the scriptlet needs to look into the issue of handling extra space in between the words and collapsing them when needed. The fully merged results appear to have 16 information items less as compared to the 'mathematically-counted' number of information items that adds up from the individual countries' item. This happens because the Piggy Bank automatically merges these items together. This is due to that the Piggy Bank employs a taxonomy that collapses same information items and distinguishing tags in its ontology when found to have information of the same values.

4 CONCLUSIONS

In this paper we have presented an approach for harvesting a cloud of web sites. For unifying the information sources of the BSOU we presented a structured and semi-automatic approach for combining the semantic web ontology design with the web site mining using the PiggyBank application. What is always a problem in web mining in general is the dynamic nature of this information. As we saw above, a lot of policy and web development issues need to be harmonized when communities of people or virtual organizations share their information and knowledge processes online. Hopefully semantic web and its wider usage together with common approaches for the web development in general will ease this aspect more in the future.

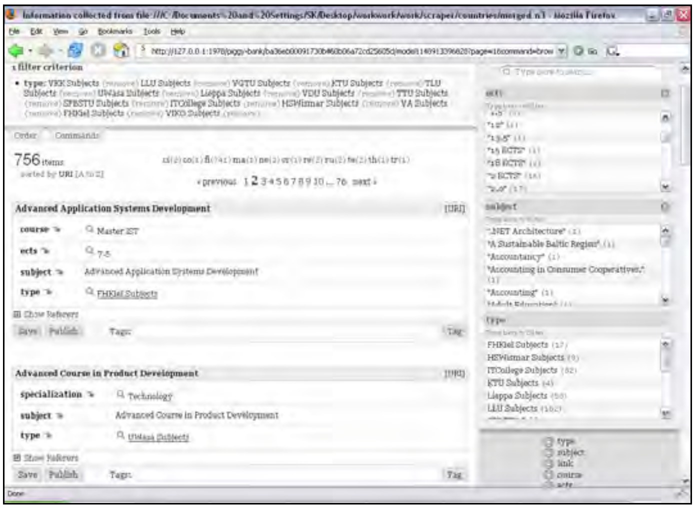


Figure 2: *Screenshot of the Full Merged Results*

References

[1] Baltic Sea Network, http://www.balticseanetwork.org/

[2] J. David Eisenberg : A List Apart: Articles: "Forgiving" Browsers Considered Harmful April 27, 2001

[3] D. Hand, H. Mannila, P. Smyth: Principles of Data Mining. MIT Press, Cambridge, MA, 2001. ISBN 0-262-08290-X

[4] Siew Kheng Lee: Automated web information system via semantic web technologies, Master thesis, University of Applied Sciences, Kiel, Germany, 2006

[5] Kimmo Salmenjoki, Yaroslav Tsaruk, Aki Vainio: Multi-agent Approach for Knowledge Processes between Research Organisations, KMO'2006 Knowledge Management conference in Maribor, 13-14.6.2006

[6] SIMILE project: PiggyBank browser extension, http://simile.mit.edu/piggy-bank/, MIT

[7] Yaroslav Tsaruk, Kimmo Salmenjoki, Helmut Dispert: Using agent approach in developing a course sharing system, Information Society 2005 multiconference, Intelligent systems conference, Ljubljana, Slovenia, ISBN 961-6303-71-6, p. 362-365

[8] Yaroslav Tsaruk, Kimmo Salmenjoki, Aki Vainio, Gurusamy Arumugam: Semantic and Context - aware Message Sharing between Organizations, KMO'2006 Knowledge Management conference in Maribor, 13-14.6.2006

[9] L. Uden, K. Salmenjoki, M. Hericko, L. Pavlič: Metadata for research and development collaboration between universities, Int. Journal of Metadata, Semantics and Ontologies, IJMSO, 2006 (to appear)

ONE SOLUTION DOESN'T FIT ALL: PROBLEMS IN USER IDENTIFICATION IN WEB-BASED PUBLIC SERVICES

Aki Vainio
Department of Computer Sciences
Matti Mäkelä
Department of Production
Faculty of Technology
University of Vaasa
Box 700
65101 Vaasa
Tel: +358-6-324 8438; fax: +358-6-324 8467
Email: {aki.vainio, msma}@uwasa.fi

ABSTRACT

This paper discusses the problems of designing a system which has to reach a very large percentage of the population, namely public services and the identification methods used in them. The major problems discussed are the lack of trust and poor understanding of the security of the systems, with short descriptions of the identification methods.

1 INTRODUCTION

For a company providing services, it is very important to think through the methods through which the clientele can contact the company. When volumes are high, web applications are often a good way of saving time for both the company and the customer. Many companies have made the strategic decision to move all their operations to the Internet, with no contact addresses or phone numbers besides those required by law.

Public services do not have the luxury of making similar decisions. They must be available to all. Citizens can not be required to own a computer and have access to a computer so easily.

Also, public services are not targeted to certain segments of the population, but instead all are interested in medical care and need information on taxes. Therefore whereas companies can require the use of certain tools (such as mobile phones or credit cards), limiting the use of public services in a similar way would pull those services from some citizens. Still, web-based public services are becoming more common and since they include information which most users wish to keep private, they must be very secure to be trusted by the users.

This paper presents a problem facing Finnish public services with interests in moving some or all of their usage to the Internet: the unwillingness of the users to adopt the system due to design decisions involving identification and security. The statistical information found in this work is from a study conducted with the patients of two laboratory units of the Vaasa Healthcare District during week 11 of 2005. Full results will be available in [16].

2. METHODS IN IDENTIFICATION – NOW AND IN THE FUTURE

Currently we are still in the early stages of information era and many of the practices are yet to fully form. Most Finns use the Internet on a regular basis, but many are still wary of using it for purposes other than web surfing and e-mail. Popularity will decide which methods will persist and which will be forgotten.

Currently there is a lot of competition regarding the right to identify people. This is understandable, because holding the keys to important services strengthens the status of the holder in society. Currently in Finland banks and telephone companies are the two main competitors, with banks having a lead.

These methods generally use strong identification which means that the identification itself relies on more than one method, for example TUPAS has three methods which are based on what the client knows (e.g. password or PIN), has (e.g. the codes) or is (e.g. fingerprints) and at least two of these must be satisfied.

2.1 Bank codes (TUPAS)

TUPAS is a service maintained by the Finnish Bank Association and provided by the Finnish banks. The idea behind TUPAS is that an individual who is a client of a bank has been identified by the bank. If the client has bank codes for Internet access to the bank, than those same codes can be used to identify the client in any situation. The system is secured by single-use codes, which make eavesdropping useless. The system varies from bank to bank, but the process of TUPAS is always the same.

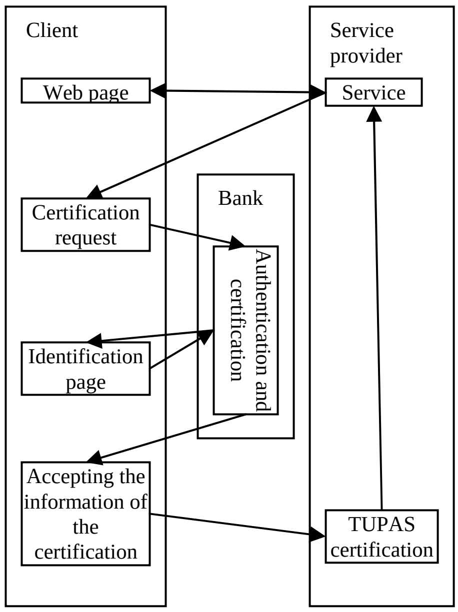


Figure 1: *The process used in TUPAS [2]*

The service itself does not communicate with the service provider during this process, it only communicates with the client. Therefore the service provider can not gain access to the bank through this system. The TUPAS has become quite prevalent and services such as the post office and the information systems of some Finnish universities use it. Most Finnish have access to TUPAS (about four million out of a population of five million have the required bank codes).

2.2 Electronic identity card (HST)

Electronic identity cards were strongly advocated by the Finnish Ministry of Finance, but they have not become popular. This is partly due to nature of using the government services: users are not interested in them until they need them and then it's too late to acquire a card, which would take some time. If all renewals and new identity cards are changed to electronic, they may become popular, but that will take decades. Currently they are mostly used by technology enthusiasts. The Ministry of Finance has changed the official line and now they advocate both electronic identity cards and TUPAS.

Electronic identity cards comply with both ISO 7816 and the EU SSCD directive to make them both secure and easily adapted to different situations.

2.3 Credit cards

Access to a credit card is sometimes used as a proof of the holder having reached the age of 18. Since the websites requiring this kind of proof are generally shady (such as porn sites), most are understandably hesitant of using this method, or any other for that matter, for identification purposes. Many people seem to be more careful with their credit cards then their identities, not understanding how much losing their identity to wrong people might cause them problems.

2.4 Debit cards

Just like any other card with a microchip, debit cards can be outfitted with PKI-based identification system. Like other electronic identity cards, they have not become popular. In part this is due to the lack of card readers in the users' computers and the lack of interest in acquiring one. Although in the future all debit cards will probably include methods of identifying the holder, they are not expected to become popular.

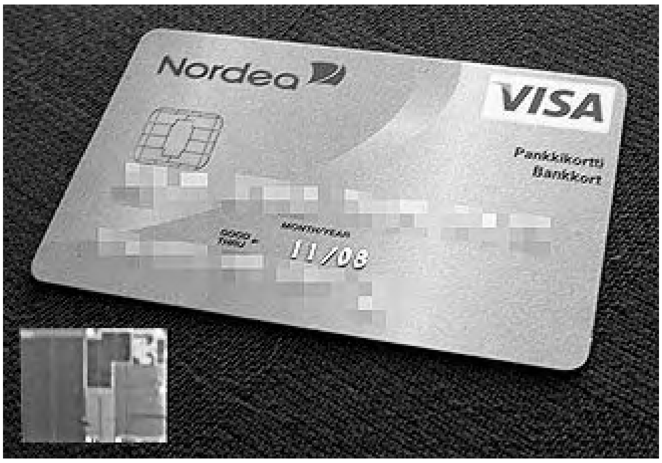


Figure 2: *Finnish smart debit card [17]*

2.5 SIM card

The largest telephone companies in Finland have expressed interest in including the functionality of identity cards in the SIM-card. This would be a new step for these companies and shows the interest in having control over the identities.

2.6 Identifying the service provider or another organization

For security reasons, the user must be able to identify the service provider as well. This is usually achieved through the use of PKI-based identification. Transparency is the key: as long as the service provider is the right one, knowing that identification has happened is of no interest to the user.

PKI technology can also be used for identification of other organizations, especially within the government.

3. THE CUSTOMER ATTITUDES

In accordance with the strategies put forth by the Finnish Ministry of Social Affairs and Health, a group of Finnish hospitals has been developing several IT-solutions independently, but in such a way that all members of the group can benefit from the results. As part of the group, Vaasa Healthcare District has been developing and testing new systems and models for providing services through the Internet. Two services are currently in development: making laboratory appointments and getting advice from a doctor.

During a pilot run of new eServices in Vaasa Central Hospital, some of the users did not want to use the TUPAS-system. They preferred using traditional username-password –combinations. The problem is two-fold: Using username-password –combinations is not as safe as using TUPAS or HST –system, but if the users do not want to use the system because it only accepts these methods, the system will lose users, which means that the investment in the system is not as profitable as initially calculated.

Using registration with traditional username and password should be avoided because it brings a new set of problems with lost passwords and even usernames. Also, connecting the person to the right information would be problematic as there is no guarantee of the registered person being who he or she claims to be, which would mean that the pesson has only access to services which have no connection to his or her personal information.

The old system did not have appointments. People would visit the counter, tell the nurse why they were there and receive a number. They were called by the number. With appointments made through the Internet, such numbers were unnecessary, but privacy seems to be an issue. Many people are afraid that information about their personal health might spread.

In a study conducted with patients at the laboratory facilities, 67.7% were against being called by name. The responses from the younger patients were less against the practice (with only 56% against), but the opposition was still great. Interestingly, using names is standard practice in most other healthcare services in Finland. Also, obviously the nature of the tests are never disclosed at this point, but perhaps the possibility of rumors scares patients.

Despite the best attempts at shortening the waiting time by using Internet as a tool, 94.1% of the responses still thought that the current system was good, despite long waiting times. Only 0.8% of the responds were definitely against the system and 84.4% thought the waiting times were not too long.

Despite the current system being quite popular, 56.1% said they would make the appointment beforehand, if they had the methods available to them. Especially the younger people (under 20) were interested in making appointments with 67.5% popularity. Of the methods presented in the form, 50.0% would like to make the appointment by phone, but only 27.7% were interested in making the appointment through the Internet.

All in all, the responses made by younger people were more interested in using the Internet, but only 4.9% of the total 852 number of responds were made by people under 20 years old. On the other hand, more than half (50.9%) were 60 years old or older. The oldest category was the least interested in making appointments through the Internet, with only 16.3% interest. This is probably partly due to the lesser computer access among the older people, whereas most young people have daily access either from home or school.

4. POSSIBLE SOLUTIONS

The major problem is that the general public can not be taught to adopt an identification method. It would take too much time and resources and would still not guarantee enough popularity for a method to be useful. Currently most organizations are more or less in standby waiting to see which methods will become popular and which methods will fail.

At the same time, without testing the waters no method will have the chance of becoming successful and popular. Obviously the identification must work in such a way that the system does not need major changes if the identification method is changed. Therefore the methods must be implemented modularly in such a way that they are interchangeable and more than one can be available for use at the same time.

To increase interest in the use of the Internet-based solutions, they will have to have obvious benefits for the user. This would mean that many more services should be available through the Internet.

Trying to educate the population would probably work too. Simple links to explanations on how the identification method works and why it is secure or more secure than some other method, would lead at least some of the users to try it. This in turn would lead others to test them through word of mouth. In many cases parents and the elderly are instructed by their children to use these systems, so this approach could reach people who would otherwise be left outside of the new systems.

The need for these systems is obvious: currently the load of both laboratory units peaks midweek with over 50% more customers than Thursday or Friday. With appointments, the load could be divided more evenly between different weekdays. With information like this, perhaps the customers could be persuaded to try the appointment system.

5. CONCLUSIONS

Based on this, currently moving services completely to the Internet would not be a good idea since most of the current users of the services are not interested in the developments and might lack access to the technology needed to use them. Since the availability of the technology is constantly growing and interest in the younger users is high, now is the time for developing them. In time they will become popular. With the average life expectancy on the rise, traditional services will have to be available for a long time to come, but if even part of them can be simplified with the use of the Internet, it will mean savings.

Adopting the identification methods is one of the more crucial aspects of adopting the system. If a user feels that he or she is giving too much information or the system is too complex, it will not be used and the user will seek to satisfy his or her needs through a more traditional channel.

Providing services through the Internet is more efficient for both the user and the provider, which means that although there are some obstacles in the way, the systems should be developed. At this point many of the systems might prove themselves useless, but in time some of them will be adopted by the general population and will become very important to the users.

References

[1] Finnish Bank Association, http://www.pankkiyhdistys.fi/english/ and http://www.pankkiyhdistys.fi/sisalto/upload/pdf/tupasV21.pdf [in Finnish]

[2] Process flow of a TUPAS implementation library written in Perl http://www.uta.fi/~ccjasi/libtupas/libtupas-process-flow.jpg

[3] Digitoday (2005): Kertakäyttösalasana jyrää hst -kortin http://www.digitoday.fi/page.php?page_id=11&news_id=200510115 [in Finnish]

[4] Schneier, Bruce (1996): Applied Cryptography

[5] Stallings, William (1999): Network Security Essentials – Applications and Standards

[6] Stallings, William (2003): Cryptography and Network Security – Principles and Practices

[7] Comer, Douglas E. (2004): Computer Networks and Internets with Internet Applications

[8] Hassler, Vesna (2001): Security Fundamentals for E-Commerce

[9] Alesso, H. Peter & Craig F. Smith (2001): The Intelligent Wireless Web

[10] Finnish Ministry of Finance: http://www.vm.fi/vm/en/01_main/index.jsp

[11] Finnish identification service: https://www.tunnistus.fi/ [in Finnish]

[12] Setec Oy: http://www.setec.fi/

[13] Lumijärvi, Ismo (1996): Mikä on laatua sairaanhoitopalveluissa? [in Finnish]

[14] Sosiaali- ja terveysministeriö (1999): Tietotekniikan hyödyntämisstrategia, http://pre20031103.stm.fi/suomi/tao/julkaisut/hyodstra/ttekn sis.htm [in Finnish]

[15] Ministry of Social Affairs and Health (2005): Data and Information Reform 2005 – Group Report, English summary. http://www.stm.fi/Resource.phx/publishing/store/2004/06/hu1087537077475/passthru.pdf

[16] Mäkelä, Matti (2006): Pro Viisikko –hankkeen väliraportti – e-Palvelut ja niiden hankinta terveydenhuollossa [in Finnish]

[17] Wikipedia (2006) Smartcard.jpg: http://en.wikipedia.org/wiki/Image:Smartcard.JPG

[18] Grönlund, Åke, Tuomo Kauranne, Frank Hartkamp, Olov Forsgren, Huberta Kritzenberger and Lars Albinsson (2000): Managing Electronic Services – A Public Sector Perspective.

[19] Sommervile Ian (2001): Software Engineering, 6th edition.

[20] Marick, Brian (1995): The Craft of Software Testing – Subsystem Testing Including Object-Based and Object-Oriented Testing.

[21] Gilb, Tom (1988): Principles of Software Engineering Management.

ENHANNCEMENTS OF P3P

Marko Hölbl, Marjan Heričko, Tatjana Welzer Družovec
Faculty of electrical engineering and computer science
University of Maribor
Smetnanova ulica 16, 2000 Maribor, Slovenia
Tel: +386 2 2355129; fax: +386 2 2355134
e-mail: marko.holbl@uni-mb.si

ABSTRACT

The platform for privacy preferences is a W3C standard thath enables automatic and transparent acquisition, processing and storage of privacy policies. The main activity is the P3P agrrement which involves two entities: the user agent and content provider. The technology offers a technical platform for dealing with privacy, but neither a organizactiona nor a legaslative platform. In this paper problems of P3P are stressed and enhancements for solving this problems are given. Problems involve legislative aspects, inadjustement with legislation and bad adoption of the technology. We give enhancement, which try to make P3P more tending to use; use of digital signing, version tracking, localization and personalization. Enhancement could enable a wider adoption of the technology.

1 INTRODUCTION

In times of internet and mobile application, assuring privacy is a difficult task. The aim of P3P is to increase and relivie management of privacy for users. The P3P specification was defined by the W3C [1] and enables transparent handling of privacy policies. For the purpose of acquisition special software is used; so called agents. Agents keep the users informed about practices of content providers. The main document involved in the interaction between the agent and the content provider is the privacy policy. Privacy policies are well known from orgnaziational environment. P3P defines the privacy policy in a XML form and in human-readable form.

2 P3P

The main activity of P3P is the agreement between the agent and the content provider. The agent as the user's representative knows of the her/his pereferences concerning personal data.

The most significant document on the user's side linked with P3P are the user preferences. The user defines how his/her personal data should be treated with use of preferences. The user preferences are saved in a formal language called APPEL (A P3P Preference Exchange Language), which enables easy processing and comparison with privacy policies. User preferences are a set of rules defined in different ways:

- default preferences,
- through administration tools and
- through the accession "remember my decision".

The default preferences are predefined when the agent is installed an can be changed later. Administrative tools enable the user to define her/his preferences through a graphical interface when using the agent. The third approach is well known from the field of antivirus software. The agent learns the user preferences in course of its usage. When the agent comes accros a situation for which no rule is defined it asks the user what to do. The user's decision can be temporary or permanent. Later the decision becomes a rule.

On the other hand there is the privacy policy defined by the content provider. P3P demand the privacy policy to be in human readable form and machine readable form, namely XML.

After the user and the contect provider have specified their preferences concerning personal data a P3P agreement can be perfomed. The agreement can be described as follows [2], [3]:

1. Review of the privacy policy.
2. Checking of the syntactical correctness regarding the P3P XML schema.
3. Comparison of user preferences and privacy policy of the content provider.
4. Taking measures as to the result of the comparison and implementation.

How the agent acts when the privacy policy is syntactical incorrect or doesn't match the user preferences is not strictly defined and depends on the specific implementation of the agent.

In order for a P3P agreement to work, the following documents are needed [2]:

- Reference file and privacy policy file on the side of the content provider.
- The APPEL file contating the user preferences on the user's side.

The reference specifies which privacy policy refers to which web resource. It can be viewed as an index of privacy policies and must be placed at a known location as defined by the P3P specifications [2].

The privacy policy contains practices of the content providers regarding the handling of personal data. Accordning the P3P specification it must be defined in a human readable form and a machine readable form – XML file [2], [3]. We won't go into details of the XML privacy policy. Interested readers can look up details in [2] and [3].

3 PROBLEMS OF P3P

The automation of privacy protection has alarmed consumer unions. Karen Coyle of Center for Democracy & Technology has criticized P3P in 1999 (before the standard was adopted) [6]. Her argument was that P3P intends to speed up the collection of data from web sites rather than assuring privacy. The gaining of data is one-sided, only users give data whereas content providers don't. P3P covers the technical aspect of management of privacy, but social, organizational and legal issues are neglected. P3P also doesn't enable the post-deletion of personal data. It actually only rises the trust of users in the content provider, not privacy. Users tend to haste in giving their personal data when they trust a specific web site [4], [5], [6].

3.1 Legal issues

W3C is not a legislative agency and can't define laws. That is why P3P only covers technical issues and there is no guarantee that the content provider is going to stick to the privacy policy which she/he defined. In the USA there is no legal act, which manages privacy. There are companies which check web sites and their P3P policies, like TRUSTe [10] and BBBOnline [11]. If the content provider sticks to the privacy policy which she/he defined, she/he gets a certificate confirming that. Nevertheless there is no guarantee that companies like these are doing everything correct.
In the EU there are directives covering the field of privacy [8], [9]. Abuse of personal data is a criminal act. Nevertheless users must be attentive when using non-European web sites. If a content provider isn't situated in the EU there is no legal implication and prosecution. For these reason we think that P3P should enable localization, which will be presented later. The EU is against the usage of P3P for protecting privacy. The European commission believes that P3P wasn't developed to raise privacy but to lower privacy standards. In their opinion the lack of legal issues transfers the responsibility for privacy protection to the user, which is discordant with international practice. P3P could also make confusion as European content providers would consider only the P3P agreement and not EU directives. Every corporation has to consider the EU directive 95/46/EC [8] regarding personal data. According to the European commission, P3P not only confuses content providers but also users. Because of this facts the EU didn't consider P3P as s technology for privacy protection [9].

4 ENHANCEMENT TO P3P

Because of several imperfection of P3P there has been a slow enforcement of the technology. We will try to give some ideas for enhancements of P3P, which refer to localization, personalization and user profiling and version tracking. We will show how these ideas try to solve some of the mentioned problems. This enhancement are covering the organizational and legal issues of P3P.

4.1 Digital signing

The P3P agreement can have legal consequences in certain countries. For this reason an authentication mechanism should be defined. Digital signatures enable authentication of both sides (user and content provider) and is already used today. The P3P specification should be supplemented to include the demand for digital signing in the process of the P3P agreement. The sining should imply to the XML form using XML digital signature specification (figure 1).

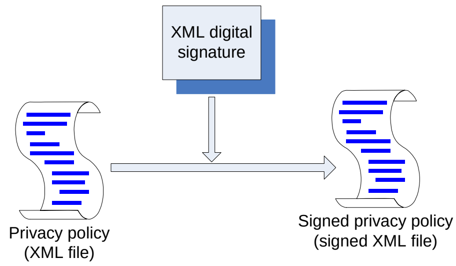


Figure 1: *Signing of the privacy policy in XML form*

4.2 Version tracking

Another issues connected with legal and organization issues of P3P is version tracking. P3P should specify different versioning of privacy policy, because privacy policies which are published on a web site change during time. The user agree on a specific version, which is valid in a certain period of time. The content provider can later change the privacy policy and the coresponding conditions. Because a P3P agreement can be seen as signing a contract, a versioning and version tracking has to be specified. Version tracking should be carried out by both parties (user and content provider).

4.2.1 Prerequisite for version tracking

There are some prerequisites that have to be fulfilled to enable version tracking. The whole process must be supported by software because the P3P agreement is an automatic process. The version tracking implementation should be a part of the agent's implementation on the user's side and the corresponding software solution on the content provider's side. A database should be defined containing the following data:

- Client's data (user or content provider),
    - Company / Name,
    - Address,

- o Telephone,
- o E-mail,
- o Web site and
- o Other data (upgrade possibility)
- Digital signature of parties involved in the agreement,
- Security policy version, which is the subject of the agreement in XML form,
- Validity date of the privacy policy version and
- Digital time stamp.

The data should be stored in a database of a third party (for instance an agency), which can act as a mediator in case of a dispute. We can see the analogy to the public key infrastructure.

4.2.2 The agreement

In the process of the agreement digital signing must be included, which enables authenticity and non-repudiation. The content provider generates a specific version of the privacy policy in XML form and sings it with a digital signature. (figure 2). After that the privacy policy is published on the internet.

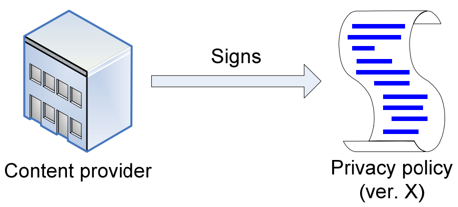


Figure 2*: Signing of a privacy policy by content provider*

As the agent (user) visits the web site it acquires a privacy policy. It checks the validity of the digital signature and the validity date of the policy. A comparison between the user preferences and the privacy policy is conducted. If the agreement is formed, the agent signs the privacy policy with its digital signature and sends it to a third party, the authenticator. The authenticator verifies both digital signatures and the date of the privacy policy. If the verification succeeds, the authenticator signs the privacy policy and generates a time stamp. The data is then stored into the database of the authenticator. The whole process is depicted on figure 3.
Version tracking is not the only problem of P3P. Because we have different legal issues as to the location of the user (differences between countries) the specification should anticipate a localization mechanism. We will give an idea how to solve the problem.

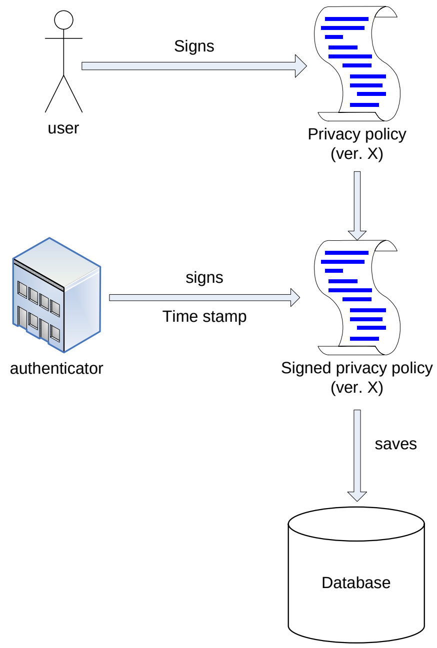


Figure 3: *P3P agreement with digital signing and third party participation*

4.3 Localization and personalization

Privacy protection is differently handled by law in different countries. In the USA, a P3P agreement between an user and a content provider is from the legal view different than in the European union. In the EU there are different directives linked with privacy protection [7], [8]. Members states (including Slovenia) have to include these directives in their national legislation. For this reason the P3P specification should include location data. In this way we could adapt the privacy policy as for the location and the appropriate laws. In the initialization phase, the agent can send the content provider location data. The content provider could then choose the appropriate privacy policy for he specific location, which he would transfer to the agent. The whole process would take place in the secure zone [2], which can prevent abuse of location data (figure 4).

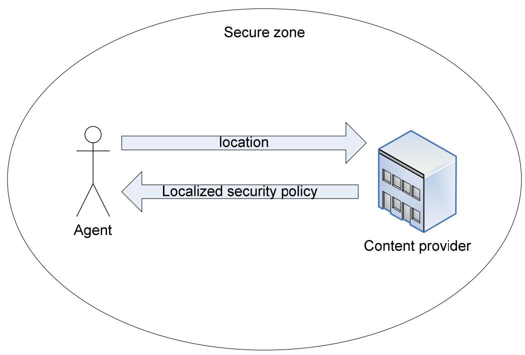


Figure 4: *Exchange of location data and the appropriate localized security policy*

Because location data is a user's personal data, the exchange of the location must take place in the security zone. Data exchanged in this zone is handled as non-existent. In this way we can assure abuse of personal data.
The second enhancement which is tightly connected with localization is personalization. P3P users are not only different regarding their location but also regarding the type. Home users can user P3P to gain information in exchange of giving their personal data. The other sort of user is corporate user. In contrast of home users which own their computers and data, corporate users are very much depending on the policy of the company. Computers of corporate users are the property of corporations in which they work as well as parts of data. A very important fact is also the role of the user in an organization. Let's look at a everyday situation – the transfer of an IP address. A employee of a company visits web site www.website.com and gives his personal data together with the IP address to the content provider. The computer she/he uses is property of the company, which doesn't want the IP address to be transferred to someone. In this sense the user violates the company policy. This is a trivial example which shows the problems when transfering data.
Home users don't have that kind of problems, because she/he is the owner of the computer and network or at least they are related the owner.
With the use of personalization we could solve such problems. We can implement user profiles:

- Home users and
- Corporate users

The home users can use the computers and resource without any constraints. A enhancement must be defined for the corporate user which include a third party. The third party is the organization or company, the users employer (figure x).
In course of the agreement procedure the privacy policy must meet the preferences of both the user and the corporation. User preferences must also suit the corporation's regulations.

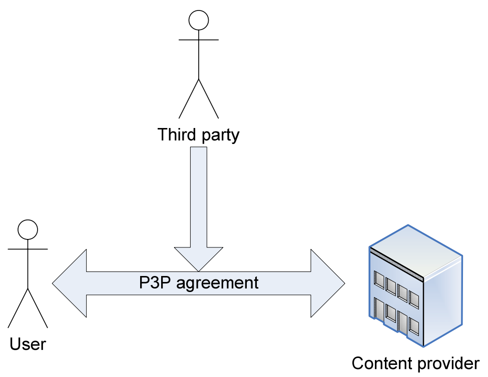


Figure 5: *P3P agreement including a third party*

6 CONCLUSION

We proposed enhancement to P3P in order to make it wider adopted. Furthermore we stressed problems that arise when using P3P. These are legal as well as organizational. The proposed use of digital signatures can raise the security level, because it gives us an authenticational and non-repudiational aspect. The proposed version tracking can be used in legal aspects, whereas the localization and personalization can increase user friendliness.
Inspite of all the problems concerning P3P, we think that it is a step in the right direction. User's must be more concerned with their privacy and that is where P3P can help.

REFERENCES

[1] W3C - World wide web consortium, http://www.w3.org, last visited 2.8.2006

[2] The Platform for Privacy Preferences 1.0 (P3P1.0) Specification, W3C Recommendation 16 April 2002, http://www.w3.org/TR/P3P/, last visited 2.8.2006

[3] Web Site Privacy with P3P, H. Lindskog, S. Lindskog, Wiley, 2003

[4] Platform for Privacy Preferences (P3P) : How Far can P3P Guarantee the Respect of the Data Protection Directive Requirements?, Jean-Marc Dinant, Proceedings of the IFIP Conference on User Identification & Privacy Protection, Stockholm, 1999

[5] Pretty Poor Privacy: An Assessment of P3P and Internet Privacy, June 2000, Electronic Privacy Information Center, www.epic.org, Junkbusters, www.junkbusters.com, last visited 2.8.2006

[6] P3P: Pretty Poor Privacy?, A Social Analysis of the Platform for Privacy Preferences (P3P), Karen Coyle, June, 1999, http://www.kcoyle.net/p3p.html, last visited 2.8.2006

[7] Directive 97/66/EC Of The European Parliament And Of The Council Of 15 December 1997 Concerning The Processing Of Personal Data And The Protection Of Privacy In The Telecommunications Sector

[8] Directive 95/46/EC of the European parliament and of the council of 24 October 1995 on the protection of individuals with regard to the processing of personal data and on the free movement of such data

[9] Platform for Privacy Preferences and the Open Profiling Standard. Draft opinion of the Working Party on the Protection of Individuals with regard to the processing of Personal Data, European Commission, 1998, http://www.epic.org/privacy/internet/ecp3p.html, last visited 2.8.2006

[10] BBBOnline, http://www.bbbonline.org/, last visited 2.8.2006

[11] TRUSTe, http://www.truste.org/, last visited 2.8.2006

KDO SO UDELEŽENCI V NAŠI INFORMACIJSKI DRUŽBI IN KAJ OD NJIH PRIČAKUJEMO

doc. dr. Marko Colnar
Služba za investicije
Ministrstvo za šolstvo in šport, Kotnikova 38, Ljubljana
telefon 01 478 42 75
telefaks 01 478 43 28
e-mail: marko.colnar@gov.si

Povzetek

Namen prispevka je sistematično analizirati sestavine in udeležence informacijske družbe v Republiki Sloveniji s poudarkom na sektorjih bančništva, trgovine, zdravstva, sodstva, izobraževanja in uprave.

Analiza zajema prikaz obstoječega stanja sektorjev in nadaljna pričakovanja od udeležencev v naši informacijski družbi.

V zaključnem poglavju je podan poskus odgovora na drugi del naslova tega prispevka na način, kdo in kako naj sodeluje v naši informacijski družbi z namenom, da se obstoječe stanje po izpostavljenih sektorjih v prispevku izboljša.

1. NEKAJ MISLI O INFORMACIJSKI DRUŽBI

Brez dvoma lahko trdimo, da je informacijska družba rezultat tkim. nove industrijske (tehnološke) revolucije. Tako danes ne gre več samo za npr. proizvodnjo, potrošnjo in denar, v realnem svetu, temveč tudi za pretok informacij o teh agregatih; včasih že same informacije pomenijo kar te agregate.

Ta pretok informacij je omogočen z uporabo sodobnih informacijsko komunikacijskih sredstev, pri tem pa udeleženci potrebujejo tudi neko novo specifično znanje.

2. SESTAVINE INFORMACIJSKE DRUŽBE

Na tem mestu je primerno, da za potrebe tega prispevka, najprej opredelimo sestavine informacijske družbe.

Nova oblika obstoja in delovanja neke družbe seveda zajema najmanj vse klasične družbene sektorje, le da ti sedaj poslujejo tudi informacijsko. Ne bomo trdili, da samo informacijsko, kajti še vedno se dejavnosti odvijajo tudi v realnem prostoru.

Prav tako se je potrebno zavedati, da nekatere sestavine (dejavnosti - sektorji) nikdar ne bodo delovali (samo) na informacijski način, kot tudi, da nekateri udeleženci (kategorije članov te družbe) nikdar ne bodo uporabljali storitev te informacijske družbe.

Torej je potrebno pristopiti k razumevanju in nadaljnem snovanju (naše) informacijske družbe realno in selektivno !

Poskusimo izpostaviti nekaj najbolj značilnih družbenih sektorjev, kjer so informacijski interesi ponudnikov in povpraševalcev nekako največji. Gre vsekakor za področja:

- bančništva,
- trgovine,
- zdravstva,
- sodstva,
- izobraževanja in
- uprave.

3. UDELEŽENCI INFORMACIJSKE DRUŽBE

V skladu z navedenimi sestavinami informacijske družbe (družbenimi sektorji), jim je, za potrebe tega prispevka, primerno dodati glavne udeležence, ki imajo določene pristojnosti in od katerih pričakujemo konkretne odgovornosti, aktivnosti oz. rezultate.

3.1 Stičišče ponudbe in povpraševanja

Vsekakor lahko razumemo navedene sestavine informacijske družbe kot »stičišče ponudbe in povpraševanja«, torej imamo pri vsaki sestavini najmanj dva udeleženca in sicer: ponudnika in povpraševalca. Večkrat pa se nad njima pojavi še država ali pa npr. civilna družba.

3.2 Vsebinski in (informacijsko komunikacijsko) tehnološki udeleženci

Že precej časa se pojavlja nekako izhodiščno vprašanje - Kdo je glavno gibalo napredka informacijske družbe, ali so to vsebinski strokovnjaki, ali pa so to tehnologi ?

Če upoštevamo v 2. poglavju izpostavljene sestavine (sektorje), se nam zdi postavljeno vprašanje zelo relevantno; stanje po sektorjih pa je različno. Lahko rečemo, da imata pri tem eno od bistvenih vlog lastniška struktura oz. profitni motiv. Nekaj pa k temu pripomore tudi »tradicionalna miselnost o posameznem sektorju« (npr. sinonim za sodstvo je sodnik, za upravo uradnik in prav gotovo ne informatik, itd…..).

4. ANALIZA STANJA SESTAVIN IN UDELEŽENCEV INFORMACIJSKE DRUŽBE

4.1 Ponudba in povpraševanje

Če torej obravnavamo izpostavljene družbe sektorje in njihove udeležence, <u>lahko najprej ugotavljamo, ali ponudba zadovoljuje potrebe povpraševanja.</u>

Pojdimo po vrsti:

- **bančništvo -** tukaj ponudba v veliki meri že sledi povpraševanju. Na spletu in preko bankomatov je ponujena večina bančnih storitev, z izjemo npr. kreditnih in depozitnih poslov; tudi informacijska (računalniška) varnost je dobra;
- **trgovina** - tu je situacija nekoliko drugačna, saj obstaja mnogo vrst trgovin, kar pomeni, da se prodaja / kupuje množica artiklov, ki so, eni bolj, drugi manj primerni npr.za »internetno prodajo«. Če gremo v naši analizi še nekoliko dlje, so eni bolj, drugi pa manj primerni tudi za »internetno potrošnjo«. Največ kar se lahko z informacijsko komunikacijskimi sredstvi omogoči praktično vsem artiklom pa so, dobre informacije. Še vedno pa je v tem sektorju prisotno nezaupanje v internetno plačevanje, kar precej zmanjšuje odstotek »internetne prodaje«;
- **zdravje** - ta sektor je precej pod pričakovanji povpraševanja, saj bi se dalo informacijsko komunikacijska sredstva precej bolj izkoristiti. Verjetno je problem v sami naravi izvajalcev tega sektorja, ki imajo relativno monopolni položaj; poraja se občutek, da bi z večjo ponudbo na »internetu« izgubili nekaj pomembnosti. Dejanska ponudba v tem sektorju zajema predvsem zdravstveno zavarovanje (pri tem gre v glavnem za nadzor na plačanimi prispevki in nad tem, da zavarovanci ne bi preveč porabili), nadalje pa sledijo (le) še informacije o posameznih zdravstvenih zavodih; vse ostalo je potrebno opraviti osebno - v čakalnicah in ordinacijah;
- **sodstvo -** tudi to področje je (žal) pod pričakovanji povpraševanja. Edina svetla izjema je »elektronska zemljiška knjiga«, ki pa tudi ne daje vseh pričakovanih rezultatov (vzroke gre iskati bolj izven informatike). Mnogo pa bi se dali postoriti z vzpostavitvijo elektronskih vlog, spremljanja stanja in tudi z večjo elektronsko podporo pri delu sodnikov;
- **izobraževanje -** naj pod ta sektor najprej združimo tako formalno izobraževanje kot tudi funkcionalno usposabljanje. Potencial informacijsko komunikacijskih sredstev v tem sektorju pa je relativno še precej neizkoriščen. Lahko ugotovimo, da je tudi ta sektor, tako kot predhodna dva, še precej konzervativen, hkrati pa ima še relativno monopolen položaj (vsaj kar zadeva formalnega izobraževanja). Sodobna tehnologija omogoča množico multimedijskih in interaktivnih gradiv za vse stopnje izobraževanja in usposabljanja, nadalje izvajanje pouka s pomočjo informacijsko komunikacijske tehnologije v vzgojno izobraževalnih zavodih, kot tudi »izobraževanje na daljavo«. Internet pa je, če drugega ne,

udeležencem odprl nepregledno množico virov in literature;

- **uprava** - zgodovina naše elektronske uprave traja nekako pet let. V tem času nam je uspelo vzpostaviti portal eUprava, kjer so najprej prevladovale informacije o upravnih organih in možnih upravnih postopkih; danes je na tem portalu (z izjemo davčnega področja in nepremičnin) še vedno (pre)več informacij in premalo storitev, ki bi prebivalcem prihranile čas in denar. Razlog tiči tudi v neizvedeni prenovi poslovanja upravnih organov, s katero bi poenostavili, odpravili, združili vse upravne postopke, šele nato bi se lahko lotili izdelave in povezave informacijskih rešitev, ki bi resnično in v celoti, preko interneta, strankam omogočili izpeljavo postopka od doma (ali iz svojega podjetja). Posebej pa bi se naša uprava pokazala za prijazno, če bi odpravila množico nepotrebnih upravnih postopkov (torej bi bila uprava prijazna do strank največkrat takrat, ko jim sploh ne bi bilo potrebno priti). Tudi pri upravi lahko ugotovimo, tako kot pri predhodnih treh sektorjih, da prevladuje monopolni položaj, kar, z vidika motivacije za boljše npr. elektronsko poslovanje, prav gotovo ni dober obet.
  V zadnjem času je v naši upravi npr. posebej izpostavljena storitev eUprave tkim. »eDemokracija«; osebno si ne predstavljam, da bi bil katerikoli zakon sprejet ali spremenjen na podlagi pobude nekega (skupine) prebivalcev ?!

4.2 Razmerje med vsebinskimi in tehnološkimi strokovnjaki

Če v skladu s postavljenim izhodiščnim vprašanjem v poglavju 3.2 analizirajmo stanje po izpostavljenih sestavinah (družbenih sektorjih) (naše) informacijske družbe. Ugotavljamo za:

- **bančništvo -** da je informatika relativno pomembna, kar zadeva, mesta in vloge pri razvoju sektorja in informacijski zasnovanosti dejavnosti;
- **trgovino** - situacija je podobna kot v bančništvu;
- **zdravstvo** - tu je situacija že bistveno drugačna. Daleč na prvem mestu je strokovni kader, informatiki so »drugorazredni kader«. Zato je tudi stanje informacijske zasnovanosti temu primerno;
- **sodstvo -** tudi tukaj je situacija podobna, kot pri zdravstvu.
- **izobraževanje** - situacija je podobna kot pri zdravstvu in sodstvu; morda le malenkostno boljša. K temu verjetno pripomore drugačna sestava na strani povpraševanja, kjer je populacija mlada in bolj sili k napredku. Vsekakor lahko ugotovimo, da so zdravstvo, sodstvo in izobraževanje klasični - recimo »manj tržno konkurenčni družbeni sektorji«, iz česar sledi (ne)pripravljenost in (ne)nujnost za uvajanje (tudi) sodobnih (informacijsko komunikacijskih) tehnologij;
- **upravo** - za upravo lahko enostavno ugotovimo, da je, kar zadeva razmerja (pomembnosti) med vsebinskimi in tehnološkimi kadri, nekje na sredini med izpostavljenimi družbenimi sektorji. Poleg tega je potrebno upoštevati še časovno dimenzijo stanja tega razmerja in sicer, da so bila obdobja, ko je bila informatika že bolj priznana (v ospredju), sledilo pa je obdobje, ki informatika ni toliko pomembna.

5. KAJ TOREJ PRIČAKUJEMO OD UDELEŽENCEV V INFORMACIJSKI DRUŽBI

Glede na ugotovitve iz 3. in 4. poglavja, kaže vsekakor, na vsakem od družbenih sektorjev, brez dvoma **približati ponudbo povpraševanju oz. bolj izkoristiti informacijsko komunikacijska sredstva in kadre, kar pomeni, da je pred nami še precej dela pri izboljšanju ponudbe.**

Vsekakor je potrebno bolj sistematično zastaviti spremljanje strani povpraševanja (potreb / pričakovanj od ponudbe) v vseh sektorjih. Pri tem velja opozoriti, da se le-to izvaja precej bolje v sektorjih, kjer ponudnike žene tržni mehanizem oz. profitni motiv, kot pa v sektorjih, kjer prevladuje monopolni položaj, vključno z našo upravo.

Na strani povpraševanja pa velja, poleg zaznavanja potreb po storitvah, **najti način, da se prebivalstvu (gospodinjstvom), za podjetja v večini primerov to ne velja, zagotovi na čimbolj enostaven in poceni način, za pridobitev informacijsko komunikacijskih sredstev in, ne pozabimo, znanja.**

Poleg tega bi veljalo dati informatikom in vsebinskim strokovnjakom bolj enakovredne vloge po večini družbenih sektorjev, saj ni enoznačnega odgovora na vprašanje: Kdo je generator razvoja - npr. neke organizacije, dejavnosti ali sektorja? Dejansko nikjer ne moremo govoriti samo o vsebinskih strokovnjakih, ali pa samo o (informacijsko komunikacijskih) tehnologih. Naj ne bodo informatiki pri precejšnji množici družbenih sektorjev (tudi v upravi) samo »serviserji PC-jev in podobnega«.

Kdo naj torej sodeluje ?

Država, podjetja, šole, posamezniki, civilna družba, v projektih, kjer imajo vsebinski in tehnološki strokovnjaki enakovredno vlogo.

Na kakšen način ?

Država (poleg že znanih pristojnosti / odgovornosti za zagotovitev zakonodaje) tudi pri zagotovitvi komunikacijske infrastrukture in znanja v veliki meri. V manjši meri pa tudi pri olajšanju zagotovitve pridobivanja ostalih informacijskih sredstev (računalniške in programske opreme).

Podjetja (v sodelovanju za državo), predvsem s področja računalniške in programske opreme ter usposabljanja in svetovanja, naj najdejo čimbolj konkurenčne artikle in storitve; država lahko tudi v nekem obsegu stimulira (npr. sofinancira) določeno opreme in storitve.

Šole (prav tako v sodelovanju z državo - ne nazadnje je velika večina šol državnih ali na pol državnih) naj zagotovijo najmanj prostorske kapacitete za izvajanje široke dejavnosti usposabljanja prebivalstva za uporabo storitev informacijske družbe oz. informacijsko komunikacijskih sredstev.

Posamezniki naj v čimvečji meri izkoristijo že ponujeno elektronsko komuniciranje oz. poslovanje; pri zagotovitvi določenih informacijsko komunikacijskih sredstev pa naj morda tudi prerazporedijo svoje prioritete (morda tudi vire).

Civilna družba naj predstavlja predvsem vez med državo in posamezniki. Veliko lahko stori npr. na področju organizacije usposabljanj, na področju pomoči, svetovanja posameznikom. Hkrati lahko nekako institucionalno tudi združuje določene skupine posameznikov, predvsem na strani povpraševanja in zastopa njihove interese proti ponudnikom.

VIRI IN LITERATURA

1. COLNAR MARKO: Ali e-Uprava izpolnjuje pričakovanja?, Portorož, 2006, Dnevi slovenske informatike 2006, Zbornik posvetovanja, str. 126 in CD
2. COLNAR MARKO: Kje smo s prenovo procesov v naši upravi?, Portorož, XII Dnevi slovenske uprave 2005, CD
3. COLNAR MARKO: Zakaj potrebujemo usposabljanje javne uprave za elektronsko poslovanje, Portorož, Dnevi slovenske informatike 2005, Zbornik posvetovanja, str. 91-97
4. COLNAR MARKO: Kako do prenove slovenske uprave, Ljubljana, 2006, GV Založba, 225 str.
5. MINISTRSTVO ZA INFORMACIJSKO DRUŽBO: Strategija Republike Slovenije v informacijski družbi, (RSvID), 2003

EVROPSKI UPRAVNI PROSTOR IN RAZVOJ E-UPRAVE V RS

Tjaša Ivanc
Univerza v Mariboru, Pravna fakulteta
Mladinska 9, 2000 Maribor, Slovenija
Tel: +386 2 2504237; fax: +386 2 2523245
e-mail: tjasa.ivanc@uni-mb.si

POVZETEK

Prispevek izpostavlja enoten evropski upravni prostor in nadaljnje možnosti za razvoj e-uprave v Republiki Sloveniji. Vključevanje v sodobne evropske tokove, spremljanje modernizacije javne uprave, evropeizacija javnih politik, implementacija evropskih upravnih principov, je okolje v katerem naj nacionalne uprave zagotavljajo izhodišča za integracijo v evropski upravni prostor.

1 UVOD

Proces evropske integracije je v zadnjih desetih letih vplival tudi na konvergenco oz. medsebojno zbliževanje upravnih sistemov držav članic Evropske unije. Na nastanek in razvoj »evropskega upravnega prostora« (ang. European Administrative Space) vpliva tako sodelovanje med državami članicami glede izmenjave izkušenj in dobre upravne prakse, kot tudi definiranje skupnih upravnih principov in standardov. Vključevanje v sodobne evropske tokove, spremljanje modernizacije javne uprave, evropeizacija javnih politik, implementacija evropskih upravnih principov, je okolje v katerem naj nacionalne uprave zagotavljajo izhodišča za integracijo v evropski upravni prostor.
V prispevku bo definiran pojem »evropskega upravnega prostora« in kakšna je strategija prizadevanja in dohitevanja evropski stopnji konkurenčnosti.

2 POJEM IN NASTANEK EVROPSKEGA UPRAVNEGA PROSTORA

Z vstopom v informacijsko dobo in preoblikovanjem tradicionalne javne uprave v omrežno e-upravo, se slovenska javna uprava sooča s pomembnimi spremembami in izzivi.
Na evropski ravni je bilo sprejetih že več ukrepov za pospešen prehod v informacijsko družbo, in sicer je med drugim postavljen jasen okvir za elektronsko poslovanje, pospešuje se liberalizacija telekomunikacij in podpiranje raziskav in razvoja. Zato je za Slovenijo razvoj informacijske družbe in e-uprave pomemben za dvig in ohranitev svojega položaja v Evropi in edina pot v prihodnost. Na splošno je mogoče ugotoviti, da hiter tempo sili javne uprave po vsem svetu k drugačnemu načinu delovanja. Trendi v javni upravi kažejo, da se vloga države spreminja. Hitri razvoj spleta v gospodarstvu in vstop v vsakdanje življenje, sta povečala pritisk na javni sektor. Splet spodbuja preoblikovanje javne uprave iz klasične uradniške oz. administrativne organizacije, ki poudarja standardizacijo in izvedbeno stroškovno učinkovitost, v e-javno upravo, ki se opira na načela novega javnega managementa: oblikovanje koordinacijskih mrež, vključevanje zunanjih sodelavcev in usmerjenost k uporabnikom.[1] Rezultati poročila Združenih narodov o javnem sektroju (United Nations World Public Sector Report) so pokazali, da je do leta 2003 imelo več kot 173 držav vzpostavljene vladne spletne strani (government web sites).

Ne glede na različne modele organizacije javne uprave, nacionalni upravni sistemi različnih držav med seboj komunicirajo na podlagi usklajenih standardov in principov. Prihaja do poenotenja ključnih elementov na področju upravnih zakonodaj in dobre prakse. Skozi delovanje institucij Evropske unije se vzpostavlja sodelovanje med upravami Evropskih skupnosti in nacionalnimi upravami. Pri tem je pomembno, da sodelovanje uprav temelji na hitri medsebojni izmenjavi velikih količin podatkov ter med administracijami in gospodarstvom, ob tem pa sledi hitremu tehnološkemu razvoju, ki ga prinaša informacijska družba.[2]
Stalni kontakti, izmenjava izkušenj in razvoj acquis communautaire[3] so pripomogli k sprejemanju in poenotenju metod in prakse držav članic ter definiranju osnovnih načel upravnega prava.

Evropski upravni prostor nastaja na podlagi usklajevanja pravnih sistemov držav članic in Evropske Komisije ter z

[1] Tat-Kei Ho Alfred, Reinventing local governments and the E-government initiative; Public administration Review 62/4 2002.
[2] Takšno sodelovanje je moč doseči le ob koordinirani uporabi sodobnih informacijsko-komunikacijskih tehnologij.
[3] Pravni red Evropskih skupnosti (acqius communautaire) je zbir za članice neposredno veljavnih primarnih in sekundarnih pravnih aktov (ustanovne pogodbe, regulative/uredbe, direktive/smernice, odločbe itd.), ki skupaj s splošnimi pravnimi načeli, mednarodnim pravom, sodno prakso, običaji in pravno znanostjo podajajo pravni okvir delovanja v ES in EU.

razvojem splošnih upravnih standardov in načel.[4] Sam pojem evropski upravni prostor torej ne pomeni enotne zakonodaje na področju javne uprave, ampak upoštevanje vsem upravam skupna načela in standarde. Ker se pravni red Evropske Skupnosti le v minimalnem deležu neposredno nanaša oz. ureja področje javne uprave se je izoblikoval t. i. neformalni evropski pravni red v obliki minimalnih standardov, potrebnih za učinkovito implementacijo acquisa.

Lahko bi rekli, da je evropski upravni prostor dober okvir za določanje osnov za izgradnjo moderne državne uprave v državah članicah ter da zajema izdelane evropske politike in pravila, pri tem pa EU prepušča strukturalno in funkcionalno oblikovanje javne uprave vsaki državi članici.[5]

Predmet evropskega upravnega prostora in izzivi so reforme kakovosti uprave, e-uprave, usposabljanje javnih uslužbencev, javnih financ, zbiranje in procesiranje podatkov na evropski ravni itd.
Izhodišča za integracijo v evropski upravni prostor predstavljajo naslednja načela:
1. zanesljivost in predvidljivost (Legal Certainty and Predictability Principles),
2. transparentnost in odprtost (Openness and Transparency)
3. odgovornost (Accountability) in
4. učinkovitost in uspešnost (Efficiency and Effectiveness).[6]

Za zagotavljanje načela uspešnosti in učinkovitosti za spodbujanje kakovosti v upravi kot ena izmed skupnih dejavnosti na evropski ravni skrbi posebna delovna skupina Innovative Public Services Group (IPSG). Ta skupina je ena izmed štirih delovnih skupin, ki delujejo pod pokroviteljstvom ministrov in generalnih direktorjev držav članic EU in pristopnic, pristojnih za upravo, pod skupnim nazivom Evropska mreža za javno upravo (angl. EPAN – European Public Administration Network). Ostale delovne skupine, ki sestavljajo mrežo so:

• Upravljanje človeških virov (Human Resource Management – HRWG),
• E-uprava (E-Government),
• Boljši predpisi (Better Regulation).[7]

Namen delovanja mreže je zlasti podpora izmenjavi izkušenj, idej, informacij o programih ter razvoj skupnih orodij za uporabo v javnih upravah držav članic Evropske unije (EU) in v Evropski komisiji. Slovenija sodeluje pri mreži evropskih javnih uprav od leta 2003, ko smo bili povabljeni k sodelovanju kot država pristopnica, danes pa Slovenija sodeluje pri vseh programih, ki jih izvajajo delovne skupine.

3 IZHODIŠČA ZA INTEGRACIJO IN SEDANJE STANJE RS V EVROPSKEM UPRAVNEM PROSTORU

Za Slovenijo je razvoj informacijske družbe in e-uprave pomemben za dvig in ohranitev svojega položaja v Evropski Uniji. Velik pomen razvoja na tem področju je Slovenija spoznala že leta 2001, ko je ustanovila Ministrstvo za informacijsko družbo. Glavna razloga za to sta bila neuravnotežena struktura naložb na področju razvoja in uporabe informacijsko-komunikacijske tehnologije. Ker je eden ključnih dejavnikov, ki vodijo k učinkovitem procesu odločanja in uspešnemu uresničevanju politik Evropske skupnosti, sodelovanje med upravami Skupnosti in upravami držav članic ter med njimi in zasebnim sektorjem, je mogoče takšno sodelovanje doseči le ob koordinirani uporabi sodobnih informacijsko-komunikacijskih tehnologij. Sodelovanje uprav mora temeljiti na hitri medsebojni izmenjavi velikih količin podatkov ter med administracijami in gospodarstvom, ob tem pa slediti hitremu tehnološkemu razvoju.

Za uspešen prehod Slovenije v informacijsko družbo bi lahko kot ključnega pomena navedli naslednje dokumente:
- od njegove objave naprej Bangemannovo poročilo[8] v Evropski uniji upoštevajo, kot temeljni strateški dokument za prehod v informacijsko družbo;
- za njim so bili sprejeti tudi drugi evropski in slovenski dokumenti , ki določene vidike Bangemannovega poročila podrobneje obravnavajo: Bonnska deklaracija, Lizbonski vrh[9], eEurope 2002 in eEurope 2005[10], eEurope+, Strategija Republike

[4] Sigma Paper, No.23, »Preparing administration for the European Administrative Space« OECD, 1998.
[5] Rimska pogodba ne vsebuje nobene določbe, ki bi bila splošno veljavna za področje javne uprave, prav tako glede tega ni bila sprejeta nobena direktiva.
[6] Sigma Paper No. 27, European Principles for Public Administration, str. 8-14.
[7] http://www.eupan.org/.

[8] Med prve dokumente, ki so se osredotočili na evropsko informacijsko družbo nedvomno spada besedilo z naslovom Evropska zveza in globalna informacijska družba – Priporočila Evropskemu svetu- (Europe and the Global Info Society.-Recommendations to the European Council), gradivo znano pod imenom Bangemannovo poročilo. Vizija informacijske družbe, ki je prikazana v tem priporočilu, kaže na področja, na katerih bi bilo nujno nekaj storiti, da bi se lahko začel tržno usmerjen prehod v postindustrijsko dobo. Predvsem predvideva vključevanje javnega in zasebnega sektorja v partnerstvo.
[9] Z akcijskim načrtom je EU opredelila akcije, s katerimi bi do leta 2002 dosegli tri osnovne cilje2: (i) cenejši, hitrejši in varen dostop do Interneta, (ii) naložbe v ljudi in znanje (evropska mladina v digitalni dobi, delo v ekonomiji temelječi na znanju, udeležba vseh v ekonomiji temelječi na znanju), in (iii) pospeševanje uporabe Interneta (pospeševanje e-trgovine, elektronski dostop do javnih storitev, elektronski dostop do zdravja, evropska digitalna vsebina za globalne mreže, inteligentni transportni sistemi). Presidency conclusions, Lisbon European Council, 23 and 24 March 2000, Feira European Council agreement on the eEurope Action Plan, 19 and 20 June 2000.
[10] Akcijski načrt eErope 2005 postavlja v ospredje uporabnike in poudarja stimoliranje varnih storitev, aplikacij in vsebin v široko dostopni širokopasovni infrastrukturi. Do zaključka leta 2005 naj bi bili doseženi naslednji cilji akcijskega načrta eEurope 2005: moderne spletne javne storitve (e-uprava, e-izobraževanje, e-zdravstvo), dinamično elektronsko poslovno okolje, varna informacijska infrastruktura, širokopasovne povezave dostopne po konkurenčnih cenah, merjenje napredka in

Slovenije v informacijski družbi, Strategija e-uprave RS za obdobje od 2006-2010, i2010.

Modernizacija javne uprave je torej med drugim odvisna tudi od strategije, ki si jo je država izbrala za uvajanja e-uprave. Vloga modernizacije javne uprave se odraža predvsem na dveh področjih: uprava mora delovati kot legitimna oblast in uprava mora biti učinkovita.

Hiter razvoj javne uprave v RS je bil v obdobju od 1997–2002 povezan s procesom vključevanja Slovenije v Evropsko unijo. Zaradi tega so strateške spremembe potekale v dveh smereh: v smeri krepitve administrativne usposobljenosti po posameznih resorjih (vertikalni del) in v smeri izgradnje novega zakonodajnega okvira za delovanje javne uprave (horizontalni del), usklajenega s standardi "evropskega upravnega prostora". O uspešnosti te reforme kaže Poročilo Evropske komisije o napredku Slovenije pri vključevanju v Evropsko Unijo, ki daje pozitivno oceno administrativne usposobljenosti na resorni in horizontalni ravni. Vlada RS je leta 2003 sprejela Strategijo nadaljnjega razvoja slovenskega javnega sektorja 2003-2005, v kateri posebno pozornost namenja ciljem in ukrepom modernizacije javne uprave ter določa cilje za doseganje rezultatov, primerljivih z javnimi upravami v drugih državah Evropske unije.

V preteklih letih je Slovenija namenila večji del sredstev informatizaciji javne uprave, kar je sicer pomenilo posredno korist za državljane, vendar pa takšna strategija ni bistveno vplivala na spodbujanje elektronskega poslovanja v gospodarstvu in civilni družbi, kot tudi ne na povečanje dostopnosti in interesa prebivalstva za storitve informacijske družbe. V ta namen je bila leta 2003 sprejeta Strategija Slovenije v informacijski družbi, ki predvideva med drugim kreiranje ugodnega investicijskega okolja in novih delovnih mest, rast zaposlenosti, povečanje dodane vrednosti, rast produktivnosti, modernizacija javne uprave, povečanje transparentnosti delovanja državne uprave in dostop do informacij ter zagotavljanje enakih možnosti vseh državljanov za sodelovanje v globalni informacijski družbi.[11]

Uvajanje elektronskega poslovanja kot globalnega cilja je bil kot strateški element uvajanja e-uprave opredeljen v Strategiji e-poslovanja v javni upravi za obdobje od leta 2001 do leta 2004. Sledila je naslednja pomembna ključna faza informatizacije javne uprave, in sicer sprejetje Akcijskega načrta e-uprave do leta 2004, na podlagi katerega so se pričele izvajati planirane aktivnosti in projekti za e-storitve. Trenutno stanje razvoja e-uprave je mogoče ovrednotiti na podlagi različnih raziskav opravljenih doma in v tujini, pri čemer pa je treba upoštevati, da so v teh raziskavah uporabljene različne metode. Strategija e-uprave RS za obdobje 2006 do 2010 določa strateške usmeritve in cilje za RS in EU pri razvoju e-uprave.

4 E-UPRAVA

Na splošno je mogoče ugotoviti, da hiter tempo sili javne uprave po vsem svetu k drugačnemu načinu delovanja. Trendi v javni upravi kažejo, da se vloga države spreminja. Hitri razvoj spleta v gospodarstvu in vstop v vsakdanje življenje, sta povečala pritisk na javni sektor. Splet spodbuja preoblikovanje javne uprave iz klasične uradniške oz. administrativne organizacije, ki poudarja standardizacijo in izvedbeno stroškovno učinkovitost, v e-javno upravo, ki se opira na načela novega javnega managementa: oblikovanje koordinacijskih mrež, vključevanje zunanjih sodelavcev in usmerjenost k uporabnikom.[12]

Poudarek ja na zagotavljanju storitev državljanom, cilj pa pospešitev družbenega razvoja, kar sili k uvajanju procesa informatizacije v javno upravo. Doseči bolj kakovostno in učinkovito poslovanje v javni upravi je eden izmed ciljev za uresničevanje načela usmerjenosti k uporabnikom. Ravno e-uprava je ključ do teh ciljev. E-uprava radikalno spreminja notranji ustroj upravnih sistemov in tehnološke osnove njihovega delovanja, še bolj pa načine komuniciranja uprave z njenimi uporabniki, ter naravo in kakovost njenih storitev.[13]

Splošna definicija opisuje e-upravo kot uporabo informacijske in komunikacijske tehnologije, ki bo omogočala bolj dostopno, učinkovito in zanesljivo e-upravo. Običajno so določene štiri stopnje razvoja e-uprave:

- informacije dostopne na spletu,
- enosmerna interakcija - na uradni spletni strani so dostopni obrazci in vloge, ki se lahko shranijo ali natisnejo,
- dvosmerna interakcija – na uradni spletni strani se lahko obrazci elektronsko izpolnijo in se elektronsko odpošljejo ter se tako sproži začetek postopka,
- popolna transakcija, ki vsebuje tudi vročitev in plačilo.[14]

prevzemanje dobrih primerov razvoja. eEurope 2005 Key Figures for Benchmarking EU15, 2004.

[11]Ministrstvo za informacijsko družbo, Strategija, Republika Slovenija v informacijski družbi, 2003: http://mid.gov.si/mid/mid.nsf/V/KE332AF03299A027FC1256CCC0042109C/$file/Strategija_RSvID_(2003-02-13).pdf#search=%22strategija%20slovenije%20v%20informacijski%20dru%C5%BEbi%20%22.

[12] Tat-Kei Ho Alfred, Reinventing local governments and the E-government initiative; Public administration Review 62/4 2002.

[13] Vintar M., Občan v razmerju do e-uprave, VIII. Dnevi slovenske uprave, 2001.

[14] Sakowicz M, How should e-government be evaluated?, NISPAcee occasional papers, št. 2/2004.

E-uprava omogoča dosegljivost storitev na enem mestu, brez nepotrebne izgube delovnih ur, kar lahko povzročijo administrativni zapleti. Zagotavljala povezovanje uradnih evidenc, da lahko uradniki sami pridobijo potrebne podatke brez asistence državljanov.

Opredelilni elementi e-uprave so predvsem uporaba sodobne tehnologije, zagotavljanje elektronskih storitev in vzpostavitev informacijskih sistemov.

Uspešno usmeritev za e-upravo predstavljajo v grobem štirje procesi, ki jih države, med njimi je tudi Slovenija, ob prehajanju v informacijsko družbo pospešujejo:

- deregulacija: ukinja na začetku podprte monopole, omogoča delovanje tržnih sil na vseh področjih ter prepušča pobudo zasebnemu sektorju;
- zunanje izvajanje: usmerja izvajanje primarnih nalog, zmanjšuje stroške ter odpira nove poslovne priložnosti za zasebni sektor;
- decentralizacija: uporaba sodobnih tehnologij, ki omogočajo dostop do informacij javnega sektorja, pomembnih pri sprejemanju odločitev za posameznike, s čemer se zmanjša potreba po delovanju centralno vodene državne administracije. Na novo se opredeli vloga posameznika v informacijski družbi, zaradi njegovega vključevanja v procese odločanja na lokalni ali državni ravni.
- informatizacija: vzpodbuja vse vidike elektronskega poslovanja in možnost dostopa do podatkov javnega sektorja. Uporabnike rutinskih opravil se s tem razbremeni administracije ter tako poveča njihovo lastno produktivnost in zadovoljstvo.[15]

S pospeševanjem vseh štirih procesov Slovenija varno stopa po poti v informacijsko družbo.
Pri uvajanju e-poslovanja na delovna področja javne uprave je potrebno upoštevati tri glavne relacije med javno upravo in ostalimi subjekti. Te relacije so:

- javna uprava – državljani (vertikalna povezanost) – Government to Citizen (G2C),
- javna uprava – privatni sektor (vertikalna povezanost) - Government to Business (G2B),
- javna uprava – javna uprava (horizontalna medresorska povezanost) - Government to Government (G2G).

Z delitvijo na ta način je lažje opredeliti prioritete in tudi specifične ukrepe ter probleme (npr. dejstvo, da ima e-poslovanje na relaciji uprava – državljan izjemno pomembne politične vidike, ki pogosto presegajo samo racionalnost in učinkovitost).

Velik pomen ima pri ocenjevanju uspešnosti kritični dejavniki uspeha pri uvajanju e-poslovanja v javno upravo RS, in sicer usklajevanje zakonodaje na področju e-poslovanja s tehnološkimi možnostmi e-poslovanja ter s standardi in direktivami, ki jih na tem področju sprejema in uveljavlja Evropska Unija ter zaščita in varnost transakcij e-poslovanja (varnostna politika), podpora uporabnikov z množično uporabo različnih komunikacijskih naprav, ki omogočajo e-poslovanje.

5 SKLEP

V želji zagotoviti učinkovito javno upravo, prilagojeno in usklajeno z normami EU bo morala Republika Slovenija zagotoviti ustrezno kakovost javnih storitev (zlasti z zagotovitvijo komuniciranja, učinkovitega upravljanja človeških virov, itd.). Vzpostavitev skupnega Evropskega upravnega prostora predstavlja poseben izziv tudi za Slovenijo, saj lahko le z hitrim in učinkovitim razvojem e-storitev izkoristi vse možnosti, ki jih le-ta ponuja. Šele ob takšni predpostavki bomo lahko govorili o inovativnih storitvah e-uprave in učinkoviti javni upravi.

Literatura

1. eEurope 2005 Key Figures for Benchmarking EU15, 2004.
2. Presidency conclusions, Lisbon European Council, 23 and 24 March 2000, Feira European Council agreement on the eEurope Action Plan, 19 and 20 June 2000.
3. Sakowicz M, How should e-government be evaluated?, NISPAcee occasional papers, št. 2/2004.
4. Sigma Paper, No.23, »Preparing administration for the European Administrative Space« OECD, 1998.
5. Sigma Paper No. 27, European Principles for Public Administration, str. 8-14.
6. Tat-Kei Ho Alfred, Reinventing local governments and the E-government initiative; Public administration Review 62/4 2002
7. Vintar M., Občan v razmerju do e-uprave, VIII. Dnevi slovenske uprave, 2001.

[15] Strategija e-poslovanja v javni upravi za obdobje od leta 2001do leta 2004

ŠTUDIJA IZVEDBE FOKUSNE SKUPINE V SPLETNEM PROSTORU

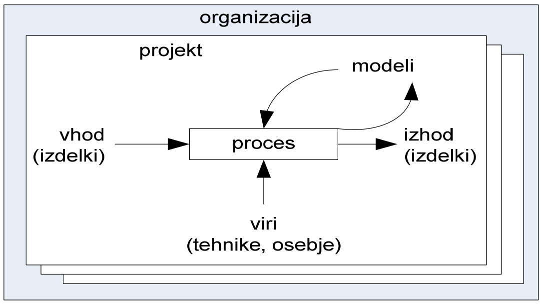
Gregor Polančič
Fakulteta za elektrotehniko, računalništvo in informatiko
Univerza v Mariboru
Smetanova 17, 2000 Maribor, Slovenija
e-mail: gregor.polancic@uni-mb.si

ABSTRACT

Med poglavitne pomanjkljivosti raziskav na področju programskega inženirstva spada pomanjkanje empiričnih raziskav, kar pogosto izhaja iz težavnega in dragega pridobivanja empiričnih podatkov. Z vse večjo priljubljenostjo virtualnih skupnosti so se pojavile nove možnosti za pridobivanja empiričnih podatkov, ki prinašajo prednosti, slabosti in odprta vprašanja.
V prispevku je predstavljena možnost izvedbe empirične raziskave v spletnem prostoru. Predstavljena je metoda fokusne skupine in izpeljanka metode, ki se izvaja v spletni obliki *(Online Focus Group - OFG)*. Na osnovi opredeljenega postopka izvedbe fokusne skupine, je predstavljen primer izvedbe metode v spletni skupnosti »Slashdot«. Med poglavitne ugotovitve uporabe metode spadata možnost cenenega pridobivanja izobilja podatkov in slaba veljavnost pridobljenih podatkov.

1 UVOD

Programsko inženirstvo *(software engineering)* je disciplina, ki se ukvarja s teorijami, metodami in orodji (v nadaljevanju tehnikami), ki so namenjeni sistematičnemu razvoju programske opreme. Za programskega inženirstvo je značilen hiter napredek, ki se odraža v nenehnem spreminjanju tehnik razvoja programske opreme. Hiter napredek je posledica vse večjih zahtev po programski opremi, kakor tudi povečevanja kompleksnosti programske opreme [1].
Poleg prednosti, ki jih prinaša hiter napredek na področju programskega inženirstva, ima le ta tudi pomanjkljivosti. Med pomanjkljivosti spadata nepreverjena učinkovitost in ustreznost sodobnih tehnik, ki se vpeljujejo v procese razvoja programske opreme. Tveganja, ki izhajajo iz zgoraj navedenih pomanjkljivosti imajo negativen vpliv na produktivnost, projektni plan in kakovost programske opreme. Posledično se programsko inženirstvo pogosto označuje kot spretnost *(craft)* in ne kot inženirska disciplina [1].
Zgoraj navedene probleme naslavlja empirično programsko inženirstvo *(empirical software engineering)*, ki z uporabo empiričnih raziskav analizira prednosti in slabosti obstoječih tehnik na najrazličnejših področjih razvoja programske opreme (*Slika 1*). Rezultati empiričnih raziskav so preverjeni koncepti in empirično znanje, ki se uporabljajo za reševanje predstavljenih problemov programskega inženirstva.



Slika 1: Možni predmeti empiričnih raziskav [1]

Strategij za izvedbo empiričnih raziskav je več in se v osnovi delijo na kvalitativne in kvantitativne. Kvalitativne raziskave običajno preko interpretacije kvalitativnih podatkov, raziskujejo predmete raziskav v naravnem okolju. Kvantitativne raziskave so običajno namenjene raziskovanju operacionaliziranih povezav med različnimi raziskovalnimi skupinami katerih rezultat so najpogosteje potrjene ali zavržene kavzalne povezave.
Osrednji del procesa empirične raziskave predstavlja izvedba raziskave z uporabo ustrezne metode raziskave. Pri tem izbiro ustrezne metode raziskave pogojujejo: namen raziskave, tip raziskovalnega vprašanja in faza v celotnem raziskovalnem projektu [2]. Primerjava treh pogosto uporabljenih metod raziskovanja, ki se izvajajo v realnem okolju, je predstavljena v tabeli na naslednji strani (*Tabela 1*).
V prispevku je podrobneje predstavljena raziskovalna metoda fokusne skupine, ki je doživela nagel vzpon v zadnjih dvajsetih letih [3]. V poglavju 2 je podrobneje predstavljena metoda fokusne skupine, postopek izvedbe metode, analiza pridobljenih podatkov in razširitev metode za uporabo v spletnem prostoru. V 3. poglavju je predstavljena študija primera, ki se je izvedla z namenom analiziranja prednosti in slabosti uporabe spletne fokusne skupine. V sklepnem, četrtem poglavju, so predstavljeni povzetki raziskave, odprta vprašanja in možnosti za nadaljnje raziskave.

Tabela 1: Primerjava različnim metod raziskovanja

	Študija primera	Anketa	Fokusna skupina
Namen raziskave	Preučevanja primera v realnem in reprezentati-vnem okolju.	Preučevanje informacij, zbranih od skupine ljudi, projektov, organizacij ali literature.	Neformalni intervju v okolju diskusijske skupine.
Faza v raziskovalnem projektu	Vmesna.	Začetna (raziskovalni tip ankete), končna (pojasnjevalni tip ankete).	Najpogosteje začetna.
Obseg postavljenih vprašanj	Velik.	Velik.	Majhen.
Tip pridobljenih podatkov	Kvantitativni, kvalitativni.	Predvsem kvantitativni..	Kvalitativni
Okolje	Realno.	Realno.	Realno.
Tip sklepanja	Analitični.	Statistični.	Analitični.
Usmerjenost metode	Metoda usmerjena v strokovnjake.	Metoda usmerjena v strokovnjake.	Metoda usmerjena v strokovnjake.
Tip raziskave	Pojasnjevalni	Razlagalni.	Raziskovalni.

2 PREDSTAVITEV FOKUSNE SKUPINE

Po Neumanu [3] je fokusna skupina *(focus group)* specialna, empirična, kvalitativna in terenska raziskovalna tehnika, v kateri so ljudje neformalno intervjujani v okolju diskusijske skupine (glej tudi *Tabela 1*). Jedro postopka fokusne skupine predstavlja skupina okoli 10 strokovnjakov, ki imajo interes diskutirati o podani tematiki. Večina fokusnih skupin traja približno 90 minut. Cilj moderatorja je biti nevtralen z namenom vzpodbujati odprto diskusijo. Idealna skupina je sestavljena iz homogenih članov, ki se med seboj ne poznajo (minimiziranje medsebojnih vplivov). Za doseganje boljših rezultatov, se pogosto izvede več fokusnih skupin zaporedoma. Na takšen način se poveča število intervjujanih ljudi. Fokusna skupina prestavlja ključno tehniko za zbiranje kvalitativnih podatkov [2]. Raziskovalno metodo fokusne skupine je v okviru celotne raziskave smiselno dopolnjevati z drugimi raziskovalnimi metodami. S tem se doseže efekt komplementarnosti oziroma triangulacije metod, ki izniči slabosti (Tabela 2) posamezne metode raziskave. Triangulacija metod se najpogosteje realizira s kombinacijo kvalitativnih in kvantitativnih metod raziskovanja [3].

Fokusna skupina se lahko izvede na več načinov. V zadnjem času je vse bolj pogosto možno zaslediti izvedbo spletnih *(online)* fokusnih skupin. Pri tem se spletna različica fokusne skupine lahko izvede z uporabo sinhrone (IRC, MSN, konferenčna programska oprema) ali asinhrone interakcije (spletni forumi, blogi).

Tabela 2: Prednosti in slabosti fokusnih skupin [2,3]

Prednosti	Slabosti
Naravno okolje, v katerem se nahajajo udeleženci, omogoča svobodno in ne-obremenjujoče izražanje zamisli. Udeleženci se počutijo sposobne in posledično motivirane. Udeleženci se lahko medsebojno sprašujejo in medsebojno pojasnjujejo odgovore. Odprti odgovori zagotavljajo velike količine podatkov. Omogočeno je podajanje vprašanj na že podane odgovore.	Pojavi se lahko efekt »polarizacije«. V okviru fokusne skupine se lahko naenkrat diskutira zelo majhno število vprašanj. Moderator lahko nehote omeji svobodno diskusijo. Udeleženci v fokusni skupini običajno proizvedejo maj zamisli kot intervjujani posamezniki. Postopek izvedbe raziskave fokusne skupine je redko pojasnjen. Težko je pojasniti razlike, ki lahko nastanejo med intervjujanimi posamezniki in fokusno skupino. Prevlada posameznih udeležencev. Omejitve v primeru generalizacije pridobljenih rezultatov na širšo populacijo. Odprte odgovore je težko organizirati in interpretirati.

2.1 Postopek izvedbe fokusne skupine

Osnovni postopek izvedbe fokusne skupine se ujema s postopkom izvedbe preostalih empiričnih metod raziskovanja, ki je naslednji: (1) definicija raziskave, (2) načrtovanje raziskave, (3) realizacija raziskave, (4) izvedba raziskave, (5) analiza pridobljenih podatkov in (6) pisanje poročila o raziskavi [1].

Natančnejši postopek izvedbe fokusne skupine je po Johnson-u naslednji: (1) definicija ciljev raziskave, (2) definicija udeležencev raziskave, (3) definicija velikosti fokusne skupine, (4) definicija profila udeležencev, (5) definicija števila fokusnih skupin, (6) načrtovanje vsebine vprašalnika ter (7) načrtovanje zapisovanja in analize rezultatov. Natančna navodila so dostopna v literaturi [3].

2.2 Analiza podatkov fokusne skupine

Rezultat fokusne skupine so kvalitativni podatki, ki se analizirajo na drugačen način kot kvantitativni podatki. V preteklosti je bila osnovna pomanjkljivost kvalitativnih raziskav pomanjkanje sistematičnega pristopa v kvalitativni analizi podatkov. Kljub temu, da še vedno ne obstaja enotna in uveljavljena metoda za kvalitativno analizo podatkov, je le ta danes že veliko bolj sistematična [3].

Osnovni namen kvalitativne analize podatkov je na osnovi »surovih« kvalitativnih podatkov oblikovati nove ali izboljšati že obstoječe koncepte. Raziskovalec pogosto oblikuje še definicije konceptov in raziskuje njihove medsebojne povezanosti. Ena izmed tehnik, ki omogočajo analizo kvalitativnih podatkov je tehnika kodiranja podatkov. Neuman [3] opisuje kodiranje kvalitativnih podatkov kot sestavni del analize podatkov, kjer razvijalec organizira surove podatke *(raw data)* v konceptualne kategorije in na tak način oblikuje teme ali koncepte. Osnovni namen kodiranja podatkov je redukcija velikih količin surovih podatkov v majhne in obvladljive podatkovne enote. Kodiranje podatkov je vodeno s strani raziskovalnega vprašanja in usmerja raziskovalca k oblikovanju novih raziskovalnih vprašanj, generalizacij in teorij. Tehniko kodiranja podatkov sestavljata dve sočasno izvajani aktivnosti: mehanična redukcija podatkov in analitična kategorizacija podatkov. Pri tem je granulacija kodiranja (na primer: posamezne besede, posamezne povedi ali odstavki) odvisna od raziskovalnega vprašanja, »zgoščenosti« zbranih podatkov in namena raziskave. Obstajajo tri osnovne vrste (faze) kodiranja podatkov [3]:

a. **odprto kodiranje** *(open coding)*. Običajno predstavlja prvo fazo kodiranja zbranih kvalitativnih podatkov, s pomočjo katerega raziskovalec pregleduje podatke z namenom kondenziranja podatkov v (preliminarne) analitične kategorije ali kode. Pri tem ostaja razvijalec odprt za dodajanje ali spreminjanje preliminarnih kod. Rezultat odprtega kodiranja so, na osnovi surovih podatkov, identificirane kode, ki se nahajajo na nizkem nivoju abstrakcije.

b. **osno kodiranje** *(axial coding)*. Predstavlja drugo fazo kodiranja kvalitativnih podatkov, v kateri raziskovalec ureja in povezuje prvotno definirane kode z namenom določanja ključnih analitičnih kategorij.

c. **izbirno kodiranje** *(selective coding)*. Zadnja stopnja kodiranja podatkov, v kateri raziskovalec pregleduje in primerja identificirane kode s surovimi podatki. Namen je identificirati področja podatkov, ki ustrezajo konceptualnim kategorijam, ki so se oblikovale v prejšnjih fazah kodiranja.

Tehnike kodiranja podatkov se uvrščajo med splošne tehnike analize kvalitativnih podatkov. Zato jih raziskovalci pogosto dopolnjujejo z analitičnimi strategijami namenjenimi kvalitativnim podatkom, kot so na primer zapovrstna aproksimacija *(successive approximation)*, ilustrativna metoda *(ilustrative method)*, analiza domene *(domain analysis)*, analitične primerjave *(analytic comparison)* in metoda negativnega primera *(negative case method)* [3].

2.3 Spletna fokusne skupina

Zaradi vse večjega obsega informacij, ki so dosegljive preko spleta, raziskovalci konvencionalne metode zbiranja podatkov vse pogosteje prilagajajo spletnemu okolju. Med metode, ki jih je možno zaslediti v spletni obliki, spadajo spletne ankete *(online survey)*, terenske raziskave z opazovanjem udeležencev v spletnem okolju in spletne fokusne skupine *(Online Focus Group - OFG)* [4].

Poglavitne prednosti in slabosti posameznega pristopa (fizične, spletne) izvedbe fokusne skupine izhajajo iz komunikacijskih kanalov. Fizična izvedba metode fokusne skupine je primerna pri udeležencih z dobrimi retoričnimi sposobnostmi, medtem, ko je spletna izvedba metode primerna za udeležence z dobro računalniško pismenostjo in udeležence, ki so sposobni svoje ideje izražati z besedilom [4]. Na spodnji tabeli (*Tabela 3*) je podana analiza fizične in spletne izvedbe fokusne skupine.

Tabela 3: Primerjava fizične in spletne fokusne skupine [4]

	Fizična fokusna skupina	**Spletna fokusna skupina**
Izvajalec raziskave	Govorne sposobnosti.	Sposobnost komuniciranja preko spletnih medijev, poznavanje tehnologije.
Zbiranje udeležencev	Telefonsko, osebno, e-pošta.	E-pošta, preko spletnih mest.
Stroški	Visoki.	Nizki.
Tehnološke zahteve	Avdio oprema, osebni računalnik s pisarniško programsko opremo.	Omrežna oprema, konferenčna programska oprema, splet.
Zapis podatkov	Ni dostopen neposredno (zvočni zapis, zapisnik).	Avtomatski, dostopen neposredno.
Analiza podatkov	Tekst, avdio zapiski, ne-verbalna opazovanja.	Samo tekst.
Splošni vidiki	Primerna za ljudi z dobrimi retoričnimi sposobnostmi.	Primerna za računalniško pismene ljudi.
	Na nivo udobja vpliva okolje.	Nivo udobja je visok, ker se udeleženci nahajajo v lastnem (domačem, pisarniškem) okolju.
Značilnosti diskusije	Moderator lahko z dodatnimi vprašanji odkrije in odpravi dvoumnosti.	Moderator težje odkriva dvoumnosti.
	Pridobijo se lahko poglobljene informacije.	Poglobljene informacije se težje dosežejo.
Komunika-cijski tok	Na odgovore udeležencev lahko vplivajo drugi udeleženci.	Anonimnost in fizična dislociranost povečujeta iskrenost in spontanost.
	Enostavno vzdrževanja fokusa.	Izguba fokusa je možna tudi v primeru intervencije moderatorja.
	Lahko je potreben poseg moderatorja, da se diskusija premakne iz »mrtve točke«.	Značilen je hiter prehod med predmeti diskusije.
Ne-verbalna komunikacija	Zaznavna je govorica telesa.	Zaznava se odzivni čas, pogostost podajanja odgovorov, črkovanje in stil pisanja.
Verbalna komunikacija	Iz tona in govora so razvidna čustva.	Izkazovanje čustev je omejeno s simboli komunikacijske aplikacije.

3 PRIMER IZVEDBE SPLETNE FOKUSNE SKUPINE

3.1 Predstavitev predmeta raziskave

Uporaba spletne fokusne skupine se je poskusno izvedla na raziskavi, povezani s sprejetostjo in uporabo programskih ogrodij. Programska ogrodja, predstavljajo učinkovito tehniko ponovne uporabe, saj zagotavljajo izboljšave v produktivnosti, kakovosti in času realizacije končnih rešitev [5], kar potrjujejo tudi empirične raziskave [6]. Neodvisno od prednosti, ki jih zagotavljajo ogrodja, je veliko ogrodij kakor tudi njihovih uporab neuspešnih, zato avtorji prispevkov, ki navajajo prednosti ogrodij, običajno navajajo tudi njihove poglavitne pomanjkljivosti [7], ki so najpogosteje povezane s težavnostjo razvoja ogrodij, spoznavanja ogrodij in uporabe ogrodij. Iz navedenega sledi, da je stopnja sprejetosti ogrodij, kakor tudi kratkoročna učinkovitost ogrodij (v primerjavi z drugimi tehnikami ponovne uporabe) slaba.

3.2 Načrtovanje raziskave

Primarni cilj raziskave je bil identificirati poglavitne faktorje, ki vplivajo na sprejetost in uporabo programskih ogrodij in s tem prispevati koristne informacije razvijalcem in uporabnikom programskih ogrodij. Glede na tip raziskovalnega vprašanja, ki se je glasilo: »Kateri faktorji vplivajo na sprejetost programskih ogrodij?«, se je kot ustrezna metoda raziskave identificirala fokusne skupina (glej tudi *Tabela 1*). Kriterijem mesta raziskave je ustrezalo spletno mesto »Slashdot« (SD), ki je dostopno na spletnem naslovu »www.slashdot.net«. SD je največji tehnološki forum z ozko usmerjenimi tematikami, ki ima registriranih preko 880.000 uporabnikov, in je prejel že preko 14.000.000 objav. Osrednji del SD predstavlja kategoriziran sistem za objavo novic, ki omogoča postavljanje vprašanj, na katera lahko nato anonimni in registrirani uporabniki podajajo svoja mnenja.

3.3 Rezultati raziskave

Na vprašanje, ki se je zastavilo udeležencem SD, je bilo podanih 291 odgovorov (vključno z odgovori na odgovore). Odgovore je podalo 57 različnih uporabnikov SD, izmed katerih jih je bilo 6 anonimnih. Ugotovljeno je bilo, da uporabnik v povprečju vrednoti programska ogrodja po treh različnih kriterijih. Surovi podatki so obsegali 119 strani prostega teksta. Tehnike analize kvalitativnih podatkov so obsegale odprto in osno kodiranje. V fazi odprtega kodiranja se je identificiralo 168 kod, izmed katerih se je največkrat identificirala koda »enostavnost uporabe«, ki se je identificirala 11 krat. V fazi osnega kodiranja so se odprte kode po vnaprej predpisanem postopku združile v analitične kategorije. Poglavitni rezultat raziskave je bil, da je za uporabnike ogrodij najpomembneje da so le ta: enostavna za uporabo, fleksibilna, ustrezna njihovim zahtevam, koristijo njihovem delu, zanesljiva, odprta in imajo pozitiven odziv med uporabniki.

4 SKLEP

Primer izvedbe metode fokusne skupine v okviru spletnega mesta SD je podal naslednje pozitivne ugotovitve: (1) izvedba metode raziskave je pokazala ujemanje z lastnostmi spletne fokusne skupine (Tabela 3), (2) metoda omogoča, da se z nizkimi stroški raziskave pridobi veliko število empiričnih podatkov, (3) v raziskavo so se prostovoljno vključili zainteresirani strokovnjaki, ki so bili motivirani za podajanje mnenja o zastavljenem vprašanju., (4) poleg odgovorov na vprašanje so se pridobile še nove ideje in kritike o predmetu raziskave in raziskovalnem vprašanju, (5) sodelovanje strokovnjakov v raziskavi je bilo zaradi anonimnosti spleta sproščeno. Kot poglavitne slabosti in omejitve so se izkazale naslednje: (1) vzorec raziskave je bil namenski in ne naključen, (2) ni bil poznan natančen profil sodelujočih v raziskavi, (3) spletno mesto SD ni omogočilo sinhrone interakcije med sodelujočimi. (4) raziskovalec je imel majhen vpliv na udeležence in format zapisa odgovorov.

Fokusna skupina je kvalitativna raziskovalna metoda, ki je uporabna predvsem v začetnih fazah raziskovalnih projektov in v primeru identifikacije mnenja uporabnikov o določenem predmetu raziskave. Spletna različica fokusne skupine prinaša tako prednosti kakor tudi tveganja, med katerimi izstopata možnost cenenega pridobivanja izobilja podatkov in slaba veljavnost pridobljenih podatkov. Zato je metodo smiselno uporabiti v kombinaciji z drugimi metodami raziskav.

Literatura

[1] Bernd Freimut, Teade Punter, Stefan Biffl, and Marcus Ciolkowski. State-of-the-Art in Empirical Studies. 2002. Virtuelles Software Engineering Kompetenzzentrum. Ref Type: Report

[2] Robert Johnston and Graeme Shanks. Research Methods in Information Systems. 2003.

[3] W. L. Neuman, Social research methods : qualitative and quantitative approaches, 2005.

[4] L. Chase and J. Alvarez, Internet research: The role of the focus group, Library & Information Science Research, 22 (2000) 357-369.

[5] Daquin Hou, Kenny Wong, and H.James Hoover, What Can Programmer Question Tell Us About Frameworks, 13th International Workshop on Program Comprehension IWPC'05, 2005.

[6] M. Morisio, D. Romano, and I. Stamelos, Quality, productivity, and learning in framework-based development: An exploratory case study, Ieee Transactions on Software Engineering, 28 (2002) .

[7] Berit Eriksson, baharak G.Fard, and Branca Grubesic. Frameworks - an introduction. 2002. Department of Computer Science and Engineering - Malardalen University.

INFLUENCE OF THE CAPABILITY MATURITY MODEL ON THE INTEGRABILITY INDEX

Maja Pušnik, Boštjan Šumak, Matjaž B. Jurič, Marjan Heričko
Institute of Informatics
Faculty of Electrical Engineering and Computer Science
Smetanova ulica 17, 2000 Maribor, Slovenia
Tel: +386 2 2207379; fax: +386 2 2207272
e-mail: maja.pusnik@uni-mb.si

ABSTRACT

The always present need of companies to be one step ahead with their software and their business processes encourages diverse system evaluations, which can express quality of a company. The integrability index (II) evaluates an information systems (IS) on several levels; from data level to user interface. However, a great deal of impact on II holds the Capability Maturity Model (CMM), another measurement model for process quality, where a high graded process level influences the II evaluation.

This paper presents the connection of the already established CMM and the developing II. To present the importance and connection of both models, we will explain the companies needs in the introduction. Features of both models will be presented in second and third chapter. The forth chapter will be dedicated to the connection of the two evaluation strategies and the fifth and final chapter will summarize findings in our research and introduce our future work.

1 INTRODUCTION

The aim of the II is evaluation of a company's capability to integrate with another company respectively the capability of their IS, applications and business processes with features of flexibility, fast update ability and low-cost. In this process, information about the CMM level might come very useful, almost predictive of the final result.
Research in this filed has not been widely conducted, since the idea about the II is relatively new. On the other hand the CMM development is widely explored and compared. We have focused on the facts about the CMM from [1], taken from the CMM official site and learned from [2] where an example about CMM implementation is explained. From the II part we have leaned on our previous work about that matter [3] and [4], where common facts about integration are given. Joint effort on those two aspects of CMM and II were not found, we did however use information from paper [5], where success of companies that survived integration is given as well as its impact on future IS capabilities.

2 BASIC FEATURES OF THE CMM MODEL

The CMM started its journey in the 80' as a model for evaluating the maturity of specific parts at software development [1]. Its initial purpose has spread into a wide use at all kinds of process developments. Because of wide range of application, its initiator SEI (Software Engineering Institute) extended the original model to CMMI (CMM Integrated), which intergrades all fields that had established in this area. The purpose of CMMI is to provide guidance for improving organization's processes and the ability to manage the development, acquisition, and maintenance of products or services [2].
Currently there are four bodies of knowledge available when selecting a CMMI model. In our research we will focus on software engineering (CMMI-SW). Others, released in 2002 [2] are:

- Systems Engineering (SE),
- Software Engineering (SW),
- Integrated Product and Process Development (IPPD),
- Supplier Sourcing (SS).

The maturity level of an organization provides a way to predict the future performance of an organization within a given discipline or set of disciplines [1, 2]. Each level is defined by several Key Process Areas (KPA). Areas identify the issues that must be addressed to achieve a certain level of maturity [2]. The more specific description of the levels and KPA at each level is given below:

1. Initial level ("The software process is characterized as ad hoc and occasionally chaotic. Few processed are defined, and success depends on individual effort"). There are no KPA's here.
2. Managed level ("Basic project management processes are established to track cost, schedule, and functionality. The necessary process discipline is in place to repeat earlier successes on projects with similar applications"). The following KPA's must be obliged:
   - Requirements Management – establishing a process with the customer to ensure software meets expectations and requirements are controlled and managed as they change,

- Software Project Planning – establishing planned timelines and goals,
- Software Project Tracking and Oversight – establish management oversight so that the project's progress can be monitored and adjusted when changes accure,
- Software Subcontract Management – establish effective criteria to select and manage software sub-contractors,
- Software Quality Assurance – establish a validation and auditing processes to ensure that software is delivered,
- Software Configuration Management – establish a process that ensures the effective management and maintenance of a software product throughout its life cycle.

3. Defined level ("The software process for both management and engineering activities is documented, standardized, and integrated into a standard software process for the organization. All projects use an approved, tailored version of the organization's standard process for developing and maintaining software"). The following KPA's must be obliged:
   - Organization Process Focus – establish responsibility for process activities that improve the organization's overall software processes capability,
   - Organization Process Definition – establish and maintain the organization's standard software development and engineering process,
   - Training Program – establish a process to develop the skills and knowledge of all included,
   - Integrated Software Management – builds upon the level 2 key process areas so that a software project is planned and managed according to organization's standard software process,
   - Software Product Engineering – establish a software engineering process to ensure consistent and correct coding practices organization-wide,
   - Inter-group Coordination – establish a communication process to maximize efficiency within the organization and to ensure that systems will work correctly when integrated,
   - Peer Reviews – establish a process of peer review with the goals being to remove defects as early as possible in the development cycle and to foster organization wide communication and understanding.
4. Quantitatively Managed level ("Detailed measures of the software process and product quality are collected. Both the software process and products are quantitatively understood and controlled"). The following KPA's must be obliged:
   - Quantitative Process Management – measure and control the results of the software process quantitatively to identify areas of weak performance,
   - Software Quality Management – a way of quantitatively measuring and achieving specified quality goals in software products.
5. Optimizing level ("Continuous process improvement is enabled by quantitative feedback from the process and from piloting innovative ideas and technologies"). The following KPA's must be obliged:
   - Defect Prevention – identify the causes of errors and prevent future occurrences,
   - Technology Change Management – introducing new technologies into the organization in an orderly fashion,
   - Process Change Management – a process to continually improve those key processes that influence quality, productivity and efficiency.

3 BASIC FEATURES OF THE INTEGRABILITY INDEX

The maturity of a companies ability to integrate its IS depends on several factors, which can be measured scientifically or extracted from ones experience. The II presents a methodical approach to learning about IS integration ability, where the most powerful motivation represents competition, cost reduction and increased efficiency.

The II evaluates, how prepared a company is to integrate on specific levels, including data level, application interfaces level, business methods level, presentation level, security level and business to business (B2B) level. This knowledge helps a company overview its ability to expand its features.

3.1 Integration process

The integration process is about connecting two or several separate units into a larger unit, where the functionalities are combined, preferably in the manner one plus one is three. With these action we can provide older systems with new solutions, which have extended functionalities; enabling them an entrance in B2B and furthermore the ultimate e-market participation.

A developed electronic market is based on electronic document exchange in a simple, fast and safe way. To achiev this goal via integration, we need a supportive information system and technologies such as Java or .NET.

3.2 Levels of integration process

While integrating existing and new solutions there are always difficulties such as different domains, architectures and technologies or all above. So the integration must include all different architecture types and provide them with some sort cohabitate. To assure all levels of the architecture are correctly linked, the II examines the following levels [3], where main parameters are explained in brackets:

1. data level (data models documentation, distribution level, flexibility, data mining development and connection possibilities with other databases),
2. level of application interfaces (technical view of application functionality reuse, low-level functionality access, level of physical/logical structure documentation),
3. level of business methods (business process models documentation and definition, abstraction level, resource distribution level, business process dependency level, business method and business processes connection, application transportability, larger transaction support, model and net interoperability, integrity, consistency, long-term transaction support, resource supervision, different-types support, standard platforms for application development (J2EE, .NET)),
4. level of presentation (unified user entrance, model definition of data presentation, application user interface, type support, connectivity and expansion possibilities of existing models, qualitative and automatic administration notifications),
5. security level (firewalls, protective architecture, data autification, data accuracy supervision, administration rights supervision, non-repudiation, security standards and safety mechanisms for data coding) and
6. B2B level (business processes to executable code transformation, automation and integration of business processes, business application aggregation, abstraction level, business process definition interoperability with applications and business components, integrity, consistency, effectiveness, definition of long-term transactions, protected access to business processes, open standards and standard technologies for B2B, like BPEL (Business Process Execution Language), ebXML (electronic business Extensible Markup Language), WSCI (Web Service Choreography Interface) and others).

Based on past experiences the integration process needs to be executed in an incremental-iterative fashion, with careful supervision and a systematic approach.

3.3 Index integrability measurement

The integration process is far to complex to go by it and examine it in a holistic way, so we integrate on levels as described above. Therefore these separate levels are measured and evaluated for the purpose of creating II. Further more, each level is examined in detail in the following areas:

- quality of models and documentation,
- quality, difficulty and safety of business process access,
- control and management of business processes,
- standards application.

Based on these four evaluation groups we create an integrability matrix (Figure 1), which provides the global and overall picture of a companies integration ability.

$$F(II) = \begin{bmatrix} x_{11} & x_{21} & x_{31} & x_{41} & x_{51} & x_{61} \\ x_{12} & x_{22} & x_{32} & x_{42} & x_{52} & x_{62} \\ x_{13} & x_{23} & x_{33} & x_{43} & x_{53} & x_{63} \\ x_{14} & x_{24} & x_{34} & x_{44} & x_{54} & x_{64} \end{bmatrix}$$

Figure 1: *Integrability matrix*.

Figure 1 presents an integrability matrix, which holds the above explained levels on the axis and the evaluation areas on the ordinate:

- integration levels, where i presents an evaluation area from 1 to 4:
  - x1i … data level,
  - x2i … application interfaces level,
  - x3i … business methods level,
  - x4i … presentation level,
  - x5i … security level and
  - x6i … B2B level,
- evaluation areas, where j presents an integration level from 1 to 6:
  - xj1 … models,
  - xj2 … access,
  - xj3 … control and management,
  - xj4 … standards.

Certain evaluations are gathered based on parameters, which introduce different technical and conceptual features of levels. The next step is an integrability vector, which includes weights respectively priorities of a certain level. The weights depend on companies preferences. The 'u_i' in the following figure (Figure 2) represents the preference of an evaluation area.

$$f(II) = \begin{bmatrix} u_1 & u_2 & u_3 & u_4 \end{bmatrix} \cdot F(II)$$

Figure 2: *Integrability weights*

By multiplication of weights vector and the integrability matrix we gain the wanted vector that provides us with more general information about companies integration abilities (Figure 3). The $F(X_i)$ presents an evaluation of integration levels.

$$f(II) = \begin{bmatrix} F(X_1), & F(X_2), & F(X_3), & F(X_4), & F(X_5), & F(X_6) \end{bmatrix}$$

Figure 3: *Integrability vector*

The transformation of the vector into an index is presented in Figure 4. U_i presents the preference of a certain integration level.

$$II = f(II) \cdot \begin{bmatrix} U_1 & U_2 & U_3 & U_4 & U_5 & U_6 \end{bmatrix}^{-1}$$

Figure 4: *Integrability index*

The integrability index is the most general and most representative number for the company and is very useful as an indicator, weather an integration would be successful.

4 CMM INFLUENCE ON II

Both models evaluate the quality of a process or its consecutive product, weather it is an application or an entire IS. The KPA that in some way evaluate the process of developing software, are coherent with II parameters, which evaluate how software was developed.

So we can comprehend the connection as a matter of time perspective; CMM evaluates pre-development and II evaluates post-development. They are not the same obviously. While II tries to cover a much wider range, the CMM is focused more specifically. However one result is consecutive of another [5]. We have tried to define a general relationship between the two models as shown on Figure 5.

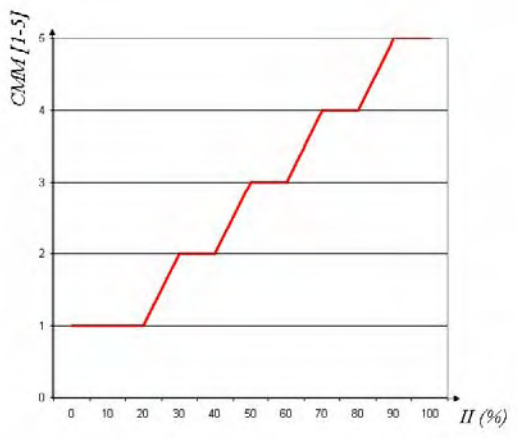


Figure 5: *Relation between CMM and II*

The parameters of II were already presented in [3], so we focused only on general descriptions. A process on CMM level 1 is without a doubt not going to be successful at an II evaluation. A CMM level 2 process will give satisfactory results in evaluation areas for models (they include much of documentation) and control and management. Level 3 CMM introduces the need for standards, which gives a positive evaluation on the standards level; however, satisfaction of higher integration levels is still questionable. The level 4 CMM is quality oriented, so we can aspect improvements on security level and B2B level. While CMM level 5 is by default ready for changes and a product designed with such a process has to receive the highest possible II evaluation.

Because specific differences the two models can not be equalized, however a positive CMM evaluation of the process can assure a higher II evaluation of the resulting product; the role might not apply inversely though.

Based on graphic research we propose this formula (Figure 6), where alpha factor still has to be defined in future research.

$$fII = II + alpha \cdot CMM$$

Figure 6: *Integrability index and CMM*

5 CONCLUSION

It has been a long time since companies were competitive by just having an IS that worked for their business processes. A lot of changes have accrued since collaboration meant exchanging mail. The systems nowadays need ever-growing improvement, security, speed and therefore must embrace new technologies on regular basis. New technologies are expensive in many ways, especially in the business process transportation and transformation aspect. Sooner or later companies will have to solve their problems with extension and integration or with innovation and renovation, which might be more expensive.

When deciding between the two aspects, cost and probability of success is valuable information. And here come useful different strategies, among them the II, which “calculates” the probable sucessfullness of an integration process in a specific company. And since everything new has to learn from the legacy of old methods and strategies to avoid unnecessary mistakes, we must base our future work on a related “evaluation model CMM”.

While the two of them are not the same, they do influence each other. In this paper, we have defined connection between them based on theoretical knowledge and experience with smaller learning systems. In the future work, we will conduct a research on larger systems to establish a more precise connection between them and to define it in a mathematically formal way.

References

[1] CMMI Product Team. Capability Maturity Model® Integration (CMMISM), Version 1.1. Staged Representation. http://www.sei.cmu.edu/cmmi/models, Pittsburgh, March 2002.

[2] TopMind Systems. Capability Maturity Model (CMM): Building a Business Case for CMM Implementation. www.topmindsystems.com/home/cmm.pdf. July 2004.

[3] Maja Pušnik, Boštjan Šumak, Matjaž. B. Jurič, Marjan Heričko. Ocenjevanje pripravljenosti podjetij na proces integracije s pomočjo indeksa integrabilnosti. Zbornik D 7. mednarodne multikonference Informacijska družba IS 2004, 9. do 15. oktober 2004.

[4] Matjaz B. Jurič, S. Jeelani Basha, Rick Leander, Ramesh Nagappan. *Professional J2EE EAI.* Wrox Press, December, 2001.

[5] Zahir Irani, Marinos Themistocleous, Peter E.D. Love. The impact of enterprise application integration on information system lifecycles. Information & Management. December 2002.

Zbornik 9. mednarodne multikonference
Proceeding of the 9th International Multiconference

INFORMACIJSKA DRUŽBA IS 2006

INFORMATION SOCIETY IS 2006

Kognitivne znanosti

Cognitive Sciences

Uredili / Edited by

Urban Kordeš, Matjaž Gams, Olga Markič

http://is.ijs.si

10. oktober 2006 / 10th October 2006
Ljubljana, Slovenia

Konferenca Kognitivne znanosti

Pristopi in modeli pri raziskovanju zavesti/duševnih procesov

Interdisciplinarno raziskovalno področje kognitivnih znanosti se je oblikovalo v petdesetih letih 20. stoletja, kot temeljne discipline pa so bile vključene nevrologija, psihologija, računalništvo, lingvistika in filozofija. Področje raziskovanja je obsegalo vrsto človekovih aktivnosti – prepoznavanje vidnih in slušnih vzorcev, pomnjenje, učenje, obvladovanje jezika, odločanje in reševanje problemov, ki jih uvrščamo med spoznavne (kognitivne) procese. Dandanes se je razširil tako predmet raziskovanja –v okviru kognitivnih znanosti se preučujejo različni duševni procesi, tudi čustva in družbeno delovanje, kot tudi polje disciplin, saj se v raziskovanja vključujejo tudi znanstveniki s področja fizike, kemije in biologije, kot tudi antropologi, sociologi in kulturologi. Temeljno vprašanje kognitivnih znanosti je bilo – in še vedno ostaja –, kako integrirati te raznolike pristope, saj se vsaka od disciplin problemov loteva s svojega zornega kota in uporablja svoj strokovni jezik in svoje metode.

Uvedba ustrezne metode povezovanja spoznanj znanstvenih disciplin s spektra kognitivnih znanosti bi že sama po sebi rešila nekaj najbolj perečih problemov, s katerimi se trenutno ukvarjajo. Takšna integrativna metoda bi bila rešitev metodološkega »težkega problema«, ki je ekvivalent klasičnemu kognitivnemu »težkemu problemu« (torej problemu ločitve telesnega in duševnega), saj bi uspela povezati naravoslovje (ki preučuje nevrofiziološke procese) in humanistične vede (ki preučujejo doživljajske vsebine). Jasno je, da se mora to povezovanje zgoditi na višji in bolj celostni (*interdisciplinarni*) ravni. Šele na tej ravni je mogoče dajati odgovore na tako težka vprašanja, kot so vprašanje duševnosti in zavesti.

Trenutno stanje (ki ga opisujejo nekateri članki v pričujočem zborniku) je še vedno precej razpršeno: vsaka disciplina si raziskovanje kognitivnih pojavov predstavlja drugače. Ne le način dela in območje raziskovanja, tudi cilji in pričakovanja se razlikujejo. Na letošnji kognitivni konferenci smo hoteli vzpodbuditi interdisciplinarno debato med znanstveniki, ki se tako ali drugače ukvarjajo z raziskovanjem zavesti. Še posebej smo bili veseli avtorjev, ki so bili pripravljeni predstaviti svoje projekte s poudarkom na načinu dela oziroma metodoloških specifikah. Hoteli smo vzpodbuditi razmislek o predpostavkah na katerih temeljijo posamezne raziskave (ki so znotraj posameznega raziskovalnega polja včasih tako samoumevne, da se jih sploh ne zavedamo). Ta vprašanja osvetljujejo tudi »čisti« metodološki članki, epistemološki razmisleki in meta-razmisleki o možnostih in/ali težavah v raziskovanju kognicije.

Posebej razveseljivo pa je, da je v letu 2006 opazen bistven porast prispevkov na področju klasičnih kognitivnih znanosti.

Urban Kordeš
Matjaž Gams
Olga Markič

Reflections on Reflection – Assumptions and Analogies

Damjan Bojadžiev

Department of Knowledge Technologies, Jozef Stefan Institute
Jamova 39, 1000 Ljubljana, Slovenia

http://nl.ijs.si/~damjan/me.html
E-mail: damjan.bojadziev@ijs.si, Fax: (+386 1) 477-3315

ABSTRACT

The paper formulates and discusses some ontological and epistemological assumptions in the study of consciousness, notably its existence and the role of reflection in consciousness and its formal and computational models.

1 INTRODUCTION

The call for papers for this year's Cognitive Science conference emphasized the challenge to reflect the assumptions and (pre)suppositions, epistemological and methodological, of consciousness studies. Taking this invitation seriously, the paper makes explicit the main assumptions behind my previous contributions to the conference, without otherwise bringing much new material along the dimensions I previously explored. Over the past decade, I have contributed a series of papers to this conference and its predecessors, all having to do with more or less formal kinds of self-reference or reflection. The common assumptions of these papers were:

1) the more silent, ontological supposition that there *is* (exists) such a "thing", or quality, or aspect of cognition, as consciousness, with the corresponding epistemological assumption that consciousness can be at least partially known (understood/modeled)

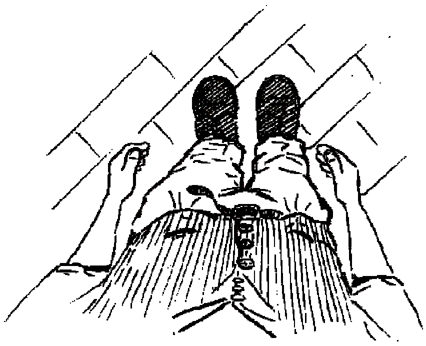
2) the methodological assumption that consciousness can be studied and modeled by formal and computational means, and

3) the natural assumption that self-referential or reflective formal systems are especially suited to studies of consciousness (major keyword: Gödel).

The present paper articulates and explicates these assumptions more carefully, giving reasons for them, and outlines the current limited reach of formal and computational structures of reflection as analogies of conscious reflection. On a more personal level, as the result of further study of results about self-reference in computation, the paper indicates a wider and more balanced picture of the range of self-referential phenomena in computation, hopefully useful at least as analogies or guiding ideas in studies of consciousness and any future attempts at implementation. In this respect, the present paper is a continuation/update of last year's contribution, entitled "Forms of reflection" (Bojadžiev 2005), which emphasized the more "positive" forms of self-reference and reflection in computation that I recently learned about (keywords: Kleene, Futamura). Sustaining this personal note a little longer, I can now claim a more comprehensive knowledge of self-referential phenomena in formal systems and theory of computation, and still preserve the impression that these phenomena are at least relevant, if not essential, to the study of consciousness, even though I can't point any more precisely to actual or pending situations of application.

2 EXISTENCE OF CONSCIOUSNESS

The basic assumption of consciousness studies should presumably be that there *is* such a thing or quality as consciousness, distinct enough from accompanying or underlying cognitive processes. This should actually be more than just a working assumption, although it is probably too much to demand some sort of existence proof. Even reliable "acquaintance instructions" seem to be lacking: if you do this and this, in these circumstances, you will know or experience consciousness. Without much more than the linguistic substantive and its dependents, it seems possible/coherent to doubt the existence of consciousness, at least as some separate, additional quality of cognition, or even to deny it. One reason for this could be the impression that, as Ryle says, "the myth of consciousness is a product of a certain para-optics" (The Concept of Mind, p. 153). This para-optics is the traditional optical model of consciousness as the inner eye (*oculus mentis*), known from Eckhart, Locke, Fichte, Brentano, … One problem with this optics is that eyes, inner or outer, have a problem with reflexivity, seeing themselves (*cf.* Wittgenstein's *Tractatus*, thesis 5.633).



More precisely, the problem is that people appear to have contradictory intuitions about such inner optics: for some, consciousness is reflective, and *is* a certain sort of self-reflection, one that "sees itself as a self-seeingness" (Perlis, Consciousness as Self-Function, 1997, and of course Hofstadter), but for others, consciosness *is* the very limitation of self-reflection: "the condition of the experience of consciousness is that it is not transparent to itself" (Žižek *et al* 1985, p. 53). This philosophical point can be argued both ways, and the apparently contradictory views might even be eventually reconciled (cf. next section), but for me it seems more important to move from this metaphorical inner optics to actual perception and self-perception (self-sensing or proprioception, kinesthesia (Sheets-Johnstone 1998)), the significance of the dead zones of such perception and their overlap, and the role of self-*con*ception. It makes sense to talk of consciousness, to accept or assume its existence, if that assumption obliges me to clarify its function, explain how it is developmentally aquired, and explain simply how it comes and goes in everyday experience (falling asleep). Whether consciousness can be more than partially known or whether it may turn out to be fairly simple after all the mysteries surrounding it seems very much open. Our insight into our own functioning is rather limited, and may well remain so.

3 FORMAL AND COMPUTATIONAL MODELS

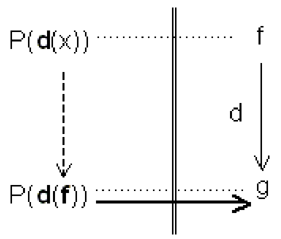
If consciousness exists as a specific cognitive process, it seems reasonable to assume that it can be studied and modeled by formal and computational means, in particular by symbolic computation. This means accepting the hypothesis of symbolic representation, and taking it consequently all the way through to self-representation (Bojadžiev 2002). This formal and computational (AI) paradigm is fairly recent, and far from being exhausted yet. Interestingly, principled objections have been raised precisely against the possibility that the paradigm may eventually explain consciousness (Lucas, Penrose, …). However, these objections actually seem to be based on various misunderstandings of the technical results in mathematical logic on which they claim to be based, namely Gödel's incompleteness theorems (Franzen 2005). If the human mind, in particular consciousness, is unscrutable to itself in some ultimate way, then Gödel's results about the limitations of formal systems couild provide a formal picture. On the other hand, instead of some impossibility in principle, a fatal limit of formalization, Gödel's and other results about formal systems also suggest precisely the opposite picture: Franzén presents a good case for saying that

> the human mind, if it is at all like these formal systems [PA or ZFC], is able to understand itself wonderfully (*Gödel's theorem - An incomplete guide to its use and abuse,* p. 125-6)

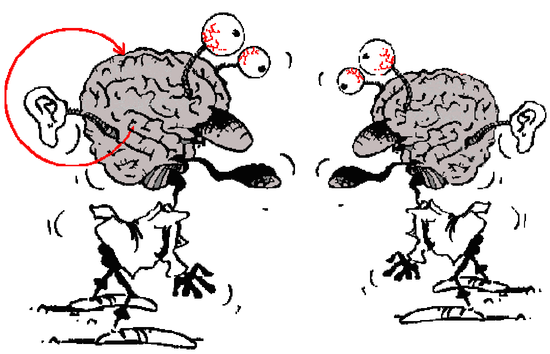
This follows from the ability of such systems to reflect their own abilities and disabilities to prove facts about themselves (about the consequences of their axioms [p. 125-6]). Incidentally, this way of putting it emphasizes a certain paradoxical character of the »Gödel objection": the incompletenesss in question comes from the capacity for reflection, which is generally supposed to characterize mind/consciousness. The objection from incompleteness would thus claim, absurdly enough, that formal systems cannot model mind/consciousness because they are capable of reflection!

3 REFLECTIVE MODELS

The end of the previous section has already started to develop the theme of such models: if formal and computational models can be used to study consciousness, and consciousness is some sort of (limited) reflection, it seems natural that *reflective* formal and computational models, ones that can represent themselves, would be especially well suited (computational reflection, "computation about computation" (Sobel & Friedman 1996)). In connection with Gödel's kind of reflection, it has been claimed that the incompleteness theorems, rather than supporting some form of mentalism, actually support a new form of materialism, on which humans either *are* machines *or* can be completely simulated, consciousness and all, by machines (Webb 1980, p. 235). However, this position seems to be more a matter of principle than of any existing or pending implementation, and more food for analogy (Hofstadter) than guide to programming such machines. This is unfortunately also the extent of my past and current contribution to the subject: it remains at the level of intuitions, similarities and analogies, most notably in the mirror analogy of self-reference. Here, I can only illustrate this analogy, literally, by saying that the diagram



of formal self-reference can be compared in substantial detail with human or animal self-recognition in the mirror (Bojadžiev 2000):



(this graphic is animated on my home-page to show the correspondence between the stages of construction of the self-referential sentence and the stages of development of the self in the "mirror stage"). In defense of such analogies, it can be said that a well-developed analogy, at a certain level of detail, stops being (merely) an analogy and becomes a theory. Building/implementing self-regarding machines, eg. robots that can recognize themselves in mirrors and learn to use them in other ways is also a fairly recent option that hasn't been explored much yet. Programing such behaviour is not likely to be trivial, and might well give insight at least into some operational prerequisites for consciousness.

The references to Gödel incompleteness above may give the impression that reflection in formal systems is a matter of exotic and abstract theories. However, reflection or self-reference comes up in the theory and practice of computing even in such apparently mundane subjects as the interpretation and compilation of computer programs, and in the theory, if mostly not in the actual practice, of writing computer viruses (Dowling 1990). At bottom, these subjects are all connected by the theme of language interpreting itself (meta-circular interpretation), or more generally self-application (in the theory of interpretation and compilation, as in the Futamura projections (Jones *et al* 1993), and in the existence of functions or programs that compute things about themselves, as follows from Kleene's (second) recursion theorem (Cutland 1980)). The acquaintance with these subjects in recent years has meant for me a continuation of the interest in self-reference, and the realization that the phenomena of formal reflection are more widespread and have a wider and more positive reach than the apparently "negative" impact of the limitative theorems. Because of this "negative" charge, Gödel's sort of formal reflection may still hold a greater potential for analogies with the more "ultimate" things that consciousness concerns itself, like questioning self-identity, gaining self-knowledge, being the subject of paradoxical drives and (the reproduction of) desire.

References

Bojadžiev, D., Meje formalizacije v logični semantiki (Limits of formalization in logical semantics), PhD thesis, Philosophical Faculty, Univ. of Ljubljana 1992; abstract, contents and conclusion at http://nl.ijs.si/~damjan/phd.html

Bojadžiev, D., Perlis on Strong and Weak Self-Reference - A Mirror Reversal, J. of Consciousness Studies Vol. 7, No. 5, May 2000, pp. 60-6

Bojadžiev, D., Consciousness as self-referential computation, Proc. Int. Multi-conference "Information Society – Cognitive Science", Ljubljana 2000

Bojadžiev, D. Forms of reflection, Proc. Int. Multi-conference "Information Society – Cognitive Science", Ljubljana 2005

Cutland, N., *Computability: An introduction to recursive function theory*, Cambridge Univ. Press 1980

Dowling, W. F., Computer Viruses : Diagonalization and Fixed Points, Notices of the American Mathematical Society, Sept. 1990, Vol. 37, No. 7

Franzén, T., *Inexhaustibility – a non-exhaustive treatment*, A.K. Peters 2004

Franzén, T., *Gödel's theorem - An incomplete guide to its use and abuse*, A.K. Peters 2005

Jones, N., Gomard, C., Sestoft, P., Partial Evaluation and Automatic Program Generation, Prentice Hall, 1993.

Lemmens, I., Braspenning, P., A formal analysis of Smithsonian computational reflection. Research report, Univ. of Maastricht, Netherlands, 2000.

Owings, J., Diagonalization and the recursion theorem, Notre Dame Journal of Formal Logic 14 (1), 1973

Perlis, D., Consciousness as Self-Function, J. of Consciousness Studies, 4 (5-6), pp. 509-25, 1997

Pinker, S., *How the Mind Works*, Penguin 1998

Sheets-Johnstone, M., Consciousness: A Natural History, Journal of Consciousness Studies, 5 (3), pp. 260-94, 1998

Smith, B. Varieties of Self-reference, in J. Halpern (ed.), *Theoretical Aspects of Reasoning about Knowledge*, Morgan Kaufmann 1986

Sobel, J., Friedman, D., An Introduction to Reflection-Oriented Programming, Reflection'96

Webb, J., *Mechanism, Mentalism and Meta-mathematics*, Reidel Publ. Co. 1980

Žižek, S. *et al*, *Hegel and the Object*, Analecta 1985

From cortical networks oscillations to behaviour: memory in neurophysiological perspective

Simon Brežan

Faculty of medicine, University of Ljubljana
SI-1000 Ljubljana
e-mail: s_brezan@ yahoo.com

ABSTRACT

Cognitive neuroscience searches for neuronal correlates of higher mental functions, including working memory. Various neuropsychological phenomena and models are commonly explored by two basic approaches: functional imaging studies (fMRI, PET, etc.) and electrophysiological methods (electroencephalography- EEG, intra/extracellular electric potentials detection, etc.).
High spatial resolution of functional imaging methods allows precise neuroanatomical identification of activated neurons during the performance of specific cognitive tasks. On the other hand, with electrophysiological methods the same phenomena can be explored on the level of electrical activity of the brain, therefore with better time resolution (milliseconds). This allows the study of basic mechanisms of information processing (including working memory) and operational system of the brain.
EEG-coherence, as a newer method of EEG signal analysis, is suitable for studying integrative brain function. It measures interregional synchronized oscillatory activity of neurons as one possible mechanism of the functional integration – binding of different communicating brain areas, present with different distributed brain processes and behavioral modes, for example working memory.

1 INTRODUCTION

1.1 WORKING MEMORY (WM)

Memory includes the following main processes: *encoding* (cognitive events during presentation of information), *storage* (maintenance) and *retrieval* (recall) of information. Its basic structure can be described by different memory stores (*sensory* memory, *short-term* and *long-term memory*), each with specific structural and processing characteristics.

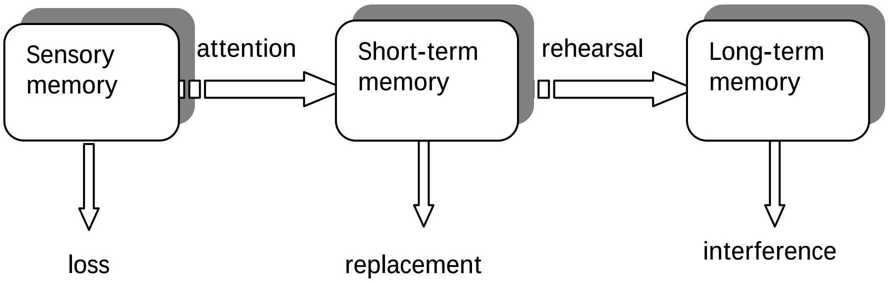


Figure 1. Basic structure of memory (Atkinson and Schiffrin, 1968).

The short-term memory is also termed working memory. This emphasizes its active role in cognitive processes – besides temporal storage of information, the information is also available for active manipulation. WM can therefore be defined as a complex of cognitive processes for maintenance, manipulation and utilization of mental representations.

One of the best studied models of WM is Baddeley's model. It consists of the attentional control system – the central executive (CE), and 3 subsystems: the phonological loop, the visuospatial sketchpad and the episodic buffer. CE plays a major role in mediating many cognitive processes and is assumed to resemble the supervisory attentional system (SAS model, Norman and Shallice, 1986). It is a limited capacity control system that is responsible for controlling other subsystems, for strategy selection and planning. Information is stored and actively rehearsed or updated in the modal specific subsystems – visuospatial information in visuospatial sketchpad and verbal information in phonological loop. Also the conative, emotional and motivational control of WM and its role in multi-level control of action (Frith et al., 2000) is crucial, but largely ignored.

What drives the System?

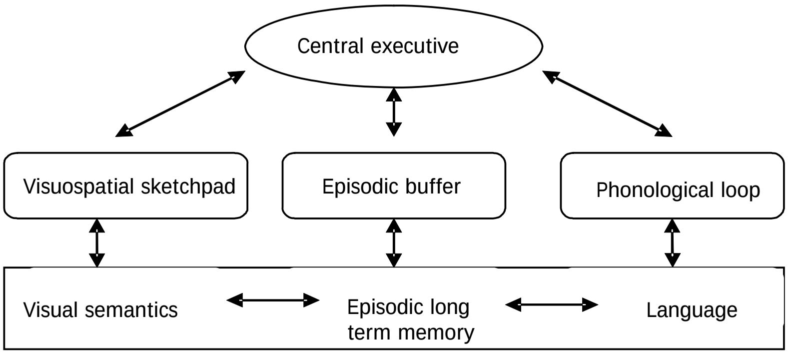


Figure 2. Baddeley's working memory model (Baddeley, 2000).

1.2 NEUROPHYSIOLOGICAL AND NEUROANATOMICAL BASIS OF WORKING MEMORY

The basic neurophysiological mechanism of short-term (working) memory is supposed to be based on short-term increase of synaptic efficacy in specific neural network pattern and on repeated reverberations of electrical impulses in reverberational (feedback) loops (Štrucl, 1999). The repeated excitation (by depolarization by external incoming stimuli) of a synapse in such excitational loop leads to a progressive increase of excitatory postsynaptic potential (EPSP).

This mechanism of short-term postsynaptic facilitation can drive the time-limited maintenance/ reverberation of specific information, coded by a specific sustained activation of neural network pattern. Here, functional-only plastic change (increase) in synaptic transmission efficacy (increased synaptic weight) is based on the presynaptic depolarization and/or cAMP/protein kinase activation and includes calcium-dependent mechanisms of sustained increase of neurotransmitter mobilization/release even after the relevant external stimulus is not present anymore. The process of active rehearsal, repeating the information in mind, which further maintains the information in working memory, could hypothetically enhance or even induce the proposed electrophysiological changes.

Dilemmas persist also about *how* information is stored or manipulated in working memory (reverberational excitatory circuits, »delay-period activity« neurons) and *what* is the nature of information stored (retrospective vs. prospective codes).

Various components of working memory are mediated by different anatomically separated neuronal networks. Research shows that WM is mainly based on the activity in prefrontal, premotor, limbic, and posterior association temporo-parietal areas of the brain.

The exact mechanisms of dynamic interactions of many involved but anatomically separated brain regions with neural mechanisms for information processing itself are not yet well known.

The functional integration (‘binding’) of different brain areas, responsible for specific (working memory) functions, is one of the key problems in understanding brain function – a question not yet resolved.

Binding is perhaps mediated by synchronized oscillatory activity of neuronal networks, which can be determined by the electroencephalographic (EEG) coherence analysis.

Coherence between two EEG signals (x, y) equals the squared cross-correlation power spectrum in the frequency domain. It shows, how synchronously the power of certain frequency band changes between two distant brain areas over time and reflects the degree of phase-locking (coupling) between two distant signals as a measure for the degree of inter-regional synchronization of neural oscillations.

2 SYNCHRONOUS NEURAL OSCILLATIONS AND COGNITIVE PROCESSES

EEG is a method, which measures repeated, periodic electrical activity of cortical neurons. Summed activity (mainly postsynaptic potentials with resulting extracellular ionic currents) of many neurons results in field potentials, many of them constituting macropotential (EEG signal). It is influenced by intrinsic qualities of neurons and by dynamic interactions between communicating neuronal networks. Macropotential is a result of changing pattern of synchronization and desynchronization of regional brain cells, as this results in amplitude changes of specific frequency bands. EEG has great time resolution and shows distinct patterns of activity (brain rhythms, oscillations).

Brain rhythms can be divided in many frequency bands (delta: 0,5-4 Hz, theta: 4-7 Hz, alpha: 8-13 Hz, beta: 13-30 Hz, gamma: more than 30 Hz) with their specific functional and behavioral correlates and activating contexts and spatial scales. The proposed role of brain oscillations is switching neural networks between different functional states with activating or inhibiting proper neural systems. Evidence about causality of this relationship is also based on some computational simulation neural models.

The central problem for cognitive neuroscience is to describe how cognitive processes arise from the brain. Recent evidence shows that synchronous neural oscillations and computations performed by such assemblies of functionally connected neurons reveal much about the nature of cognitive processes such as (working) memory, attention and consciousness. Memory processes are most closely related to theta and gamma brain rhythms, whereas attention seems closely associated with alpha and gamma rhythms.

Conscious awareness may arise from synchronous neural oscillations occurring globally throughout the brain rather than from the locally synchronous oscillations that occur when a sensory area encodes a stimulus. The emerging view of brain processes is based on reverberations of reentrant electrical activity in complex neural networks. Synchronization is how the brain probably achieves large-scale integration of its many parallel, distributed processing activities, allowing coherent cognition and behaviour. The goal is to describe how this oscillatory activity of the brain as revealed by the electroencephalography (EEG) or magnetoencephalography (MEG) as well as more invasive recordings, is related to the dynamics of cognitive performance, including working memory.

The neurophysiological theory of higher mental functions predicts that multiple superimposed synchronized (coherent) oscillations in different frequency bands with different spatial patterns and functional correlates govern specific mental functions.

In working memory, mainly pre(frontal) and posterior association brain areas were found oscillating synchronously (theta, gamma, alpha band), which could mean that either prefrontal cortex itself rehearses and maintains the information transferred from posterior storage areas and manipulates with it or it inserts top-down control by its central executive function. Baddeley's model of working memory predicts constant interplay and functional coupling between central executive control system (probably mediated by prefrontal cortex, Collette et al., 2002) and slave subsystems for storage of verbal and visuospatial information, located in posterior and premotor brain regions (Gathercole, 1999).

3 NEURAL ENCODING VS. DECODING

The synaptic connections in brain networks play a very important role as their specific organization in a given brain area determines a specific function performed by that area. Researchers develop large-scale mathematical models of brain networks and then explicitly simulate these models using high-performance supercomputers.

Neural *en-coding* of information represents a systematic variation of neural activity with respect to a behavioural variable (e.g. stimulus-response function). Known research options are single-cell firing rate activity recordings etc. and standard statistics can be used. On the other hand, just the opposite, neural *de-coding* refers to extracting the value of specific variable from the neural activity, which makes it possible to predict behaviour. Here, we consider extracted data from wider neuronal populations and multivariant statistics must be implemented to study neural population vectors (NPV) for continuous variables or discriminant analysis for discrete variables. Simulations of large-scale brain models could be important for detecting the relevant brain signals and their spatial localization and temporal dynamics.

MEG or EEG data signals carry sufficient trajectory information to predict/decode the movement trajectory or even higher mental and musical imagery just from these noninvasive recordings alone. So information is present in a signal and the challenge remains how to extract it. MEG (and EEG) from whole brain signals shows overlapping but still distinct, different dynamics for different tasks. The cross-correlation function (CCF/ coherence) between pre-whitened data adds to these studies by exploring the interactions among neuronal populations.

NEURAL CORRELATES OF SERIAL ORDER AND MECHANISMS OF MEMORY SCANNING

In studying memory, serial-order neural mechanisms are very important as everything in time is serially ordered and all processes are meaningful only in time context of serial sets: the stream of thoughts, the flow of consciousness, memory or any integrative action, speech etc. In memory serial-recall tasks (e.g., redrawing a geometric shape after presentation) we can observe a switch abrupt activity to different NPV vectors according to the serial position in a sequence without any spatial component included (Georgopoulos et al., 2005).

In context-recall serial position memory scanning tasks it has been proved that cca. 20% of all brain cells activated during the specific task encode only the specific serial positions of stimuli, the others encode direction, force of movement etc. In single-cell recordings it can be revealed that a certain percentage of cells specifically activates/ fires as a function of serial position (which is shown in the frequency of its action potential firing rate), but others fire only with respect to specific segment, shape, length or movement parameters etc. regarding redrawing a shape. Parallel co-processing of more parameters is needed, as we use serial order movements to construct or copy/ redraw e.g. a certain shape.

How then to decode a specific segment serial position? Analysis of internal neural representations shows separated strengths of the serial order position activities after the shape was shown and this separation of different population activites starts before and is also prolonged to the redrawing/copying of shape phase, with separate distinct peaks of firing of different involved neural ensembles for different time points/positions in the sequence/series (Carpenter et al., 1999)

NEUROPHYSIOLOGICAL WORKING MEMORY MODEL: LISMAN IDIART JENSEN (LIJ) MODEL

Experimental work based on single cell recordings supports the hypothesis that working memory representations are retained by sustained neuronal firing. While this hypothesis can account for the maintenance of a single memory item, it remains unclear how multiple working memory items are represented with serial order retained.

Here we will discuss the possible physiological mechanism responsible for the maintenance of multiple working memory items including mechanisms based on sustained firing and synaptic encoding.

The model focuses on temporal segmentation by phase encoding, namely by the idea that several working memory items are activated sequentially at different points in time. It has been proposed that a mechanism of nested gamma (30–80Hz) and theta (4–8Hz) oscillations is responsible for controlling the reactivation of the memory list. This mechanism has been shown to be compatible with multiple behavioral findings on working memory such as the data from the Sternberg experiment.

The model predicts that different memory representations (7 items ± 2) are encoded and activated separately and sequentially in subsequent phases of theta cycle. This means the model is based on serial information processing principles. Therefore it can explain empirical data (Sternberg, 1964) on the increase of reaction times with respect to the working memory load (number of items). The theta input serves as a signal carrier and induces repeating of scanning and working memory maintenance processes. The source of theta oscillations could be the hippocampo-cortical reverberating loops.The memory code itself is mediated by synchronous gamma oscillations, induced by a pattern of alternating excitation and inhibition of different memory code population activities.

Working memory processes are thereby potentially mediated by posterior (sensory)-hipocampal- prefrontal neural network, which is integrated and functionally coupled by the synchronization of oscillations in theta frequency band.

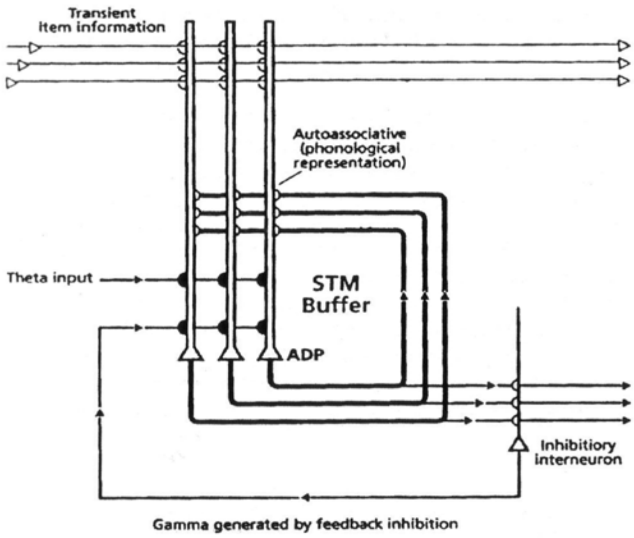


Figure 3. LIJ model (1998) of a network functioning as a multi-item short-term memory buffer.

Theta and gamma oscillations play an important role in the concept. *Afterdepolarization (ADP)* is triggered after a cell fires (sensory input) and it causes an increasing depolarizing ramp that serves to trigger the same cell to fire again after delay. These ramps are temporarily offset for different memories, an offset that causes different memories to fire in different gamma cycles.

The key function of this buffer is to perpetuate the firing of cells in a way that retains serial order. The repeat time is determined by theta oscillations due to the external input. Gamma oscillations arise from alternating global feedback inhibition and excitation (the cell with the most depolarized ramp will fire again) because of separate firing of different memory codes. In the retention interval (delay period), the items are maintained by activity-dependent intrinsic properties of the neurons coding these items (based on ADP- membrane potential changes which depend on distinct ion channels properties).

CONCLUSIONS

The described neurophysiological and neurocomputational approaches and research could bring further progress in understanding our brain and mind also with important applicative value, considering the development of new technologies of *»neural prostheses«* and *brain-computer interface* (BCI) implementation.

These would equip us with necessary tools for »behaviour prediction and control«, including the possibilities of automation and control of different artificial computer-based processes and machines. Eventually, neuroscience may even succeed with the nowadays still more or less futuristic fantasies of human »mind-reading«.

All that challenges and fundamental progress might possibly be accomplished just by intelligently taking into account the temporal and spatial dynamics of relevant electrochemical signaling in our brains, thereby discovering and revealing our miraculous *»inner universe«.*

REFERENCES

1. Babiloni C., Carducci F., Vecchio F., Rossi S., Babiloni F., Cincotti F., Cola B., Miniussi C., Rossini P.M. (2004). Functional frontoparietal connectivity during short-term memory as revealed by high resolution EEG coherence analysis. Behavioral neurosciencies, 118(4), 687-697.

2. Baddeley, A. (2000). The episodic buffer: a new component of working memory? Trends in cognitive science, 4(11), 417-423.

3. Basar E, Basar-Eroglu C, Karakas S, Schurmann M. Gamma, alpha, delta, and theta oscillations govern cognitive processes. Int J Psychophysiol. 2001 Jan;39(2-3):241-8.

4. Buzsaki G, Draguhn A. Neuronal oscillations in cortical networks. Science 2004 Jun 25;304 (5679):1926-9.

5. Carpenter AF, Georgopoulos AP, Pellizzer G. Motor cortical encoding of serial order in a context-recall task. Science. 1999 Mar 12;283(5408):1752-7.

6. Collette, F., Van der Linden, M. (2002). Brain imaging of the central executive component of working memory. Neuroscience Behavioral Review, 26, 105-125.

7. Eysenck., M.V. in Keane, M.T. (1990). Cognitive psychology: A student's handbook. London: Erlsbaum Associates

8. Fuster JM. Cortical dynamics of memory. Int J Psychophysiol. 2000 Mar; 35(2-3):155-64.

9. Gathercole, S.E. (1999). Cognitive approaches to the development of short-term memory. Trends in cognitive science, 3(11), 410-419

10. Georgopoulos AP, Langheim FJ, Leuthold AC, Merkle AN. Magnetoencephalographic signals predict movement trajectory in space. Exp Brain Res. 2005 Nov;167(1):132-5

11. Jensen, O., Lisman, J.E. (1998). An oscillatory short-term memory buffer model can account for data on the sternberg task. The journal of neuroscience, 18(24), 10688-10699.

12. Jensen O. Maintenance of multiple working memory items by temporal segmentation. Neuroscience. 2006 Apr 28;139(1):237-49.

13. Kandell, E.R., Schwartz, J.H., Jessell, T.M. (2000). Principles of neural science. New York: McGraw-Hill.

14. Klimesch W. (1996). Memory processes, brain oscillations and EEG synchronization. Internal journal of psychophysiology, 24, 6-100.

15. Sarnthein, J., Petsche, H., Rappelsberger, P., Shaw, G.L., von Stein, A. (1998). Synchronization between prefrontal and posterior association cortex during human working memory. Neurobiology, 95, 7092-7096.

PASTI V RAZISKOVANJU FENOMENA ZAVESTI

Andrej Detela
Inštitut Jožef Stefan, Ljubljana
Jamova 39, 1000 Ljubljana, Slovenia
e-mail: andrej.detela@ijs.si

POVZETEK

Raziskovanje fenomena zavesti zahteva povsem nove metodološke pristope. Naštetih je pet ključnih argumentov, ki kažejo na neustreznost klasičnih pristopov, s tem pa je že nakazana smer, v kateri moramo iskati novo metodologijo.

1. UVOD

V pričujočem eseju hočem opozoriti na nek specifičen problem, ki se nanaša na *aktualne metodologije raziskovanja fenomena zavesti*. Gre za tiste načine raziskovanja, ki jim je sodobna kognitivna znanost zaradi raznih vzrokov najbolj naklonjena. Pokazati hočem, da nekatere od teh metodologij vsaj deloma peljejo v slepo ulico, in sicer zaradi inherentnih nedoslednosti, ki jih bom nakazal v tem eseju.

Spisek metodologij, ki se jih bom dotaknil, seveda nikakor ne more in noče biti popoln. Opozoril bom le na nekatere načine obravnave, ki se mi zde najbolj problematični. To so nekakšne pasti, v katere se pogosto ujame kognitivni znanstvenik, še posebno če stopi na tako nevarno spolzek teren kot je na primer vprašanje odnosa med materijo in zavestjo (*mind-body problem*). Celotna slika seveda še zdaleč ni tako pesimistična, saj se skoraj nevidne pasti, na katere hočem opozoriti, skrivajo v bujni goščavi svežih in razsvetljujočih vpogledov v silno zahtevno področje raziskovanja fenomena zavesti.

Kognitivna znanost je še relativno mlado raziskovalno področje, stkano iz številnih medsebojno povezanih pristopov ali znanstvenih disciplin. Z vso pravico lahko govorimo o *transdisciplinarni znanstveni metodi* in to je nekaj, na kar smo kognitivni znanstveniki lahko resnično ponosni, saj je radikalna transdisciplinarnost avantgardna smer v moderni znanosti.

Obravnave fenomena zavesti se bom tu dotaknil prvenstveno z vidika bazične naravoslovne znanosti – pa ne zato, ker bi ta vidik bil vrednejši od ostalih aspektov (psihološkega, socialnega, kibernetičnega vidika ipd.), temveč zato, ker je najbliže moji stroki.

2. METODOLOŠKE PASTI

Kognitivni znanstvenik s podlago v bazičnem naravoslovju (s tem mislimo zlasti fiziko, kemijo, biologijo, medtem ko bi na primer medicino lahko dali že v drugo skupino) se najraje sklicuje na metode, ki so se razvile v teh znanstvenih disciplinah. Pri tem se rad (zavestno ali nezavedno) sklicuje na naslednje *privzetke*, na katere se je navadil pri raziskovanju »materialnega sveta« (navednice pišem zato, ker je zares nemogoče začrtati mejo med »materialnim« in »nematerialnim«):

1. Predmet znanstvene obravnave se da spoznati po metodi znanstvenega redukcionizma: Iz celovite realnosti iztrgamo »čiste fenomene« (take, ki pripadajo samo enemu izoliranemu tipu pojavov), jih ločeno analiziramo, nazadnje pa posamezne dele sestavimo nazaj v celoto realnega sveta. Ta *redukcionistična metodologija* se je razvijala vse od grške antike dalje (po zatonu predsokratikov) in se je do zdaj pokazala za relativno uspešno – v bistvu je šele ta omogočila razvoj moderne znanosti.

2. Predmet znanstvene obravnave je povsem objektivne narave in je ločen od opazovalca, torej ga gledamo od zunaj. Ta predmet obravnave je materialne narave in nima lastnosti uma, subjekt opazovanja pa je čisto duhovne narave in nima lastnosti materije. Najbolj znani protagonist te *dihotomije med umom in materijo* je bil Descartes na začetku 17. stoletja (*kartezijanska znanstvena paradigma*).

3. Opazovani fenomen moramo tako zelo »očistiti« vseh tujih primesi, da je znanstveni eksperiment povsem *reproducibilen*, torej, ob enakih robnih pogojih bodo rezultati poskusa vedno enaki. Na ta način se da eksperimentalne rezultate podrediti jasni logični analizi – če je le možno, z eksaktnim matematičnim orodjem.

4. Predmet obravnave je del našega fenomenalnega sveta, zato ima lastnosti, ki se dajo

opisati z vidnimi *strukturami v prostoru in času*. Prostor in čas predstavljata osnovne koordinate, brez katerih opis ni mogoč. Prostor in čas sta opisljiva z matematičnimi orodji, kar omogoča eksaktno analizo pojavov.

Seveda se zastavi vprašanje, ali so navedeni privzetki o primerni znanstveni metodi upravičeni tudi za obravnavo *zavesti*, ki je nekaj povsem drugega kot svet »oprijemljive« materije.V našem primeru je predmet obravnave kar zavest, ki je osnovna lastnost samega opazovalca. Takoj postane očitno, da:

1. *Redukcionistični pristop* tu ne deluje, kajti izvorna zavest (ki poleg *racionalne* vedno vsebuje tudi *intuitivno komponento*) se dotika najširše (in najgloblje) realnosti, ki presega kateri koli formalni opis. Opazovalec sveta lahko kadar koli najde kako novo možnost, ki v že uveljavljenem formalnem opisu še ni upoštevana, pa vendar tudi ta nova možnost pade v območje zavesti – sicer bi bila nedostopna našemu intuitivnemu spoznanju.
2. *Kartezijanska dihotomija* je tu seveda popoln nesmisel, saj je predmet obravnave vsaj deloma identičen z opazovalcem. Ločitev med obojim nikakor ni mogoča.
3. *Reproducibilnost* ni mogoča, ker je zavest lastnost živih organizmov oziroma sistemov. Živi sistemi vedno temeljijo na *kompleksnosti*, zato je praktično nemogoče ponoviti enake (reproducibilne) robne pogoje. V biologiji je nekakšna reproducibilnost vsaj deloma še možna, zavest pa je lastnost celotnega izjemno kompleksnega živega sistema, ki ga je nemogoče statično definirati. Organizem živi, se razvija, preko kompleksnih povratnih zank vpliva sam nase in uravnava svoje živo stanje.
4. Niti približno se nam ne sanja, kako bi zavest lahko opisali v *kategorijah prostora in časa*. Čisto nič nam (še) ni znano, katere strukture bi v polju zavesti lahko nadomestile naše uveljavljeno *prostorčasje*.

S tem pa smo prišli do paradoksa, ki očitno ni rešljiv na osnovi znanih in uveljavljenih znanstvenih metodologij. Poleg tega se jasno kaže še en problem, ki ni nič manjši od ostalih (morda je celo največji) in bi ga lahko imenovali *problem izkušnje zavesti*:

5. Materija, ki jo obravnavajo klasične znanstvene discipline s področja naravoslovja (s svojimi že uveljavljenimi metodami), je pojem, ki je nam vsem evidenten sam po sebi. Iz vsakdanjih izkušenj vemo in se v glavnem vsi strinjamo v tem, kaj mislimo, ko govorimo o materiji. Ni nam treba opozarjati na to, kaj je predmet obravnave. Glede fenomena zavesti pa je to povsem drugače. Zelo malo ljudi ima *avtentično izkušnjo izvorne zavesti*. Nekatera kulturna okolja (še zlasti nekatere klasične azijske kulturne tradicije) so iskanja v tej smeri podpirala, medtem ko v naši sodobni evropski kulturi (in še bolj ameriški) glede tega živimo na površini, v območju znakov in simbolov iz materialnega sveta. Namesto zavesti same se nam v spoznavno polje postavljajo le zunanji odrazi delovanja zavesti. Če večina sodobnih psihologov sploh ne priznava obstoja duše, kako naj gremo še korak dalje in spregovorimo o tem, kar je še bolj zadaj za dušo in jo oživlja? Sodobna kognitivna znanost se skuša dotakniti fenomena zavesti, a to, česar se dotakne, je skoraj v vseh primerih le zunanji odmev zavestnega delovanja – daleč od izvorne zavesti same. Torej v kognitivni znanosti sploh še ni jasnega konsenza o tem, kaj je osnovni predmet znanstvene obravnave.

3. SKLEP

Prav je, da se zavedamo omenjenih težav. V tem prehodnem času sta potrebni potrpežljivost in velika mera modrosti. Transdisciplinarni pristop v kognitivni znanosti nam daje zelo dobro upanje, da se bodo počasi izoblikovale osnovne konture nove metodologije. Verjetno bo to (radikalna) *paradigmatska sprememba*, izražena vsaj v tolikšnem obsegu, kot se je to pred slabim stoletjem zgodilo na področju kvantne fizike. Prav kvantna fizika bi lahko dala nekaj namigov, kako naj se lotimo nove znanstvene paradigme na področju zavesti. Poudariti pa je treba, da brez globoke meditativne izkušnje izvorne zavesti same tudi ne bo šlo, saj moramo najprej vedeti, kaj sploh opazujemo in obravnavamo (točka 5). Do spremembe bo moralo priti v prav vseh vidikih, ki so navedeni pod točkami od 1 do 5, pa verjetno še v čem drugem. Prihajajoče spremembe pa se nam ni treba bati, saj je čas zanjo vse bolj pripravljen in bo bistveno obogatila vsa področja znanosti in seveda naš celoviti pogled na svet.

THE NATURE OF STRATEGY PROCESS: A PSYCHOLOGICAL INTERPRETATION

Jernej Dolenšek
Faculty of Economics,
University of Ljubljana,
Kardeljeva ploščad 15, 1000 Ljubljana, Slovenia
e-mail: jernej.dolensek@ef.uni-lj.si

ABSTRACT

Seeking the psychological underpinning of strategic process, the cognitive process becomes fruitful venue to pursue. It provides the backbone of skilful execution of strategy process. This paper will present the relationship between strategy process and cognitive structure, then recognize the analogy between strategy process and creative process, and present the consequences of such observation for strategic management. The internal structure of individual will be based upon modern psychodynamic and cognitive psychological theory.

INTRODUCTION

Cognition is one of the least emphasized fields in the modern psychology. Modern psychological textbooks differentiate between cognitive, emotional and motivational processes. The cognition as presented by cognitive psychologists is usually either excluded from analysis, when a behaviouristic approach is followed, or focuses the discussion mainly on the sensation and the perception, and not on the perception to meaning transformation. When such discussion of cognition is initiated, it is generally included under a separate heading of human personality. Fully integrating the cognitive and the psychodynamic approach into the psychological processes provides an interesting integrative approach to the psychological processes for use in strategic management.

Modern psychology has developed an interesting research into the creative process. While still not supported by some, it recognized the connection between a personal internal structure and an effective behaviour. Comparative analysis of the strategy process and the creative process will show an analogy in their structure, thus enabling transfer of conclusions about the creative process onto the strategy process.

However, first a clear connection of the strategy to the personal cognitive structure will be established within the strategic management literature.

Since this is an essay exploring the psychological nature of strategic management, only the established psychological theories are used. A standard of such recognition is inclusion of such theory in mainstream psychological textbooks.

THE NATURE OF STRATEGY

Strategy is the central theme in strategic management. Strategic management has developed many competing schools of thought, which is also represented in the definition of strategy. Since all schools do study the same subject, the definitions present different aspects of strategy. An integrative approach recognizes five meanings of strategy (Mintzberg, 1987); the sixth is added on the basis of the organizational analysis.

Strategy as a plan

There are two meanings of strategy as a plan. Strategy can be a plan of actions and a plan of decisions. Strategy is conscious plan of actions, used in specific situation (Mintzberg, 1987, p. 11). It includes a long term goal setting and an allocation of resources needed for the implementation (Chandler, 1990, p. 13). The definition was developed from a military terminology (Mintzberg, 1987, p. 11). A planned strategy can be achieved or not. The result of a plan implementation is formal organization.

Strategy as a pattern in a stream of

Strategy is a pattern in a stream of actions that enable company to achieve goals (Mintzberg, 1987, p. 12). It is a pattern in the behaviour of a company (Mintzberg, 1987, p. 13). Sometimes is referred to as a pattern of actions, sometimes as a pattern in decisions.

Strategy is more then just a set of key decision (on the goals and their implementation); it is a pattern of decisions on key goals and resource allocation (Andrews, 1987, p. 14, 15). Such decisions are binding company to actions (1978, p. 935; 1977-78, p. 28). The challenge of strategic management is recognizing the pattern of challenges, opportunities and dangers and the formulation of a unique response to it (Ansoff, McDonnell, 1990, p. 30).

A decision is irrelevant, if it is not followed by action. Actions can be planned or emergent, successful and unsuccessful. Successful strategies can be emergent strategies and planned strategies. Planned strategy can be unsuccessful. Emergent strategy, being consciously recognized only in retrospect, is nonexistent in an unsuccessful company. Successful emergent, unplanned strategy can emerge in the absence of planned strategy or even in spite of it. (Mintzberg, Waters, 1985, p. 257; Mintzberg, 1994c, p. 360)

Strategy as an organization

Strategy is more then just a plan or a stream of actions in a company. By consistency in the (decided) actions a stable structure of relationships in a company is established. Organization is a stable matrix of relationships between people, the members of organization, which ensures the survival, its specific characteristics and the successful goal performance (Lipovec, 1987, p. 34-35). Strategy is structure (Andrews, 1987, p. 93), the structure of organization. Thus strategy establishes organization and strategy as a plan ensures formal organization, while strategy as a pattern presents informal organization.

Strategy as a ploy

Strategy is tactical actions, the goal being overcoming the adversary (Mintzberg, 1987, p. 12). A company produces products for customers, but uses tactics to control its relationship with competition. A ploy demands ‘cunning’ in managing relationship with any specific interest group, and includes market signals (see Porter, 1980, p. 75-87) and competitive moves (see Porter, 1980, p. 88-105).

Strategy as a strategic positioning

Strategy is strategic position of a company in an environment (Mintzberg, 1987, p. 15). Strategy is the means of intermediating between internal and external environment. (Mintzberg, 1987, p. 15). Company is managing the internal strengths and weaknesses, the external threats and opportunities, and the social responsibility (Andrews, 1987, p. 18).

Strategy as a strategic perspective

Strategy is a projection of personal values of strategic apex on the decisions on the actions of a company (Andrews, 1987, p. 53). Basic values of decision making person cannot be separated from decision making itself (Andrews, 1987, p. 53). Thus strategy process not only manages strengths, weaknesses, opportunities and threats and social responsibility, it includes the basic values of strategic apex (Andrews, 1987, p. 18). A simple conceptual frame is needed by a practicing manager that is nurturing a realistic view of organization and its goal (Andrews, 1987, p. xiv). Simple does not mean oversimplified (Andrews, 1987, p. xiii).

Strategy is an established way of perception and cognition. It is a mental structure, a frame of reference, a cognitive structure, a world view. It is the culture, the ideology of a company, its paradigms. Strategy is a concept. (Mintzberg, 1987, p. 16)

This establishes a connection of strategic management research to the cognitive process research. Yet the research of the configuration school of management, that offers most integrative approach to strategic management theory, mostly uses the theory on the different nature of left and right brain hemisphere. Due to current reviewing of theory (crf. Fink et al., 1997), a different approach is needed, and research on creative process is utilized. Further, the cognitive processes are emphasized, but not also emotional and motivational processes. Thus psychodynamic theory is utilized.

THE CREATIVE PROCESS VERSUS STRATEGY PROCESS

Strategy is a creative act (creative: Andrews, 1987, p. 186; unique: Andrews, 1987, p. p. 27). Strategic apex is more managing the decision process then making decisions (Andrews, 1987, p. 114). Further analysis of the psychological research of the creative process is thus appropriate.

Modern psychologists have developed a sequential model of the creative process needed for solving unprogrammed problems. Phases of creative process are: Preparation (introduction with the problem and data gathering), Incubation (establishing cognitive elements by convergent mental operations on gathered data with intent of gaining familiarity), Illumination (Mental operations on established cognitive elements with intent of solution formation), Verification (further mental operations of adaptation of solution with other known cognitive elements) and Communication (Communicating solution to the environment) (Kompare et al., 2001, p. 154).

Strategy process consists of strategic planning and strategy formation. Strategic planning is the input, the catalysts and the output of strategy formation (Mintzberg, Ahlstrand, Lampel, 1998, p. 77). Strategic planning as an input is strategic analysis (example: an analysis of internal strength and weaknesses, an analysis of external opportunities and threats), a convergent thinking process. Strategic planning as a catalyst is ad hoc planning, and is still a convergent thinking process. Strategic planning as an output is strategic programming (of execution), again a convergent thought process.

In the middle (after analysis of environment and before planning execution) of strategic process a strategic vision formation is generally positioned. Exception is Pučko (1993), who positioned strategic vision element as a planning presupposition, i.e. at the beginning of strategy process. Yet his model does not include cognition of adaptive nor entrepreneurial strategy formation, strictly planning approach. And since pure planning approach is not seeking to find a solution of a fully unstructured problem, it is ok if it is full convergent thought process.

Strategic vision is mental transformation (Mintzberg, 1989, p. 22). It is result of a group process or a personal introspection, is sudden or gradual, planned or emergent (Mintzberg, vision, 1989, p. 35). It core form products, markets, organization or values (Mintzberg, 1989, p. 22). Strategic vision is the result of its historic context that created it (that enabled and was input for mental structure development) (Mintzberg, 1989, p. 35).

This shows perfect fit between the strategy process model and the creative process model. Strategic vision formation is the essence of strategy formation, characterized by a divergent thought process and is symbolic of Illumination phase of creative process. Strategic planning is characterized by a convergent thought process and represents Preparation and Incubation (the strategic analysis), Verification and Communication (the strategic programming). Strategic planning as a catalyst is a convergent execution of ad hoc planning. Strategic analysis and programming consists of various modules, each one designed to produce a mental structure, which are then in an act of Illumination connected into a strategic vision. Such conclusion is congruent with behavioural analysis that states that Illumination is not a creation of something new, just o new connection of existing knowledge.

This explains why the modular structure of strategic planning is appropriate, and what is the nature of strategic planning execution in each of its modes. To enhance creative solving capacity, further analysis of strategy process is necessary. For that end psychodynamic theory is utilized.

INTERNAL STRUCTURE OF STRATEGIC PERSPECTIVE

A model of the mental operations of the strategy as a creative process establishes a theoretical framework for cognitive processes of strategy process. Yet such process emphasizes mental cognition. To balance the approach, further focus is appropriate to include emotional and motivational processes. Psychodynamic theory is utilized, for it develops a model of individual expression starting at the base, the motivational process.

Every person has a basic urges, called libido. Yet permanent clash exists between socializing and individualizing. Basic motivation is the expression of an individual. Individual has, in view of being in contact with society, four basic options of self expression (Freud, 2001, p. 45, 46, 47): 1. Free immediate satisfaction of a basic pleasure seeking need; 2. Sublimation of motivational urges into a character nature; 3. Sublimation of motivational urges into scientific, ideological or artistic impulses; 4. Direct blocking of an individual expression (later manifesting as secondary expression). Forms of personal secondary expression are: Projection, Rationalization, Repression, Displacement (Freud in Hayes, Orrell, 1998, p. 268).

The relevance of psychodynamic theory for strategic management is:

Strategic vision formation is a subconscious process

Primary thinking is always subconscious (Blažević, Cividini-Stranić, Beck-Dvoržak, 1989, p. 37, 38). Id, most of ego and most of superego are subconscious (Musek, Pečjak, 1997, p. 225,226). Thus the timing and executing of strategy process must be tailored to the way of subconscious mind.

Strategic planning is conscious process

Strategic planning is (mostly) conscious convergent process of creating mental structures out of available mental data, the mental structures then being subjected to subconscious creative process. Skilful approach (choosing the modules/tools of strategic planning) at creating cognitive structures is vital for successful strategic management.

Fiat or Veto experience

Strategy is decisions and actions. Decisions that do not lead to actions are not relevant. There are two experiences (and three positions): fiat experience and veto experience (and the absence of such experience until the eventual fiat or veto experience). It is most vital for personal motivation. Fiat or veto experience is not a rational decision of ego, its roots are deeper. Skillful strategy process will reveal one's deep motivation and recognize fiat and veto experience.

Motivating emotions and mental transformation

First three Freud options (see above) are the drivers of creative problem solving. Base motivation is the fuel of motivating emotions of a stable character and the true source of a cognitive transformation. The root of a true strategy process motivation lies in the deepest manifestation of individual expression.

Emotional affects and mental entrenchment

Emotional affection or mental entrenchment are two most damaging factors to successful creative process (Pečjak, Musek, 1997, p. 170, 172). They are both result of blocked primary individual expressions. This is important consideration in character assessment for participants selection and in strategy process facilitation.

CONCLUSION

Psychological theory is relevant to the strategic management. Psychodynamic theory, cognitive psychology and creative process research are congruent with strategic management research. Such analysis presented further specific insight into the strategy process theory.

References

[1] Andrews, Kenneth R.: The concept of Corporate Strategy, 1987 (third, revised edition; first edition 1971), 132 p.

[2] Ansoff, Igor; McDonnell Edward: Implanting Strategic Management. Cambridge: Prentice Hall International, 1990. 520 p.

[3] Blažević, Duška; Cividini-Stranić, Eugenija; Beck-Dvoržak, Maja: Medicinska psihologija. Ljubljana: ČGP Delo. 1989, p. 199.
[4] Carlson, Neil: Psychology. Boston: Allyn and Bacon. 1990. 683 p.
[5] Chandler, Alfred DuPont: Strategy and structure: Chapters in the History of the American Industrial Enterprise. Cambridge: The MIT Press, 1990 (second edition, first edition in 1962). 463 p.
[6] Fink, G. R. et al.: Hemisphere specialization for global and local processing: the effect of stimulus category. Journal of Royal Proceedings B, 264(1997), 1382(apr), p. 487-494.
[7] Fink, G. R. et al.: Where in the brain does visual attention select forest and trees? Nature, 382(1996), 6592(aug), p. 626-628.
[8] Freud, Sigmund: Nelagodje v kulturi. Ljubljana: Gyrus. 2001. 144 p.
[9] Hayes, Nicky; Orrell, Sue: Psihologija. Ljubljana: Zavod Republike Slovenije za šolstvo. 1998. 597 p.
[10] Hill, Grahame: Psihologija:shematski pregledi. Ljubljana: Tehnična založba Slovenije. 2001. 224 p.
[11] Kompare, Alenka et al.: Psihologija. Ljubljana: DZS, 2001. 414 p.
[12] Lipovec, Filip: Razvita teorija organizacije. Splošna teorija organizacije združb. Maribor: Obzorja, 1987. 365 p.
[13] Mintzberg, Henry, Ahlstrand, Bruce W., Lampel, Joseph: The Strategy Safari: A Guided Tour through the Wilds of Strategic Management. London [Etc.]: Prentice Hall; New York: The Free Press, 1998. 406 p.
[14] Mintzberg, Henry: Patterns in Strategy Formation. Management Science, 24 (1978), 9, p. 934-948.
[15] Mintzberg, Henry: Strategy Formulation as a Historic Process. International Studies of Management & Organization. 1 (1977-78), 1-2, p. 28-40.
[16] Mintzberg, Henry: The Rise and Fall of Strategic Planning. New York [Etc.]: Prentice Hall, 1994. 458 p.
[17] Mintzberg, Henry: The Strategy Concept I: Five Ps For Strategy. California Management Review, 30 (1987), 1, p. 11-24.
[18] Mintzberg, Henry; Waters, James A: Of Strategies, Deliberate and Emergent. Strategic Management Journal, 6 (1985), 3, p. 257-272.
[19] Musek, Janek: Uvod v psihologijo. Ljubljana: Filozofska fakulteta. 1999. 224 p.
[20] Musek, Janek: Znanstvena podoba osebnosti. Educy, Ljubljana, 1997, 418 p.
[21] Musek, Janek; Pečjak, Janez: Psihologija. Ljubljana, Educy, 1997. 280 p.
[22] Porter, Michael E.: Corporate Strategy. New York: Free Press, 1980. 396 p.
[23] Pučko Danijel: Planiranje v podjetjih. Ljubljana: Ekonomska fakulteta, 1993. 492 p.

DANIEL DENNETT IN RAČUNSKI OBRAT

Matjaž Gams
Odsek za inteligentne sisteme
Institut Jožef Stefan, Jamova 39, 1000 Ljubljana, Slovenia
Tel: +386 1 477 3644; `matjaz.gams@ijs.si`

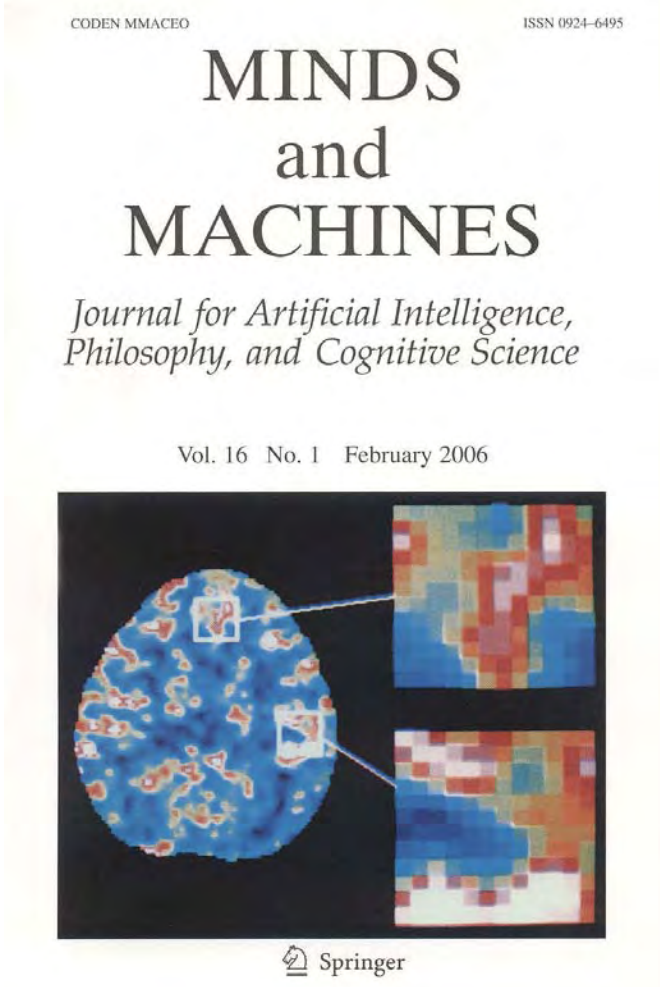
POVZETEK

Narejena je analiza in pregled dela prof. Daniela Dennetta predvsem po specialni številki Minds and Machines, izdani februarja 2006. Cela številka je namenjena prof. Dennettu in njegovim ključnim prispevkom – računskemu obratu, tj. da je računalnik najboljše orodje za izdelavo mentalnih modelov, njegovi teoriji mnogoterih poskusov idr. Dodana je kratka analiza njegovih knjig o verovanju.
Dennett je nesporno eden najbolj odmevnih kognitivnih znanstvenikov - filozofov, zato je z analizo njegovih zamisli dejansko narejena analiza dobrega dela kognitivnih znanosti.

1 UVOD

V reviji Mind and Machines se intenzivno ukvarjajo z vprašanji odnosa med umom in računalniki. Posebej zanimiva je bila številka februarja 2006, posvečena delu prof. Daniela Dennetta (Minds and Machines 2006), predvsem njegovim ključnim prispevkom – računskemu obratu, tj. da je računalnik najboljše orodje za izdelavo mentalnih modelov, njegovi teoriji mnogoterih poskusov idr. (Sliki 1 in 2). Dodana je kratka analiza njegovih knjig o verovanju.

Dennett sodi med najuspešnejše filozofe in kognitivne znanstvenike. V svojem plodnem življenju se je ukvarjal z veliko pomembnimi vprašanji, zato pregled njegovih dosežkov zajema dobršen del kognitivnih znanosti. V precejšnji meri pa se na Dennettovo delo naslanjajo tudi raziskave avtorja, recimo princip mnogoterega znanja, ki je blizu Dennettovim "multiple drafts" (Gams 2001).



Slika 1: Februarska številka revije Minds and Machines je posvečena Dennettovim prispevkom.

2 RAČUNSKI OBRAT

V predgovoru omenjene revije specialni urednik Jon Dorbolo piše o nagradi ameriškega filozofskega združenja, posvečeni Dennettu leta 2003 za pomembne prispevke s področja filozofije in računalništva, posebej v povezavi z računskim obratom.

Čeprav Dennett ni avtor izraza "**računski obrat**", ampak Leslie Burkholder, in čeprav je med zagovorniki računskega obrata množica priznanih filozofov, so Dennettovi prispevki tako signifantni, da je posebej omenjan. Računski obrat naj bi bil namreč nasprotje "jezikovnemu obratu", ki je dominiral na tem področju filozofije večino 20. stoletja. Namesto strukture, uporabe in pomena jezika se sedaj vse vrti okrog računalništva in informatike, seveda kot orodja filozofije in kognitivnih znanosti: umetna inteligenca, umetno življenje, strojno učenje, računalniška zavest, robotika.

Do jezika ima Dennett dvojni pogled. Po eni strani ga vidi kot enega najpomembnejših mehanizmov, ki ga imamo ljudje in ne tudi druga bitja, vendar meni, da je jezik prešibak mehanizem, da bi opisal dejanske miselne procese. V primerjavi z drugimi živalmi imamo torej dva preskoka: prvi nivo je tisti, kjer se začne uporabljati jezik, drugi pa tisti, ko so miselni procesi močnejši kot jezik sam. Možno je sicer, da je predpogoj za jezik tudi tisti drugi močnejši mehanizem.

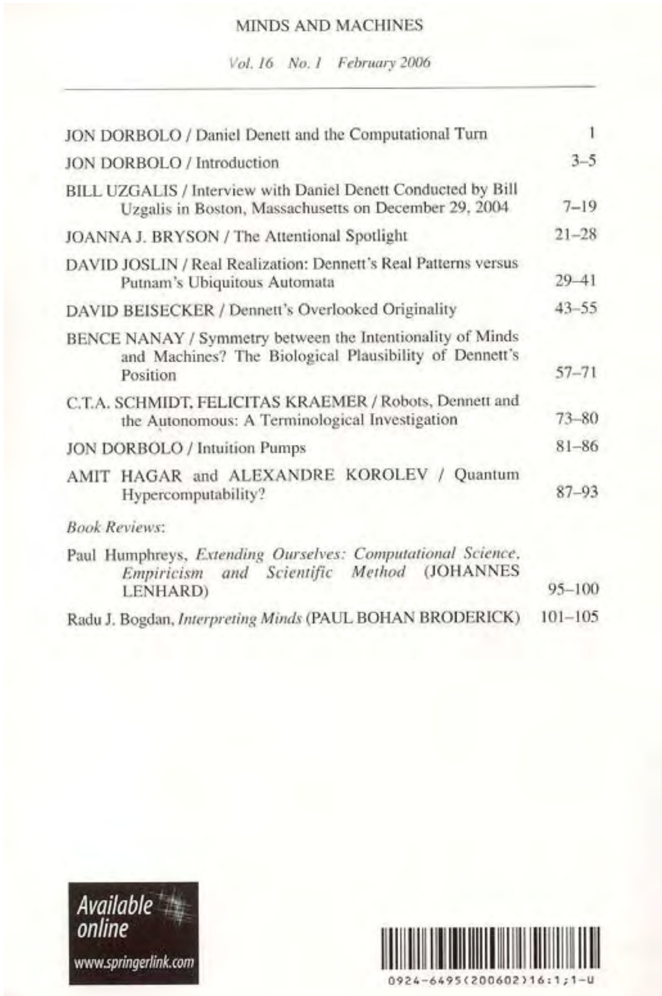
Dennett je pristaš **gradualizma** – zanj se večina stvari razvija korak za korakom, tako ljudje iz živali, tako umetna inteligenca. Prava inteligenca in zavest sta zanj nastajali postopoma preko čedalje bolj razvitih živali do prvih preprostih človečnjakov in do čedalje pametnejših ljudi. Z živalmi si delimo veliko skupnih lastnosti, predvsem fizično. V umskem smislu pa smo naredili neverjeten napredek naprej in sedanje stanje uma je bistveno bolj zapleteno, kot mislimo. Zato je tudi razvoj umetne inteligence tako zapleten. Postavi primer severnega medveda – ali ima koncept snega ali ne? V nekem smislu ga gotovo ima, najbrž pa ni jezikovan in ga ne zna v obliki jezika prenesti drugim. Ljudje pa znamo ne samo opisati koncepte, ampak predvsem manipulirati z njimi, tj. "delati" z njimi.

Dennett je za nas računalničarje bolj filozof (kljub temu, da ga viri navajajo tudi kot strokovnjaka umetne inteligence, vendar vsebinsko to pomeni – strokovnjaka za filozofska vprašanja umetne inteligence), je pa njegove misli realizirala množica mladih programerjev pod njegovim vodstvom. Programi so bili s področja genetskih programov, populacijske genetike, statistike, geologije, nevroznanosti, nevroanatomije in umetne inteligence.

Umetna inteligenca je bila za Dennetta vedno le filozofija, narejena z računalniki. Programi so le umski eksperimenti in zato strokovnjaki le težko opišejo, kaj pravzaprav počnejo, kaj je njihovo področje. V resnici delajo umske eksperimente, prenašajo procesiranje informacij, kot se dogaja v umu, v neko dejansko delujočo verzijo programa na določenem problemu.

Po Dennettu so računalniški programi najboljše orodje, kar ga imamo za preizkušanje mentalnih modelov. Vse ostale metode so bolj ali manj biološki eksperimenti ali akademska razmišljanja. Programi pa omogočajo dejansko eksperimentiranje z različnimi modeli in metodami. Dennett zagovarja mnenje, da so razna področja računalništva, posebej umetna inteligenca, v zadnjih desetletjih naredila ogromen korak naprej. Delujoča orodja, znanje, cenejši in hitrejši računalniki, vse to omogoča čedalje boljše modeliranje umskih procesov. Umetna inteligenca je prešla raziskave z relativno enostavnih modelov kot recimo šah, na zahtevne dinamične in kognitivne modele. Čeprav je bila pri šahu najuspešnejša, to trenutno ni največji problem.

Naredi primerjavo z avionom. Imamo kolesa, imamo okna in vrata, imamo aluminij, rabi bi izgradili avion, vendar ne znamo integrirati celotnega sistema. To se zdi največji problem. Avtor tega prispevka je podobne misli objavil v (Gams 2001), kjer je predstavljen princip mnogoterega znanja. Preprosto povedano – ljudje mislimo, da smo ena in enovita miselna celota, v resnici pa je miselni model bližje temu, kot da bi imeli v glavi na desetine ali stotine "ljudi", ki se med seboj dogovarjajo, si ugovarjajo in stalno integrirajo v neke skupne odločitve. Ti miselni procesi torej stalno potekajo v skupinah nevronov, ki med seboj interaktirajo in v določenem smislu sodelujejo in si konkurirajo kot osebki iste vrste v populaciji (Edelman 2000). Pomembna razlika je predvsem v tem, da so osebki iste populacije približno isti, medtem ko so miselni procesi pravzaprav bolj ali manj poljubni, čeprav verjetneje med seboj bolj interaktirajo bolj podobni.


MINDS AND MACHINES

Vol. 16 No. 1 February 2006

Available online
www.springerlink.com

0924-6495(200602)16:1;1-U

Slika 2: Zadnja stran februarske številka revije Minds and Machines prikaže prispevke, ki jih tu analiziramo.

Dennett (Uzgalis 2006) torej vidi umetno inteligenco kot uporabo računalnikov z namenom preiskušanja filozofskih teorij na računalniku. Ukvarja se z vprašanji, kaj je to inteligenca, ali je inteligenca vezana na ljudi, ali bi bili inteligentni računalniki tudi subjekti, in seveda je ena od nalog tudi konstrukcijska – zakaj ne bi izgradili kakšen inteligenten stroj in ga analizirali.

Sodeloval je tudi pri projektu Cog, pri poskusu na MITju, da bi naredili umanoidnega robota na nivoju 2-letnega otroka. Ideja je znana iz umetnega življenja – ker so ljudje tako zapleteni, raje najprej naredimo modele preprostih bitij, recimo žuželk in tako naprej, dokler ne pridemo do otrok in nato do odraslih. Nekaj časa je bila zelo priljubljena iguana kot preprost organizem. Tu se Dennett do neke mere strinja z Dreyfusom, ki je kritiziral starejše formalistične veje umetne inteligence (Dreyfuss 1979), češ da brez utelešenja in stalnega delovanja v realnem okolju ne bodo nikoli dosegli inteligence. Po drugi strani pa Dennett pravi, da je pomembna razlika med "težko" in "nemogoče" in to naj bi bila glavna napaka Dreyfusa. Umetno inteligenco na računalniku ni nemogoče narediti, samo izredno težko.

Dennett je včasih omenjan kot pristaš "močne umetne inteligence", tj. pristopa, da bodo računalniki slej ko prej postali inteligentni in zavestni kot ljudje. Tako kot so se ljudje počasi razvili v pametna bitja, se bodo tudi računalniki. V "Consciousness explained" (Dennett 19991) Dennett trdi, da je **zavest** samo posebna funkcionalna lastnost izredno visoko razvitega sistema za procesiranje informacij, tj. naših možganov. Zanimiva je relacija s Chalmersem. Čeprav sta si oba zelo podobna in razmišljata, da je možno narediti računalnike oz. stroje, ki bodo zavestni in inteligentni, in se torej bistveno ločita od Searla ali Dreyfusa, pa se ločita v tem, da Dennett vidi problem le v zelo veliki zapletenosti in sofisticiranosti človeškega uma, medtem ko Chalmers vidi delovanja uma kot ločenega od možganov, tj. dualizem, vendar kot tak še vedno izvršljiv na fizičnih strojih, tj. ljudeh ali računalnikih. Morda velja opomniti, da se tudi avtor tega prispevka strinja, da je možno narediti stroje in računalnike, ki bodo inteligentni, zavestni itd., ampak ti stroji bodo bistveno bolj zapleteni kot sedanji digitalni računalniki in bodo morali znati integrirati mnogotere procese, ki aktivno interaktirajo med seboj. Ti mehanizmi pa so v principu močnejši kot univerzalni Turingovi stroji oz. digitalni računalniki (Wegner 1997).

Čeprav so si tu ideje Denetta in avtorja precej podobne in izvirajo iz Minskyje "Society of the mind" (1991), kjer je um predstavljen kot množica med seboj povezanih in tekmujočih agentov, pa je Denettova ideja o množici paralelnih procesov, ki je tako kot druge bistveno drugačna od strogo urejenega jezikovnega ali "kartezičnega gledališča", vseeno premalo poudarjena v smeri interakcije med temi mnogoterimi procesi, saj le ti omogočajo dodatno računsko moč.

Chalmers in Dennett, dva izmed najbolj priljubljenih kognitivnih znanstvenikov, se kljub podobnosti v nekaterih ključnih pogledih bistveno razlikujeta. Najbolje se to vidi pri Chalmersovih "zombijih" (Chalmers 1996), kjer Chalmers na primeru zombijev, ki so na videz ljudje, vendar brez zavesti, pokaže, da je zavest nekaj več kot samo enostavna procesorska funkcionalnost. Zombiji so namreč še vedno sposobni delati večino stvari v realnem svetu, ne zmorejo pa najvišjih človeških mentalnih lastnosti. Denettu se zdijo ti argumenti tako napačni kot Searlova Kitajska soba, medtem ko je avtor tega prispevka manj prepričan.

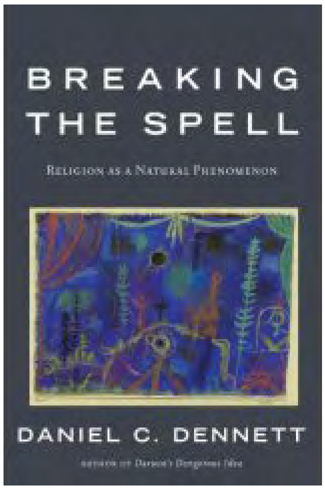
Seveda pa Dennett Searlu upravičeno očita, da je njegov sklep na primeru Kitajske sobe logično nepravilen, saj v izpeljavi v določenih korakih nepravilno posplošuje.

3 ANALIZA VEROVANJA

V zadnjih letih oživljajo razprave o duhovnem pomenu. Na Amazon.com je na prvem mestu Dennettova analiza smotrnosti verovanja, poleg tega prihaja še ena njegova knjiga.

Po Dennettu je religija sicer evolucijsko koristna, čeprav ima tudi negativne stranske pojave, ki v današnjem času prerastejo koristi. Pravzaprav je mnenja, da so ti stranski pojavi brez smisla, ostanek pradavnega praznoverja, v splošnem pa je nenaklonjen verovanju.

Bolj zanimiva je njegova razlaga glede drugih ljudi, npr. umrlih sorodnikov in znancev. Vsi ljudje naj bi imeli v glavah del možganov rezerviranih za posebne ljudi in ti deli možganov se samostojno obnašajo, kot Minskyjevi agenti. Če se nam torej zdi, da govorijo ali nam projecirajo kakšne misli v naše, potem se oglaša ta del možganov kot samostojni program, inteligentni agent v računalništvu ali samostojni programi v filmu Matrica.



Slika 3: Dennett je pričakovano ostaja kritičen do "zastarelosti" naukov verovanja, kljub temu pa opiše kar nekaj zanimivih hipotez.

4 ZAKLJUČEK

Dennett je nesporno eden najpomembnejših kognitivnih znanstvenikov in nesporno sposoben pisati o kognitivnih pojavih, pa naj bo to zavest, računski obrat ali analiza verovanja. Večino njegovih misli in trditev je možno bolj ali manj sprejeti kot trenutno najbolj razvito znanstveno stanje naših znanj o omenjenih problematikah. Kljub temu se zdi, da je včasih nekoliko preveč prepričan, da je možno zgraditi resnično inteligentne razunalniške sisteme, saj za začetek ne postavlja posebnih dodatnih zahtev na njegove mnogotere poskuse. Če in ko bodo postali računalniki inteligentni, bomo lahko rekli, da je imel Dennett prav, morda pa se bo izkazalo, da morajo biti digitalni računalniki bistveno izboljšani, s pomembnim kvalitativnim preskokom, da bodo res lahko inteligentni, kot recimo trdi avtor tega prispevka. Po drugi strani pa lahko le čestitam Dennettu za množico zanimivihprispevkov in misli.

Literatura

D.J. Chalmers, The Conscious Mind - In Search of a Fundamental Theory, Oxford Press, 1996.

D.C. Dennett, Consciousness Explained, Little Brown, 1991.

D. Dennett, Breaking the Spell: Religion as a Natural Phenomenon Viking Adult, 2006.

H.L. Dreyfus, What Computers Can't Do, Harper and Row, 1979.

G.M. Edelman, G. Tononi, A universe of consciousness, BB, 274 pps, 2000.

M. Gams, Weak intelligence: Through the principle and paradox of multiple knowledge, Advances in computation: Theory and practice, Volume 6, Nova science publishers, inc., NY, ISBN 1-56072-898-1, pp. 245, 2001.

Minds and Machines, Vol. 16, No. 1, February 2006.

M. Minsky, The Society of Mind, Simon and Schuster, New York, 1987.

M. Minsky, "Society of mind: a response to four reviews", Artificial Intelligence 48, pp. 371-396, 1991.

B. Uzgalis, Interview with Daniel Dennett at MIT, Mind and Machines, vol. 16, no. 1, pp. 7-19, 2006.

P. Wegner, Why Interaction is More Powerful than Computing, Communications of the ACM, Vol. 40, No. 5, pp. 81-91, May 1997.

Refleksija raziskovanja prepoznavanja povezanosti med biografskim potekom in odločitvijo za poklic pomoči

Mija Marija Klemenčič
Oddelek za socialno pedagogiko, Univerza v Ljubljani
Kardeljeva pl. 16, SI-1000 Ljubljana
e-mail: mija-marija.klemencic@guest.arnes.si

POVZETEK

Prispevek prikazuje refleksijo do sedaj izvedenega raziskovalnega procesa prepoznavanja povezanosti med biografskim potekom in odločitvijo za poklic pomoči. To prepoznavanje je eden od načinov, kako strokovnjak vzpostavlja zavedanje, da je v pomočniški situaciji vsakokrat vpleten ne le s stališča »tukaj in zdaj«, temveč tudi s stališča preteklih izkušenj, ki ga v temelju zaznamujejo. Zavedanje soudeleženosti strokovnjaka je eden od konceptov sodobnih teoretičnih usmeritev v poklicih pomoči in omogoča enakovredno pozicijo vseh udeleženih. V prikazu raziskovanja omenjenega pojava je predstavljen kvantitativen in kvalitativen pristop in kritična opredelitev do njiju. V zaključku prispevka je nakazana smer nadaljevanja raziskovanja s pristopom prvoosebnega raziskovanja.

1 Uvod

V sodobnih teorijah o pomočniškem delu oz. znotraj velikega števila t.i. semi-profesij, kot denimo socialno delo, nega, psihoterapija itd. (Deverell in Sharma, 2000) je danes strokovnost konceptualizirana na drugačen način v primerjavi s koncepti strokovnosti v njihovih začetkih. Ta razlika ni zgolj posledica razvijanja novih konceptov in modelov dela, temveč predvsem posledica spremembe temeljne paradigme, na katerih so znanosti teh strok temeljile. Prvotna paradigma znanosti, na katerih so bile osnovane teorije pomočniškega dela, je bila objektivistično oz. pozitivistično naravnana, teorije poklicev pomoči pa so vneto poskušale doseči objektivnost in zanesljivost dobljenih podatkov, od tod pa konceptualizirati »pravilne« diagnoze in najbolj natančne kategorizacije posameznih oblik patologij (Šugman Bohinc, 1997).

Semi-profesije so se dolgo spopadale s tem, da kompleksnosti prakse znotraj njihove stroke ni bilo moč zreducirati na eksaktno preverljive znanstvene teorije (Redmond, 2004). Praksa, pa tudi rezultati raziskav, so pokazali, da je tako variabilno polje, kot so doživljanje stiske in njeni izidi, težko enotno kategorizirati, saj na to vpliva kompleksen preplet bioloških, osebnih in socialnih dejavnikov. Teorija vseživljenjskega razvoja, ena od sodobnih teorij razvojne psihologije, izpostavlja, da v vseh razvojnih obdobjih lahko posameznikov razvoj zavzame veliko oblik glede na to, kako se posameznikova biološka zgodovina in pretekli vplivi okolja skladajo s trenutnimi življenjskimi pogoji. Razvoj ostane spremenljiv skozi celo življenje, različni razvojni izidi pa so lahko doseženi na različne načine ali kombinacijo načinov (Baltes, Lindenberger & Staudinger, 1998). Stroke pomoči so prišle do točke, ko so ugotovile, da sistemi, s katerimi se ukvarjajo, niso trivialni (Kordeš, 2004) in zahtevajo drugačen, dinamičen in celosten pristop. Te stroke so (vsaj večinoma) namesto objektivistične sprejele hermenevtično epistemologijo. Njihova spremenjena paradigma se kaže v spremenjenih pojmovanjih sistemov, s katerimi se ukvarjajo. Pomeni niso več enoznačni in predpisani od zunaj, udeleženi pomene soustvarjamo s konverzacijo, opazovalci soustvarjamo dogajanje, ugotovitve veljajo za posamezne situacije in jih ne moremo posploševati na cel svet – saj ni sveta tam zunaj, je zgolj ta, ki ga skupaj ustvarjamo.

Znotraj tako spremenjene paradigme se je spremenila definicija strokovnosti oz. profesionalnega delovanja v poklicih pomoči. Nova definicija vključuje (tako kot prvotna) strokovno znanje in veščine, tisto, kar je hermenevtično in novo, pa je poudarek na strokovnjakovem prepoznavanju pomembnosti sebe oz. lastnih osebnostnih kvalitet, med njimi pa še posebej lastnih interpersonalnih sposobnosti ter intuicije (Williams, 1993, po Deverell in Sharma, 2000). Iz predhodnega strokovnjaka, ki je težil k temu, da bi bil nevključen v dogajanje in »tisti, ki ve«, se sodoben strokovnjak zaveda, da je vključen in da s svojim doprinosom enakovredno soustvarja vsako situacijo v razmerju z uporabnikom in zavzema držo »nevednega strokovnjaka« (Šugman Bohinc, 2003). »Nevedni strokovnjak« je odprt za vse nove pomene, ki mu jih vsaka situacija prinaša.

Sayyedi in O'Byrne (2003) za področje terapevtskega dela (zaradi narave pomočniškega dela to spoznanje posplošujem na ostale poklice pomoči) menita, da so tiste osebnostne kvalitete, zaradi katerih je strokovnjak uspešen pomočnik, hkrati tudi njegove najbolj ranljive teme, zaradi katerih lahko v poklicu doživlja stres. To razmišljanje se sklada razumevanjem odnosa med strokovnjakom in uporabnikom znotraj koncepta ranjenega zdravilca po Guggenbuhl-Craig (1997) ter možnostjo zlorabe moči, ki jo ima strokovnjak v pomočniškem odnosu. Namreč teme, pri katerih je strokovnjak lahko najbolj senzibilen ter empatičen do uporabnika, so hkrati tiste, zaradi katerih lahko zavzame tudi najbolj neetično držo do njega (Kahn, 1991). Temu se lahko izogne zgolj s stalnim reflektiranjem in zavedanjem, da je kot strokovnjak vsakokrat vpleten v situacijo, ne le s stališča »tukaj in zdaj«, temveč tudi s stališča preteklih izkušenj, ki ga v temelju zaznamujejo. Prepoznavanje povezanosti biografskega poteka z odločitvijo za poklic pomoči je pomembno ravno zaradi vzpostavljanja tega zavedanja.

Prepoznavanje te povezanosti je tema mojega zanimanja že iz začetka študijskih let. V nadaljevanju bom predstavila poskuse, kako sem temo raziskovala in kje v raziskovalnem procesu sem sedaj.

2 Primer kvantitativnega pristopa

Sprva sem se teme lotila v presečni medkulturni študiji, kjer sem uporabila kvantitativno metodologijo. Namen raziskave je bila primerjava med danskimi in slovenskimi študentkami socialne pedagogike glede njihovega prepoznavanja motivov za odločitev za poklic pomoči ter prepoznavanja lastnih po izvoru nezavednih motivov pri delu z uporabniki. Uporabljeni parametri primerjave so bili: izobraževalni sistem (glede na različne usmeritve le-tega na Danskem in v Sloveniji ter glede na letnik študija), opravljanje dejavnosti samospoznavanja ter kraj bivanja (pri starših, v študentskem domu ipd., sam).

Vzorec je bil neslučajnosten, velik in namenski z numerusom 125. Sestavljalo ga je 62 študentk 1. in 4. letnika socialne pedagogike na Gentofte Seminarium v Hellerupu, Copenhagen na Danskem ter 63 študentk 1. in 4. letnika socialne pedagogike na Pedagoški fakulteti v Ljubljani, v Sloveniji, v času februarja in marca 2004 v študijskem letu 2003/04. Uporabljen je bil *Vprašalnik o študiju in poklicu socialne pedagoginje/pedagoga*, sestavljen za namen tega raziskovalnega dela in predhodno preverjen v pilotski raziskavi. Vprašalnik sem analizirala s faktorsko analizo. Za ugotavljanje statistično pomembnih razlik med podskupinami vzorca glede tako dobljenih smiselno interpretabilnih faktorjev sem izvedla multivariantno analizo variance MANOVA.

Rezultati raziskave so pokazali, da imata izobraževanje ter opravljanje dejavnosti samospoznavanja največji vpliv na prepoznavanje lastnih motivov za odločitev za poklic socialne pedagoginje ter prepoznavanje možnih načinov vedenj in čutenj do uporabnikov pri lastnem prihodnjem delu. Kraj bivanja ne vpliva toliko na te motive in je hkrati njegov vpliv najtežje pojasniti.

Izobraževalni proces vpliva na prepoznavanje motivov za odločitev za poklic pomoči s svojimi lastnostmi. V Sloveniji je to usmerjenost v spoznavanje samega sebe, na Danskem pa je tradicija tega izobraževanja dolgotrajnejša, tako da lahko deluje kot točka identifikacije v prihodnosti. Vpliv izobraževalnega procesa je viden tudi skozi razlike, ki so se pokazale med študentkami prvih in četrtih letnikov. Izobraževanje vpliva na prepoznavanje doprinosa lastne družinske vloge (preteklost ranjenega zdravilca) in želje po spreminjanju same sebe kot motiva za izbiro poklica, prav tako pa vpliva na prepoznavanje občutij zadovoljstva kot motiva za poklic pomoči in motivov po moči, ki za njim stojijo.

Pokazal se je velik vpliv izobraževanja na prepoznavanje možnih načinov vedenj in čutenj do uporabnikov pri lastnem prihodnjem delu. Izobraževanje vpliva na to prepoznavanje s svojo teoretično usmeritvijo, na kateri temelji. V Sloveniji je v primerjavi z Dansko v ozadju socialnopedagoške stroke močna psihodinamska paradigma, zato je razumljivo, da prihodnje slovenske strokovnjakinje vsaj na racionalni ravni prepoznavajo možne oblike vedenja z uporabnikom, ki izhajajo iz koncepta kontratransferja. Razlike med študentkami različnih letnikov pa pokažejo, da izobraževanje ne glede na teoretsko usmeritev vpliva na zavedanje lastne pristranskosti pri delu z uporabniki, kar je verjetno posledica v izobraževalnem procesu reflektiranih izkušenj iz prakse oz. prostovoljnega dela.

Podobno velik vpliv, kot ga ima izobraževanje na prepoznavanje motivov za odločitev za poklic pomoči in lastno prihodnje delo, imajo tudi dejavnosti samospoznavanja. Več ko opravlja prihodnji strokovnjak dejavnosti samospoznavanja, bolj prepoznava želji po spreminjanju samega sebe in po strokovnem pristopu k delu kot motiva za odločitev za poklic socialnega pedagoga, ki sta lahko tudi posledica opravljanja teh dejavnosti. Prepoznava pa bolj tudi naključno odločitev. Če nekoliko špekuliram, lahko rečem, da naključna odločitev ne izključuje možnosti, da se ne bi odločil za kak drug poklic pomoči. Večje število dejavnosti samospoznavanja pa vpliva tudi na prepoznavanje možnih vedenj in čutenj pri prihodnjem delu z uporabniki. Pri slednjih število dejavnosti samospoznavanja najbolj vpliva na zavedanje odvisnosti lastne samopodobe od uporabnika ter na zavedanje o pomenu potencialne spolnosti z uporabniki pri prihodnjem delu. Nedvomno sta to dve temi, ki terjata od posameznika precej emocionalnega napora, zato je pričakovati, da se ju bolj zavedajo tisti prihodnji strokovnjaki, ki se bolj samospoznavajo.

Kraj bivanja nima izrazitega vpliva na prepoznavanje motivov za odločitev za poklic pomoči ter lastnih po izvoru nezavednih vsebin pri delu z uporabniki. Vpliva pa na željo po spreminjanju same sebe kot vzrok za izbiro poklica ter na prepoznavanje nekaterih po izvoru nezavednih vsebin pri prihodnjem delu z uporabniki.

Ugotovila sem, da se odnos glede prepoznavanja vzrokov za poklic pomoči in vzrokov za možna ravnanja v zvezi s prihodnjim delom med študentkami prvih in četrtih letnikov v Sloveniji ne razlikuje od odnosa med temi študentkami na Danskem. Tudi dejavnosti samospoznavanja ne vplivajo na odnos med tistimi študentkami v Sloveniji ki se bolj, in študentkami, ki se manj samospoznavajo in na Danskem. Prav tako se odnos med študentkami, ki živijo same ali pri starših, glede omenjenih tem v Sloveniji ne razlikuje od odnosa med študentkami na Danskem.

Kljub temu, da so ugotovitve raziskave privedle do enega od vpogledov v raziskovano tematiko, pa opredeljujejo posamezne parametre raziskovanja (denimo izobraževanja, samospoznavanja) dokaj kategorično in puščajo precej odprtih vprašanj glede tega, kako raznoliko je področje vsakega od parametrov glede vplivanja na raziskovano tematiko. Da bi dobila vpogled v »žive zgodbe«, sem izvedla še kvalitativno študijo.

3 Primer kvalitativnega pristopa

Namen kvalitativne analize je bil raziskati posameznikovo doživljanje povezave med lastno biografsko preteklostjo ter odločitvijo za študij socialne pedagogike. Znotraj tako zastavljenega namena sem fokus analize opredelila po treh ključnih področjih: (a) samoprezentacijo lastnega biografskega poteka, (b) razlago izbire študija socialne pedagogike ter (c) eksplicitno ali implicitno prepoznavanje povezave med različnimi značilnostmi, elementi ali dinamiko lastnega biografskega poteka ter različnimi značilnostmi poteka odločitve za študij socialne pedagogike.

Vzorec so predstavljale tri študentke in en študent[1] socialne pedagogike v študijskem letu 2003/04 in sicer dve študentki prvega ter dve študentki zadnjega letnika. Za pridobivanje podatkov je bila uporabljena metoda spraševanja, znotraj te pa kvalitativna tehnika zbiranja podatkov – delno strukturiran osebni intervju. Ta je pokrival naslednja področja posameznikovega doživljanja: o sebi, moja družina, prijatelji in partnerski odnos, potek izbire študija, jaz kot bodoča socialna pedagoginja, moj lik uspešne in neuspešne socialne pedagoginje.

Študentkam, ki se usposabljajo za poklic socialne pedagoginje, prihodnji poklic pomeni del lastnega osebnega poslanstva in ga doživljajo kot zelo pomembnega. V predstavi o prihodnjem poklicu je glede na pomembnost na prvem mestu uspeh na strokovnem področju, ki jim pomeni

[1] Da se ne bi razkrila identiteta, saj je v vsakem letnik po en študent, tudi njegove izjave pišem v ženskem spolu.

osebno zadovoljstvo. Študentki četrtega letnika se ne čutita dovolj usposobljeni za delo, kar je lahko posledica dejstva, da je socialna pedagogika v slovenskem prostoru mlada veda in zato ne nudi občutka pripadnosti velikemu strokovnemu polju. Študentke imajo razvito jasno podobo o uspešnem in neuspešnem delu in z njim povezanim likom uspešnega ter neuspešnega strokovnjaka. Iz tega bi lahko izvedla sklep, da pri sogovornicah ni prisotne negotovosti glede občutka kompetentnosti za delo (kar pa je očitno v nasprotju z zgornjim). Vendar so te jasne predstave lahko v funkciji zakrivanja negotovosti o predstavi o prihodnjem strokovnem delu, saj so izražene zelo eksplicitno in predvsem postavljajo visoke kriterije strokovnemu delu. To so npr. strokovnjak mora biti prijazen, ne impulziven, razmejevati mora probleme, empatičen, nuditi mora toplino, obvladan… Sicer je pri sogovornicah deloma prisotno zavedanje, da so to previsoka pričakovanja, vendar to zavedanje ostaja na ravni racionalnega, medtem ko emocionalno preferirajo idealno socialno pedagoginjo.

Študentke posredno prepoznavajo vpliv lastnega biografskega poteka na izbiro študija, ne navajajo pa eksplicitno povezave med posameznimi elementi biografskega poteka ter odločitvijo za študij (razen vpliva drugih oseb pri izbiri študija). Z odločitvijo za poklic neposredno povezujejo le željo po pomoči ljudem, kar je zaznamovalo njihov biografski potek že pred izbiro študija. Četudi dopuščajo možnost, da se za tem nahajajo še drugi motivi po pomoči, pa jih ne prepoznavajo oz. ne prepoznavajo od kod izvira ta želja po delu z ljudmi in pomoči. Prepoznavajo pa občutke krivde, če ne pomagajo posamezniku v stiski.

Sogovornice se med seboj razlikujejo glede dogodkov v družini, partnerski zvezi in pomenu prijateljskih stikov. Nekatere so imele vlogo skrbnika v lastni družini, vlogo emocionalnega partnerja enemu od staršev, vlogo svetovalca v prijateljskih odnosih itd. Vendar pa je vsem skupna značilnost, da so se jim v biografskem poteku pripetili boleči osebne izgube, katerih bolečino, šok in travmatičnost jasno prepoznavajo. Študentke menijo, da so se zaradi teh dogodkov precej spremenile, posredno pa jih prepoznavajo tudi kot pomembne za prihodnje strokovno delo. Vendar pa so izgube sestavni del biografskega poteka in zato ne morem trditi, da obstajajo razlike med študentkami, ki so se odločile za poklic pomoči ter študentkami, ki so se odločile za druge poklice, saj pričujoče delo ne ponuja primerjave med njimi.

4 Zaključek

Kvalitativni pristop k raziskovanju prepoznavanja povezanosti med biografskim potekom in odločitvijo za poklic pomoči mi je sicer odstrl različne vidike doživljanja te povezanosti in posledično prepoznavanja te, predvsem kar se tiče intersubjektivnih razlik med sogovorniki. Ostaja pa mi še vedno dilema, da je po zaključeni kvalitativni analizi ustvarjena utemeljena teorija, izvedena iz spoznanj pridobljenih na osnovi razgovorov zgolj s temi posamezniki, ki so bili zajeti v raziskavo. Ali povedano drugače; tako ustvarjena teorija je veljavna zgolj za te posameznike (to je temeljna značilnost utemeljene teorije), in z vidika raziskovanja tega pojava se mi tako odstre zgolj en segment.

Za sklep povedanega vidim problem kvantitativnega pristopa v tem: i) da je težko sestaviti primeren instrument, ki bi meril tako subtilno področje kot je prepoznavanje povezanosti med biografskim potekom in odločitvijo za poklic pomoči, ii) kako (in če sploh) tako dobljeni rezultati pripomorejo k razvoju refleksije znotraj posameznih strok pomoči, (rezultati govorijo o splošnih vzorcih, ki nič ne povedo o posameznem strokovnjaku in njegovem zavedanju), iii) kar bi moralo biti pravzaprav zapisano kot prvi pomislek: je sploh možno to tematiko razumeti (in posledično meriti) skozi koncepte objektivističnih predpostavk, če pa je vendarle očitno, da človekovo delovanje ni algoritmično. Kvalitativen pristop se je izkazal sicer za bolj uporabnega, saj je njegov domet v ustvarjanju teorije, ki velja za vključene posameznike. Vendar pa tudi ta pristop ne upošteva vključenosti raziskovalca, tj. ne upošteva temeljne zakonitosti tega, kar raziskuje. Če sem v uvodu zapisala, da novo pojmovanje strokovnosti opredeljuje pomočniški odnos, kot odnos, ki ga aktivno soustvarjata oba udeležena – strokovnjak in uporabnik kot enakovredna partnerja, potem gledano iz metapozicije, bi morala biti (sledeč tej predpostavki) tudi sama kot raziskovalka vključena v raziskovalno situacijo, saj jo tekom intervjuja tudi jaz sooblikujem. Tako se mi na tej točki raziskovanja kot odgovor na vprašanje, kako metodološko najustrezneje pristopiti k problemu, pojavlja ena od možnosti prvoosebno raziskovanje, torej raziskovanje, kjer bom sproti reflektirala tudi svoj doprinos. Zaradi spremenjenega položaja raziskovalca v tem raziskovanju, pa vidim kot prvi korak za nadaljnje raziskovanje refleksijo prepoznavanja moje povezanosti med lastnim biografskim potekom in motivi za odločitev za poklic pomoči. S tem predvidevam, da bom poskusila spremeniti pozicijo »od zunaj opazujočega« v »ves čas udeleženega« raziskovalca, ki reflektira svojo udeležbo.

Literatura

Baltes, P.B., Lindenberger, U. & Staudinger, U. M. (1998). Life-span theory in developmental psychology. In W. Damon & R. M. Lerner (Eds.): Theoretical Models of Human Development. New York: John Wiley & Sons, Inc.

Deverell, K. in Sharma, U. (2000). Professionalism in everyday practise: Issues of trust, experiences and boundaries. In N. Malin (Ed.), *Professionalism, Boundaries and the Workplace*. London and New York: Routledge.

Guggenbühl-Craig, A. (1997). *Pomoč ali premoč: psihologija in patologija medčloveških odnosov pri delu z ljudmi*. Ljubljana: Fors, Založba Sophia.

Kahn, M. (1991). *Between Therapist and Client: The New Relationship*. New York: W. H. Freeman and Company.

Kordeš, U. (2004). *Od resnice k zaupanju*. Ljubljana: Studia humanitatis.

Redmond, B. (2004). *Reflection in Action. Developing Reflective Practice in Health and Social Services.* Burlington, Aldershot: Ashgate.

Sayyedi, M. in O'Byrne, K. (2003). Therapist: Heal Thyself! V J. A. Kottler in W. P. Jones (ur.), *Doing better: Improving Clinical Skills and Professional Competence.* New York and Hove: Brunner-Routlwedge.

Šugman Bohinc, L. (1997). Epistemologija socialnega dela. *Socialno delo 36, (4),* 289–308.

Šugman Bohinc, L. (2003). Pripovedovanje zgodb v socialnem svetovanju in psihoterapiji. *Socialno delo 42, (6),* 377–383.

NEKATERI METODOLOŠKI IN EPISTEMOLOŠKI PROBLEMI HIPOTEZE KOGNITIVIZMA
(kognitivistične hipoteze)

Žiga Knap
Oddelek za filozofijo, Filozofska fakulteta,
Aškerčeva 2, Ljubljanja, Slovenija
ziga.knap@guest.arnes.si

POVZETEK

Besedilo problematizira t.i. računalniško metaforo, na kateri sloni pretežni del sodobne kognitivne znanosti. Predstavljena je hipoteza, da gre z jezikovni problem (vzeto v širšem smislu).

Varela, Thompson in Rosch (1991, str.40) formulirajo osrednjo hipotezo sodobne kognitivne znanosti. "Centralna intuicija v ozadju kognitivizma je trditev, da je inteligenca - vključeno z inteligenco človeka - podobna računanju (ang. computation) v svojih bistvenih lastnostih, tako da kognicijo dejansko lahko definiramo kot računanje s simboličnimi reprezentacijami."

Opravka imamo s simboličnim računanjem (symbolic computation). Simboli /znaki/ imajo hkrati dve lastnosti, namreč so fizični in jim pripada tudi semantična vrednost. Računanje v tem kontekstu pomeni operacije nad/s simboli z upoštevanjem semantične vrednosti simbolov (semantika nalaga tudi določene omejitve na operacije s simboli). Računanje je v osnovi semantična operacija, mi ne moremo osmisliti pojem računanja (kot opozicijo slučajih ali poljubnih operacij nad simboli) ne da bi bili pozorni na semantične odnose med simbolnimi izrazi. Poudarimo, da računalnik dela operacije samo nad fizičnimi formami (predstavniki, reprezentanti) simbolov, ki jih "preračunava", nikakor nima nobenega dostopa do semantičnih vrednosti simbolov. povezava računalnika s semantiko, posebno omejitve, ki jih nalaga semantika, je posredovana računalniku preko sintakse simbolnega jezika, zakodirana je v programu, program pa je napisal programer. V računalniku sintaksa zrcali oziroma je vzporedna z njej pripisani semantiki. Na prvi pogled se zdi, kot da imamo opravka z izomorfizmom, z izomorfno preslikavo semantike v sintakso. Zanimiv je v matematiki pojem izomorfnih prostorov, kjer imamo opravka s prostori (množicami v katerih veljajo neke operacije), ki so najrazličnejše narave, hkrati pa so v nekem ali nekaterih aspektih ekvivalentne, pragmatično to pomeni, da so nekateri teoremi veljavni v vseh teh prostorih (množicah). Sama ideja izomorfizma se zdi zelo privlačna, problem pa seveda ostaja (nerešen) v tem, kako formulirati semantiko in sintakso, da bosta to dva "izomorfna prostora". (V filozofiji nahajamo nekatere primere posplošitev modalnih logik v teorijah o možnih svetovih, kjer imamo opravka s prenosom nekaterih semantičnih problemov na sintaktične v nekem drugem nivoju.) (Na misel prihajajo nekatere ideje/teorije starih pri pojasnjevanju procesa našega gledanja s teorijo o miniaturnih slikah, ki prihajajo v našo zavest preko oči. Težko bi odrekli tej teoriji racionalnost, je pa seveda naivna in tudi falzificirana, kar ji edino daje pečat znanstvenosti)

Kognitivist trdi, da nam opisani paralelizem kaže, da je inteligenco in intencionalnost (semantika) možno modelirati na fizičnem in mehaničnem nivoju. Hipoteza torej trdi, da računalnik zagotavlja mehanični model mišljenja oziroma, da je mišljenje kar fizično, torej simbolično računanje. (S tem bi postala kognitivna znanost kar fizično, simbolično računaje!)

No, za adekvatno razumevanje hipoteze je ključnega pomena nivo, na katerem jo predlagamo uveljaviti. (Seveda kognitivist ne trdi, da če bi odprli nekomu glavo in pogledali možgane, bi tam našli majhne simbolčke s katerimi bi možgani mnipulirali.) Simbolični nivo, ki je realiziran fizično, ni mogoče (enostavno) reducirati na fizično.

Kaže, da se problem spet vrne kot svojevrsten jezikovni problem. Ali nam kaj pove tale citat iz

Wittgensteinovega Traktata "(2.0123) Če poznam predmet, poznam tudi vse možnosti njegove navzočnosti v stanjih stvari. (Vsaka takšna možnost mora biti v naravi predmeta.) Ni mogoče naknadno najti neke nove možnosti. (2.01231) Da bi spoznal kakšen predmet, mi sicer ni treba poznati njegovih zunanjih lastnosti - moram pa poznati vse njegove notranje lastnosti."

Literatura

- Knap Ž., Kordeš U.(1905) *Dialog o nekotoryh suščnostnyh aspektah konstruktivizma*, Filologičeskie zametki, Vypusk 3, Čast 2, Permskij gosuniversitet, Univerza v Ljubljani, Perm-Ljubljana (str. 242 - 253)

- Markič O. (2006) *Problem mentalne vzročnosti* (tekst bo objavljen v Filologičeskie zametki, Vypusk 4)

- Varela F.V., Thompson E., Rosch E. (1991) *The Embodid Mind. Cognitiv Science and Human Experience.* The MIT Press, Cambridge, Massachusetts, London

- Wittgenstein L. (1976) Logično filozofski traktat. Mladinska knjiga, Ljubljana

TEMELJNI KONCEPTI PSIHOANALIZE IN NJIHOV VIZUALNI EKVIVALENT: LACAN SKOZI HOLOGRAFIJO – UVOD

Pavel Koltaj
Oddelek za filozofijo, Filozofska fakulteta,
Aškerčeva 2, Ljubljanja, Slovenija
pkoltaj@yahoo.co.uk

POVZETEK

Prispevek se ukvarja s povezavo psihoanalize, prek Lacanove koncepcije pogleda, in holografije. Ideja je, da so določeni koncepti v holografiji analogni psihičnim procesom, ki jih psihoanaliza imenuje nezavedno, ponavljanje, transfer in pulzija. Združevanje psihoanalize in holografije pelje do, prej ne očitnih, a vendar bistvenih spoznanj o povezanosti delovanja človeške zavesti in zakonitosti vizualne percepcije. Spoznanja imajo svoj smisel v proučevanju kognicije v toliko, v kolikor je mogoče prek njih ponovno pretehtati ter dopolniti nekatere pristope, ki zagovarjajo tezo, da človeški možgani delujejo podobno kot hologram (npr. holonomični model Karla Pribrama)

Francoski teoretik Jacques Lacan je večino svojega ustvarjalnega napora posvetil elaboraciji Freudovih idej in njihovi premestitvi s kliničnega na spekulativno, filozofsko področje. Za psihoanalizo v splošnem lahko rečemo, da je predana ukvarjanju s človekom, pravzaprav subjektom in njegovim odnosom z okolico, zlasti drugim. V prid lažjega razumevanja in interpretacije pravkar omenjene problematike, je psihoanaliza, natančneje njen osnovatelj, Freud, razvil teoretsko ogrodje štirim ključnim procesom človeške zavesti, ki jih je detektiral v svoji praksi zdravljenja psihičnih bolezni. Poimenoval jih je: nezavedno, ponavljanje, transfer in pulzija. Prav s temi procesi, oziroma z njihovo teoretizacijo, se je ukvarjal Lacan v svojem XI., morda najbolj znanem seminarju, naslovljenem: *Štirje temeljni koncepti psihoanalize*. Okoli tega seminarja se bo vrtela večina besed pričujočega sestavka.

Poleg analize temeljnih konceptov in njihove interakcije, za katero je Lacan trdil, da je bistvena, si je vzel čas tudi za analizo polja pogleda, ki je po njem najbolj šolski primer subjektovega stika z drugim.
Na tem mestu velja opozoriti na določen problem. Ta je namreč v tem, da povezava med pogledom in temeljnimi koncepti psihoanalize ni bila nikoli zares dobro razložena. Lacan je sicer v ta namen svoj tekst posejal s številnimi skicami in topološkimi shemami, vendar pa so te, podobno kot psihoanaliza na sploh, precej kompleksne in težko razumljive.
Zaradi tega bom skušal z vpeljavo teorije holografije, ki se v optičnem smislu neposredno navezuje na Lacanove formulacije, poenostaviti odnos pogleda in štirih konceptov.

Preden se lotim konkretizacije primerjave psihoanalitskih konceptov in holografije, je potrebno podati nekaj uvodnih informacij o Lacanovem pojmovanju pogleda.

Lacanova bistvena teza, kar se tiče pogleda kot objet petit a[1] je, da venomer obstaja določen razkol, določena shizma med očesom in pogledom. Temu je tako, ker pogled venomer uhaja očesu. Uhaja mu, nekoliko poenostavljeno rečeno, zaradi razlike med svetlobo in podobo. Svetloba je tisto v kar ne moremo nikoli gledati neposredno. Neposreden vdor svetlobe lahko naše oko poškoduje. Zato potrebujemo, da bi videli podobo (sliko), nekakšen zaslon. Ta nam s svojo neprosojnostjo omogoča, da vidimo stvari v luči, da vidimo, lacanovsko rečeno, geometrični optični prostor s perspektivo, barvami in vsemi drugimi pritiklinami. Tako kot ga je definiral Lacan, deluje zaslon podobno kot zaslonka fotografskega aparata. Bolj ko zapremo zaslonko na objektivu aparata, bolj ko zastremo naš pogled, več vidimo. Povečuje se namreč globinsko polje našega pogleda.

[1] Objet petit a predstavlja v psihoanalizi instanco drugega. V kontekstu pogleda gre torej za odnos subjekta z drugim, prek pogleda.

Zaslon ima, poleg zastiranja našega pogleda, še eno pomembno lastnost; svetlobo tudi odbija. Deluje torej podobno kot ogledalo. Svetloba, ki odseva od zaslona, je svetloba našega pogleda, zaslon nam naš pogled vrne, omogoča nam, da na sliki vidimo tudi sebe.

Oba učinka delovanja zaslona je mogoče, podobno kot zaslon sam, opisati s pomočjo tehnike fotografiranja. Ko s svetlomerom[2] merimo svetlobo objekta, ki ga želimo fotografirati, imamo na voljo dve možnosti. Merimo lahko vpadno svetlobo, ki nam bo povedala kakšne nastavitve moramo izbrati, da bo naš objekt na sliki deloval skladno z okolico, da bo jasno vidno kaj je bolj osvetljeno in kaj manj (na ravni Lacanove interpretacije pogleda bi tu lahko govorili o geometralni sliki), ter odbojno svetlobo, ki nam bo povedala kakšne nastavitve moramo izbrati, da bo objekt, ki ga želimo slikati v kar najboljši luči. Ostali elementi slike bodo bodisi presvetljeni, bodisi podosvetljeni[3]. Znotraj Lacana bi lahko dejali, da bomo na sliki dobili le zaslon ali madež, kot ga tudi (na ravni slike) poimenuje.

Zaradi odbojnosti zaslona pride v naše oko posredno, poleg pogleda, tudi svetloba. Prav zaradi tega dejstva postavi Lacan dve trditvi. Skozi pogled sem foto-grafiran, tu se nanaša na okoliščino, da svetloba pride v oko od zunaj, in pogled je venomer izven mene, tu se nanaša na okoliščino, da je pravzaprav pogled tisti, ki me gleda, saj me foto-grafira, in ne jaz sam. Ti dve trditvi imata v polju psihoanalize močan učinek, nenazadnje iz njiju Lacan izpelje tezo, da je podoba v resnici le iluzija, da imamo oči zato, da bi ne videli, da nas (drugi) vidijo, vendar na tem mestu, zaradi prostorskih omejitev in v drugo smer težečih namenov tega pisanja, ideje ne bom razvijal dlje.

Čas je, da se nekoliko pomudim pri dveh podobah, za kateri se mi zdi, da imenitno prikazujeta povezanost psihoanalize in holografije. Prva je reprodukcija slike Hansa Holbeina *Ambasadorja* iz leta 1533 (slika 1). Nastala je v času, ko so raziskave geometrične optike omogočile načine za dokaj natančno določanje pravilne perspektive. Omenim naj samo slovita Dührerjeva vratca. Zaradi teh raziskav je postalo vse bolj popularno igranje s perspektivo ali tako imenovane *anamorfoze*. Lacan jim pripiše mesto vpeljave pogleda na sliko.

Na Holbeinovi sliki vidimo dva človeka, ob katerih so številni predmeti, ki, v duhu časa nastanka slike, simbolizirajo učenost in umetnost. Na dnu slike, pod moškima figurama in predmeti je viden madež. Popačenje, ki mu sprva ne znamo pripisati nikakršne smiselne oblike. Šele ko na madež pogledamo s pravega zornega kota[4] vidimo, da je ta v resnici mrtvaška lobanja, narisana v drugačni perspektivi kot preostala slika. Potreba po tem, da sliko ošvrknemo s pravim pogledom in vidimo lobanjo, ki mimogrede aludira na ničevost (*vanitatis*) učenosti in umetnosti, ki obkroža ambasadorja, je dovolj zgovorna pričevalka v prid Lacanovi koncepciji pogleda.

Druga podoba je diagram postopka zajema holograma (slika 2). Na njem vidimo kako z uporabo laserskega žarka, ki ga razcepimo na objektni in referenčni žarek; eden osvetljuje objekt in se z njega odbija na fotografsko ploščo, drugi pa potuje neposredno na ploščo, dobimo tako imenovani pojav interference, ki se zapiše na ploščo. Prav interferenca je tista, ki ob kasnejši osvetlitvi holograma s strani, s katere je nanj padal referenčni žarek, omogoča gledalcu da vidi tridimenzionalne, prostorske podobe, ki jih za razliko od (običajnih) fotografij loči to, da imajo paralakso[5]. Hologrami v principu niso nič drugega kot podobe praznega prostora izvornega objekta, ki ga obkroža svetloba[6]. Nekoliko strukturalističnemu manku podoben pojav, ki poleg tega, da spominja na *vanitatis* Holbeinove slike nosi tudi druge analogije v psihoanalizi, h katerim se še vrnemo.

Prišli smo do točke, kjer lahko začnemo s primerjavo. Zaradi potrebe po precej dolgem uvodu v nekoliko

2 Govor je o ročnem svetlomeru. Tisti, ki so vgrajeni v aparate so le okrnjena različica ročnih, saj, bolj ali manj natančno, merijo le odbito svetlobo objekta.

3 V primeru, da so elementi okoli objekta enako odsevni kot objekt sam, se slika ne bo razlikovala od tiste, pri kateri bi merili vpadno svetlobo. Taki primeri so v praksi precej redki.

4 O tem, kako je potrebno *Dva ambasadorja* pogledati, da vidimo, kaj madež predstavlja, je obširno pisal Jurgis Baltrušaitis. Slika je bila postavljena v dvorano z dvema vhodoma. Obiskovalec je vanjo vstopil skozi desnega. Sliko si je lahko natančno ogledal. Običajno je opazil madež, ni pa ga znal razvozlati. Ko je zapuščal sobo, skozi leva vrata, se je še enkrat ozrl na sliko. Takrat, ko je glavo obračal z leve proti desni, je lahko zagledal, kaj madež je.

5 Paralaksa je sposobnost videti okoli predmetov.

6 Dejstvo, da v laboratorijskih pogojih, ob pripravi zajetja holograma, pravega objekta v ničemer ne moremo ločiti od laserske hologramske slike, nam pove, do katere mere so lahko slike, ki nam jih posredujejo naše oči, iluzorične.

neobičajno tematiko in skoposti odmerjenega prostora, ki mi je na voljo, bom nekoliko podrobneje opisal le en par holografsko-psihoanalitske naveze. Gre za analogijo med delovanjem laserja in pulzije.

Laser je naprava, ki oddaja posebno vrsto svetlobe in ki je v času izuma, v šestdesetih letih dvajsetega stoletja, omogočila bistven napredek pri izdelavi hologramov[7]. Ime laser je okrajšava za postopek ojačanja svetlobe s stimulirano emisijo (elektromagnetnega) sevanja (Light Amplification by Stimulated Emission of (electromagnetic) Radiation). Svetlobo laserja odlikujejo zlasti tri lastnosti. Najpomembnejša je, da je laserska svetloba najbolj **koherentna** svetloba, kar jih poznamo. To pomeni, da ima njeno valovanje enako frekvenco, ali, z drugimi besedami, da so svetlobni valovi, ki jih oddaja laser, natanko iste moči in si sledijo v natanko enakih časovnih intervalih. Druga bistvena lastnost laserske svetlobe je, da je v fazi. Zaradi koherentnosti svetlobe je namreč njeno valovanje enakomerno, iz česar sledi, da sta, v primeru ko imamo opraviti z dvema različnimi valovanjema, obe v fazi, se medsebojno seštevata. Pojavu pravimo **konstruktivna interferenca** in se razlikuje od destruktivne, kjer se dve valovanji medsebojno izničujeta (glej sliko 3). Kvaliteten zapis holograma je mogoč le, če je interferenca med objektnim in referenčnim žarkom konstruktivna[8]. Tretja pomembna lastnost laserske svetlobe je, da je izrazito usmerjena. Fotoni v obliki snopa potujejo v isto smer.

Poglejmo si, kako pa je s pulzijo[9]. Ta je v psihoanalizi, grobo rečeno, sila, skozi katero se kažejo učinki nezavednega. Mogoče bi bilo najbolje za izhodišče opisa vzeti Lacanov stavek, v katerem se pulzija eksplicitno veže na preostale temeljne koncepte: **pulziranje nezavednega se veže na transfer prek želje**.

Poglejmo si stavek nekoliko bolj natančno. Pulziranje nezavednega pomeni njegovo učinkovanje, način, kako se nezavedno manifestira. No, torej, to pulziranje se veže na transfer. Transfer v psihoanalizi je instanca, kjer se srečata analitik in analizant. Subjekt in drugi. Lahko je pozitiven ali negativen, odvisno od tega, kako skladen je njun odnos. V resnici bi moral reči, odvisno od tega, kako skladne so njune želje, saj Lacanov stavek, ki ga interpretiramo pravi, da se pulziranje na transfer pripne prek želje. Želja je po Lacanu tisto, kar ne more biti nikoli zadovoljeno. Potešitev ene želje rodi drugo. Želja na ta način nepretrgoma drsi, se nam izmika. Na moč podobno, kot je bilo prej opaziti pri pogledu. Ker je zadovoljitev želje vedno neuspešna, ali v najboljšem primeru le deloma uspešna, je potrebno iskanje zadovoljitve ponoviti. Znova in znova. In tu se nahaja še četrti izmed temeljnih konceptov, ponavljanje.
Pulzija po Lacanu[10], je torej konstantna, venomer prisotna in stalna sila, ki pa ima, prav zaradi neuspeha

---

[7] Tehniko izdelave hologramov je leta 1948 izumil madžarski fizik Dennis Gabor, ki pa zaradi tega, ker ni imel na voljo dovolj kvalitetnega vira svetlobe, še zdaleč ni uspel narediti hologramov, ki bi se kosali s tistimi, nastalimi po izumu laserja.

[8] Interferenca prinaša še eno zanimivo lastnost hologramov. Ker je interferenčni vzorec med referenčnim in objektnim žarkom, ki se zapiše na hologram koherenten in konstruktiven, je v vsakem delcu hologramskega zapisa shranjena celota holograma. V praksi to pomeni, da lahko poljubni hologram na primer prerežemo napol, pa vseeno iz njega, ko ga osvetlimo, dobimo celotno sliko, le pol manjša je. Prav na podlagi tega pojava je Karl Pribram razvil svojo tezo o hologramskem delovanju človeških možganov in spomina.
Smešno je, da je približno stoletje pred njim, na podlagi primerljivih izkušenj, tudi Freud prišel do svoje teorije nezavednega, v kateri se prav tako vsak del ujema s celoto. Ne smemo namreč pozabiti na dejstvo, da je Freud začel svojo kariero kot nevrolog. V svojem delu v Brückejevem laboratoriju je, ob proučevanju afazij opravil nalogo, eno izmed zadnjih, ki se jih je kot nevrolog lotil, klasifikacije izsledkov o povezanosti različnih delov možganov z njihovimi funkcijami. Zaradi zelo nasprotujočih se trditev številnih avtorjev o tem, kateri del možganov je namenjen čemu, je prišel do zaključka, da ne obstajajo posamezni centri v možganih, ki so nujno vezani na določene funkcije, saj lahko možgani te funkcije normalno opravljajo tudi takrat, ko del možganov, ki naj bi bil namenjen njihovemu nadzoru, manjka. Iz te ugotovitve je potegnil sklep, ki je bil bistven, ne samo za razvoj ideje o nezavednem, temveč tudi za precej širše področje. Freud je namreč postavil, v svojem času zelo radikalno tezo, da izvor afazij ni organske (torej somatske) narave, temveč funkcionalne.
Ko je nekaj let kasneje pisal *Tri razprave o teoriji seksualnosti*, je svojo trditev ponovil, dejal je, da problem nevroz ni v tem, da bi šlo za kakšno telesno okvaro, temveč le za pretirano difunkcionalnost. Prevedeno v jezik holografije bi to pomenilo, da smo zdravi, kadar je naša psiha interferenčno konstruktivna, bolani pa, kadar je interferenčno destruktivna.

[9] Freud je proces, ki ga je Lacan poimenoval *pulsion*, imenoval *Trieb*.

[10] Opozorim naj, da kljub temu, da večino pojasnitev psihoanalitskih terminov pripisujem Lacanu, te, v podobni obliki, obstajajo že pri samem Freudu.

zadovoljitve želje, v sebi številna mala ponavljanja, variacije. Če jo želimo predstaviti v optičnem smislu, dobimo diagram, ki je praktično identičen sliki valovanja. Ko se pulzija iz svojega vira (roba) dvigne iz subjekta in obkroži objekt (a), se (nepotešna) zopet vrne v svoj izvor. In potem ponovno vznikne (glej sliko 4).

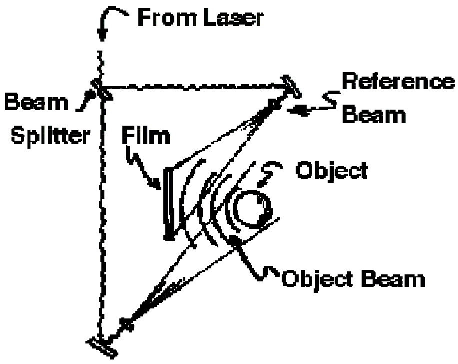
Bliža se konec. Preden zaključim, bi želel navesti le še en primer, prek katerega bo, upam, jasneje, kako se lahko povezujejo tako različne stvari kot je konstantnost pulzije in njeno variiranje, pomen shizme očesa in pogleda, funkcija zaslona ter delovanje laserske svetlobe.
Predstavljajmo si računalniški, lahko tudi televizijski, zaslon. Slika, ki jo gledamo je na videz stalna, monolitna. Če želimo videti njeno pravo naravo, torej dejstvo, da gre za podobo, ki se nenehno osvežuje, nenehno ponovno nalaga, je potrebno oči odvrniti od ekrana in pogledati mimo njega. Šele takrat v kotu naših oči, na predelu, ki ga zaseda zaslon, mimo katerega poskušamo gledati, vidimo, da slika dejansko migeta[11].

Reference

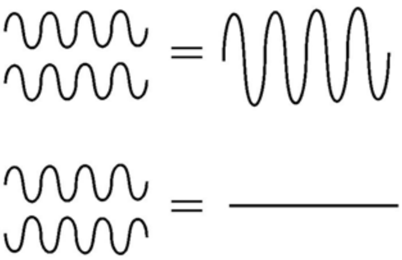
DeFreitas, Frank in Rhody, Alan in Michael, Steve: Shoebox Holography, Ross Books, Berkley 2000.
Jones, Ernest: Život i delo Sigmunda Frojda I-II, Matica srpska, Beograd 1985.
Lacan, Jacques: Štirje temeljni koncepti psihoanalize, Analecta, Ljubljana 1996.
Oražem, Vito: Holografija in družba : o štirih aspektih likovne holografije, M'ars 4/1989, Ljubljana 1989.
Outwater, C. in E. Van hamersveld: Guide to Practical Holography, Pentangle Press, Beverly Hills 1974.

[11] Vsi zasloni utripajo. Res je, da novejši in zmogljivejši, tako računalniški kot televizijski, zasloni utripajo hitreje. Frekvenca nihanja je pogosto tako visoka, da naše oko utripanja ne zazna niti kadar gleda mimo zaslona. Vendar to še ne pomeni, da ponavljanja ni, le prevara pogleda je močnejša.

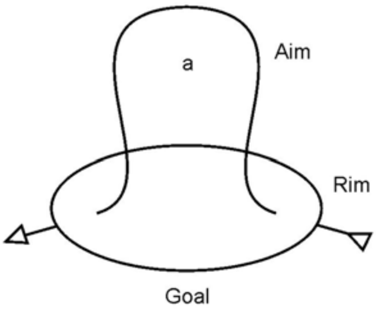
Slika 1: Ambasadorja (Hans Holbein)



Slika 2: Postopek zajema holograma



Slika 3: Konstruktivna in destruktivna interferenca



Slika 4: Shema pulzije

POROČILO O OKROGLI MIZI »MULTIDISCIPLINARNO O SPOMINU«

Urban Kordeš
Univerza v Ljubljani, Pedagoška fakulteta
urban.kordes@guest.arnes.si

Matej Černigoj
Univerza v Ljubljani, Filozofska fakulteta, Oddelek za psihologijo
matej.cernigoj@guest.arnes.si

Vid Vodušek
Univerza v Ljubljani, Filozofska fakulteta, Oddelek za psihologijo
vvvodusek@yahoo.com

Marko Bohanec
Institut Jožef Stefan, Ljubljana
marko.bohanec@ijs.*si*

Aleš Belič
Fakulteta za elektrotehniko, Laboratorij za modeliranje, simulacijo in vodenje
ales.belic@fe.uni-lj.si

Simon Brežan
Inštitut za klinično nevrofiziologijo, Klinični center Ljubljana
s_brezan@yahoo.com

Vita Štukovnik
Inštitut za klinično nevrofiziologijo, Klinični center Ljubljana
vita.stukovnik@kclj.si

POVZETEK

V okviru Slovenskega društva za kognitivne znanosti je bila v četrtek 1. 6. 2006 v hostelu Celica organizirana okrogla miza z naslovom »Multidisciplinarno o spominu«. Cilj okrogle mize je bil osvetliti isto kognitivno temo s čim več zornih kotov. Organizatorji smo želeli preizkusiti možnosti za dialog in povezovanje celotnega spektra disciplin, ki se ukvarjajo z raziskovanjem kognitivnih fenomenov. Zanimalo nas je, koliko se v praksi naše raziskovalne aktivnosti razlikujejo, kje se prekrivajo, (koliko) se med seboj razumemo in ali so kakšne možnosti za resnejše, bolj poglobljeno skupno raziskovalno delo.

Odziv na pobudo za debato je bil dokaj dober: na dogodek je prišlo kakšnih 30 udeležencev, aktivno so sodelovali nevrologi (D. Vodušek, Brežan, Štuhovnik), strokovnjaka s področja umetne inteligenca (Bohanec, Belič), filozofa (Ule, Markič), psihologa (Černigoj, V. Vodušek), fizik (Detela), biokemičarka (Žerovnik), metodolog (Kordeš) in drugi.

Udeleženci se strinjamo, da je bila debata zanimiva in nadvse raznolika. Pokazala pa je (še enkrat), da je do kognitivne znanosti kot samostojne in povezujoče disciplina še daleč. Zaenkrat smo še priča množici disciplin, ki vsaka na svoj način z večjimi ali manjšimi uspehi raziskuje pojave, povezane z duševnimi procesi. Razlike, ki jih bo morala kognitivna znanost preseči oziroma integrirati, če bo hotela postati samostojna veda niso samo razlike med besednjaki različnih ved; tudi niso le metodološke ali epistemološke razlike. Debata o spominu je pokazala, da se med raziskovalci s polja kognitivnih znanosti razlikujejo tudi predstave o samih ciljih raziskovanja.

V nadaljevanju predstavljam nekaj prispevkov, ki so bili tudi pisno predstavljeni. Ne bi si upal trditi, da lahko dodajo kaj bistveno novega na temo raziskovanja spomina, prav tako ne predstavljajo celovite predstavitve raziskovalnega dogajanja na tem področju. Dodajam jih predvsem kot metodološko ilustracijo, ki naj prikaže raznolikost stališč, načinov dela, metod in ciljev, ki se plete na polju raziskovanja kognitivnih pojavov.

Lahko bi rekel, da obstajajo (vsaj) tri možna poglavitna razlikovanja, s katerimi lahko opredelimo razlike med posameznimi raziskovalnimi praksami. Prva in verjetno najbolj fundamentalna je delitev glede na namen raziskovanja. Klasična znanstvena paradigma zahteva ločenost raziskovalca od objekta raziskovanja oziroma neodvisnost raziskovalca. V takšnem kontekstu nastajajo teorije, algoritmi, splošno veljavni opisi ipd. Področje raziskovanja zavesti pa se od ostalih znanstveni področij razlikuje po tem, da za raziskovanje »uporabljamo« fenomen, ki ga raziskujemo (kognicija oz. zavest). Predpostavka ločenosti je tu torej zelo problematična. Poraja se vprašanje kaj na tem področju pomeni »razumevanje pojava«, v kolikšni meri so možne končne teorije in koliko bi nam takšne teorije sploh koristile. Mar ne bi bilo smiselno namesto v splošnem, pri samem sebi raziskovati kognicijo, se učiti ali celo mojstriti v poznavanju njenih »pravil«, omejitev itd.? S slednjim se ukvarjajo t.i. prvoosebni pristopi, standardno znanstveno pot pa ubira t.i. tretjeosebno raziskovanje.

Dr. Matej Černigoj piše:

Pri preučevanju zavesti se moramo najprej vprašati, kaj s tem hočemo: hočemo vedeti, kaj zavest je, ali hočemo znati z njo ravnati, se v njej gibati? Združevanje tretjeosebnega in prvoosebnega raziskovanja zavesti je težavno zato, ker se ne zavedamo razlike v motivih teh dveh tipov raziskovanj.

Zanima me predvsem prvoosebno raziskovanje zavesti (motivira me torej možnost "ravnanja" z zavestjo) in kar se tiče konkretno raziskovanja spomina, me znotraj te usmeritve privlačita dve možnosti: (i) raziskovanje procesov ozaveščanja nezavednih vsebin (spominov) in (ii) ozaveščanje socilalne skonstruiranosti strukture in vsebin spomina.

Na to pa lahko navežem tudi razmišljanje o tem, kaj spomin je. Obe prejšnji točki namreč temeljita na predstavi o spominu, ki v osnovi ni "shranjevanje informacij", ampak je zgodovina strukturnega prilagajanja organizma na okolje. Po originalni definiciji je informacija redukcija negotovosti, kar nujno predpostavlja nekoga, ki je negotov, ta negotovost pa je vedno tako ali drugače vezana na naravo njegovega obstoja. S tem v debato o spominu vpeljujem teorijo avtopoeze in enaktivne usmeritve v kognitivni znanosti. To je širok pogled, pa vendar zajema le del možnosti, le tretjeosebni znanstveni del.

Prvoosebno raziskovanje je metodološko zelo problematično in je še v povojih (čeprav je tradicija poskusov na to temo že precej bogata). Vse ostale delitve, pa naj se zdijo še tako globoke, spadajo v kategorijo tretjeosebnega, objektivnega raziskovanja – tudi filozofska refleksija. V to kategorijo bi lahko uvrstili razpravo Vida Voduška, ki jo je naslovil »*O problemu reprezentacije*«

Pojem ali bolje metafora reprezentacije je osnovna operanta kognitivne znanosti in kot taka seveda nikdar ni zares problematizirana. Naj imamo opravka s kratkoročnim ali dolgoročnim spominom, mentalnimi operacijami ali kar na splošno s »kodiranjem, shranjevanjem ali procesiranjem informacij«, v ozadju kognitivnega pristopa k raziskovanju mehanizmov spoznavanja venomer stoji neprevprašana shema neposrednega zrcaljenja objekta na osi svet-jezik-um. Objekt, ki ga »najdemo« v svetu (denimo vaza) se enostavno enači z njegovim označevalcem v jeziku (beseda »vaza«) in nazadnje s predpostavljeno reprezentacijo le-tega objekta v sferi posameznikovega uma.

Nepreglednih zevi, ki jih ta navidez lahkotna zrcaljenja prestopajo, se lahko lotevamo iz več zornih kotov, znotraj več disciplin, ki se pravzaprav niti ne izčrpajo v vodah družboslovnih znanosti. Sam sem polje tega vprašanja skušal skicirati z nekaj potezami adaptativnega premisleka, ki se s svojim biološkim nadihom tudi najbolj približuje (želeni) domeni kognitivne znanosti. Skica je preprosta in sestoji iz dveh glavnih linij: prva opredeljuje objekt zmerom v odnosu do organizma, za katerega ta objekt sploh obstaja, za katerega je relevanten. Tako je »reprezentacija« objekta kot neka prostolebdeča podoba v organizmovi predstavni moči že v osnovi zgrešena metafora, saj objekt za organizem obstaja le kot vzorec določenih odzivnih konstelacij, znotraj katerih dani organizem z danim objektom občuje. Objekt se organizmu nikdar ne prikazuje kot tak – sam zase, temveč zmerom le v odnosu do – za – organizem. Ta linija sama na sebi še ne govori nedvoumno nasproti metodologiji, kakršno narekuje metafora reprezentacije. Konec koncev je za kognitivno znanost vseeno, ali nek (lokacijsko in drugače) konsistentnen vzorec živčne aktivacije predstavlja »objekt kot tak« ali le »specifičen odzivni vzorec« organizma na ta objekt. Več ali manj vseeno. Nedvomno se že na tem mestu postavljajo določena vprašanja v zvezi s »čistostjo« predstavljanja, ki se jih deloma loteva predvsem na področju zrcalnih nevronov. Se pa tej *liniji pridružuje neka druga, na katero lahko le nakažemo, ki pa v sprepletenosti s prvo postavi pod vprašaj veliko večino »spoznanj o spoznanju«.*

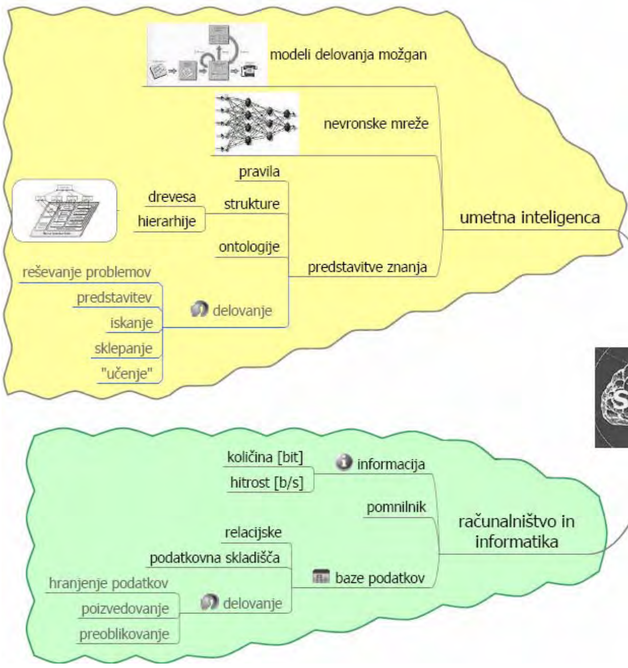
Če se za trenutek vrnemo na prvo linijo, vidimo da smo tam razbirali objekt kot odsev neke specifične udeleženosti organizma v svojem okolju; objekt nam je pomenil nek specifičen zaznavno-odzivni vzorec, ki ga je v organizmu »sprožil« nek specifičen vidik njegovega okolja. Tu pravzaprav niti ne govorimo o spoznavanju v pravem pomenu besede (pa je pojem reprezentacije že problematičen!), temveč o zaznavanju, kakor je utemeljeno oz. kakor venomer odmeva v določenem vzorcu odziva. O spoznavanju pravzaprav govorimo šele takrat, ko je organizem zmožen kombinirati in permutirati različne vidike teh »zaznavno-odzivnih« vzorcev ne da bi bili objekti za organizem neposredno prisotni. Na tem mestu kognitivna znanost privzame, da na mesto objektov (karkoli že ti so) stopi beseda. In če je bil pomen objekta vsidran nekje med stvar in odzivne vzorce, katerih nosilec je bil posamezni organizem, kam sidrati pomen besede? Če privzamemo, da ima beseda pomen šele, ko v večini ljudi izziva primerljive odzive, potem je neposredno zrcaljenje na liniji jezik-svet že a priori nesmiselno. Če beseda ni za stvar, temveč je za človeka (od človeka) potem se kot hišica kart poruši vsa struktura kognitivizma od reprezentacije naprej. Ali bolje: potem predmet, ki se ga raziskuje pod imenom kognicija ni prav dosti več kakor (malce poenostavljena) percepcija: ponovljivi zaznavno-odzivni vzorci, ki pa jim dejansko lahko sledimo le na osi organizem-okolje.

Filozofske metaanalize se je lotila tudi dr. Olga Markič, ki je (med drugim) govorila o naslednjem nivoju razlikovanja dojemanja kognitivnih pojavov – o epistemološki razliki med objektivističnim in konstruktivističnim pojmovanjem. Slednje je pogostejše v družboslovnih in humanističnih pristopih, prvo pa je stalnica (ki se večinoma jemlje za samoumevno) na področju naravoslovja oziroma tam, kjer so možne uporabe empiričnih metod.

Na področju, kjer vlada empirija (in je med mnogimi priznano kot edino res znanstveno) se ne sprašujemo o tem ali je na primer določen pojav zgolj socialna konstrukcija ali pa je objektivno resničen. Takšna razmišljanja se zdijo odvečna ali celo škodljiva za napredek znanosti. Na področju klinične nevrofiziologije je včasih odvečno oziroma prepočasno celo spraševanje o teorijah, ki poskušajo pojasnjevati empirične rezultate. Dr. David Vodušek je na to opozoril z anekdoto, da morajo klinični zdravniki »speči vola« in se mnogokrat nimajo časa ukvarjati z razmišljanjem »kako pojasniti ogenj«. Zdi se mi, da ta delitev (na »praktične« in »teoretske« kognitivne znanstvenike) nekako zaokroža celoten spekter in nas vrača k vprašanju »kako delovati«, le da tokrat s tretjeosebnega zornega kota.

V nadaljevanju dodajam še nekaj prispevkov, ki naj dodatno ilustrirajo raznolikost znanstvenega dogajanja na področju raziskovanja kognicije. Vsi prispevki, ki sledijo spadajo na področje objektivističnega dojemanja raziskovanja kognitivnih procesov, pa so kljub temu še vedno dokaj pisani.

Najprej umetna inteligenca. Dr. Marko Bohanec je problematiko raziskovanja kognicije z vidika te discipline lepo predstavil z mislenim diagramom:



Dr. Aleš Belič je nakazal možnosti povezovanja raziskovanj v nevroznanosti in računalništvu:

Identifikacija sistemov deluje na principu primerjave merjenih izhodnih signalov in stimulacijskih signalov. Na osnovi primerjave vhodnih oz. stimulacijskih *signalov in izhodnih signalov je možno sklepati na dinamične lastnosti sistema, ki povezuje ti dve vrsti signala. Obstaja več klasičnih, linearnih metod, ki dobro delujejo za enostavne sisteme, pojavlja pa se tudi vse več nelinearnih metod, kot so nevronske mreže in mehki modeli, ki v primer zapletenih sistemov dajejo boljše rezultate. V primeru raziskav delovanja možganov so kot izhod ali vhod zanimivi elektroencefalografski (EEG) signali, ki so neposredni odraz delovanja možganov. Primerjva signala stimulusa in EEG signalov ali EEG signalov in nekega končnega rezultata delovanja možgan, torej lahko pomaga pri raziskavah delovanja možganov. Izveden je bil poskus, pri katerem je nekaj zdravih prostovoljcev izvajalo gibe stiskanja s kazalcem in palcem, pri tem pa so bili merjeni: sila stiskanja in EEG signali. Prostovoljci so morali med drugim s silo stiskanja slediti sinusni obliki spreminjanja sile. Na osnovi analize EEG signalov nam je uspelo zgraditi model z nevronsko mrežo, ki je sposoben samo na osnovi merjenja EEG signalov napovedati trenutno silo stiska. Raziskave so sicer še precej na začetku, a za enkrat se kažejo precej dobre možnosti, da bi na osnovi podanega modela zgradili vmesik človek-stroj, preko katerega bi z EEG signali lahko upravljali neke enostavne funkcije stroja, kot so pzvezno premikanje v prostoru. Trenutno dela v svetu precej raziskovalnih skupin na tej problematiki, a večina je usmerjena v sekvenčno vodenje sistemov na osnovi mehanizma pozornosti, bolj malo pa je bilo narejenega na zveznem vodenju sistema s pomočjo EEG signalov.*

Kot nujno dopolnitev prikaza različnih pristopov, dodajam še poročili nevrologa in kognitivne psihologinje:

Simon Brežan: *Raziskovanje možganov: od elektrike do spomina*

Kognitivna nevroznanost raziskuje, kako in kje so v možganih »zapisani« kompleksni duševni procesi oz. išče nevronske korelate višjih živčnih funkcij (kot je npr. spomin). »Merjenja« funkcije možganov se nevroznanstveniki lotevajo s pomočjo različnih metod. Elektroencefalografija (EEG) kot ena izmed elektrofizioloških metod omogoča raziskovanje funkcije možganov na nivoju njihove električne aktivnosti z visoko časovno ločljivostjo, zato daje vpogled v osnovne mehanizme obdelovanja informacij in sam operacijski sistem možganov. S kombinacijo slikovnih (npr. funkcijsko magnetnoresonančno slikanje, fMR) in elektrofizioloških metod skušamo pokazati ne samo natančno lokalizacijo določene »funkcije« v možganih, ampak tudi časovni potek in mehanizme aktivacije posamičnih možganskih predelov oz. nevronskih omrežij. Za določitev stopnje regionalne sinhronizacije v elektroencefalografski (EEG) aktivnosti, ki kaže na aktivacijo/deaktivacijo nevronskih omrežij, uporabljamo analizo močnostnih spektrov, EEG-koherenca pa predstavlja objektivni korelat medpodročne sinhronizacije in s tem funkcijskega povezovanja v možganih. Tovrstna »sinhronost« odseva vzporedni in distribuiran način obdelovanja informacij v možganih, kjer določena funkcija (npr. spomin, pozornost, percepcija, gibanje itd.) sloni na »sinhronizirani« interakciji več (definiranih) možganskih predelov oz. nevronskih omrežij.

Pri analizi spomina moramo upoštevati vidike spomina kot procesa, kjer ločimo faze oz. mehanizme kodiranja, shranjevanja in priklica oz. uporabe informacije. Prav tako pa je pomembno razlikovati samo strukturo spomina, ki jo lahko v osnovi opišemo z različnimi spominskimi shrambami, kot npr. senzorni, kratkoročni ali dolgoročni spomin. Posebno nas zanima raziskovalno področje »delovnega spomina« (»aktivna« oblika kratkoročnega spomina), saj predstavlja osnovo vsem ostalim miselnim procesom in jeziku. Zahteva sočasno aktivacijo številnih možganskih področij in medsebojno integracijo in koordinacijo vpletenih področij (»problem povezovanja« ali «binding problem«).

Mehanizem tovrstnega sodelovanja med regijami je eden ključnih izzivov, če hočemo razumeti funkcijo možganov. Odgovore nam lahko deloma ponudijo različne matematično-statistične analize EEG-signalov, predvsem pa metoda EEG-koherence, s katero lahko objektivno določamo mero medpodročnega sodelovanja/ povezovanja v možganih. Med trenutne glavne dileme pri raziskovanju delovnega spomina v svetu in med naše raziskovalne interese spadajo vprašanja o tem, "kako" se informacija shranjuje (npr. kratkoročna elektrofiziološka sprememba v učinkovitosti/ moči sinaptičnih povezav oz. začasno ojačanje sinaptičnega prenosa, ki morda posreduje kratkoročni spomin); "kaj" je informacija, ki se shranjuje (npr. senzorični in/ali motorični kodi pri vzdrževanju spomina); nadalje predstavljajo velik izziv nevroznanosti tudi procesi kompleksne manipulacije informacij v delovnem spominu (reševanje problemov itd.), ki naj bi temeljili na dinamičnih interakcijah in transformacijah informacij med vpletenimi nevronskimi omrežji.

Končni cilj vseh analiz elektro-kemičnega signaliziranja oz. obdelave informacij v možganih bi bil torej dešifrirati nevronsko »v-kodiranje« informacij (tako na nivoju različnih duševnih procesov kot ožje, same konkretne vsebine posamezne informacije), ki ga predstavlja sistematično variiranje nevronske aktivnosti glede na vedenjske spremenljivke (funkcija »stimulus-response«, pri čemer si lahko pomagamo s standardnimi statističnimi metodami analize).
Na drugi strani pa mogoče še večji izziv in uporabno vrednost prinaša nasprotna, iz prve izhajajoča možnost »de-kodiranja« informacij, ki pomeni »ekstrakcijo« vrednosti določene vedenjske spremenljivke zgolj na podlagi znane nevronske aktivnosti (analiziramo t.i. nevronske populacijske vektorje- NPV z ustrezno statistiko za zvezne ali diskretne spremenljivke). Omenjeni pristopi bi tako omogočali nadaljnji napredek v razumevanju delovanja možganov in uporabo novih tehnologij t.i. »nevronskih protez« (»brain-computer interface«, BCI). Te bi omogočale- zaenkrat še futuristično- »branje misli« in napovedovanje ali »vodenje« vedenja v smislu upravljanja, avtomatizacije računalniško podprtih sistemov zgolj na podlagi časovne in prostorske dinamike relevantnih EEG-signalov oz. električne aktivnosti možganov.

Vita Štukovnik: *Kognitivna elektrofiziologija: merjenje evociranih potencialov in študij kognitivnih funkcij*

Moderna nevroznanost ponuja različne hemodinamske, anatomsko-funkcijske in elektrofiziološke metode raziskovanja odnosa med psihičnimi funkcijami in možgani. Pomen elektrofizioloških metod je predvsem v njihovi visoki občutljivosti za zaznavanje funkcijskih sprememb v možganski aktivnosti, kar omogoča raziskovanje mehanizmov obdelave informacij in s tem samega operacijskega sistema možganov. Metoda beleženja evociranih potencialov omogoča proučevanje poti obdelave informacij v osrednjem živčevju, od avtomatične do zavestne, pozornostno usmerjene. Evocirani potenciali odražajo namreč spremembe električne aktivnosti možganov, ki se pojavlja kot odgovor živčevja na fizični dražljaj, v povezavi z miselno aktivnostjo, ali s pripravo organizma na »akcijo«. Kot razlike v bioelektričnih potencialih, ki v obliki valov ali "komponent" nastajajo med obdelavo dražljaja, lahko evocirane potenciale s pomočjo elektrod enostavno odjemamo s površine glave. Definiramo jih lahko kot niz napetostni sprememb, časovno vezanih na specifični dogodek, ki jih lahko opazujemo znotraj epohe osnovne elektroencefalografske (EEG) aktivnosti možganov. Relativno na osnovno možgansko aktivnost lahko tako opazujemo zaporedje pozitivnih in negativnih napetostnih odklonov, pred, med in po pojavu specifičnega dogodka. Različni pogoji procesiranja informacij definirajo specifično morfologijo oblike valov (npr. prisotnost oz. odsotnost določenih vrhov valov), njihovo latenco (čas od dražljaja do začetka ali vrha vala, ki odraža hitrost obdelave informacije), amplitudo (odraža obeg sinaptične aktivnosti v skupini živčnih celic) in topografijo (iz katere sklepamo, kje v osrednjem živčevju valovi nastajajo oz. kje so njihovi t.i. generatorji). Kot kontinuirana in multidimenzionalna mera predstavljajo tako učinkovito orodje za proučevanje možganskih in miselnih funkcij. Pri študiju kognitivnih funkcij imajo pomembno vlogo predvsem t.i. pozni evocirani potenciali oz. »potenciali mislečega človeka«. V prvih 200 ms po nastopu specifičnega dražljaja t.i. zgodnji evocirani potenciali odslikujejo namreč predvsem »objektivne«, »fizikalne« značilnosti dražljaja (frekvenca zvoka, intenzivnost svetlobe), po tem času pa pozni evocirani potenciali odražajo predvsem človekov psihični kontekst in njegovo enkratno doživetje dražljaja (motivacija, strah, pozornost). Tako val P300, najbolj znan izmed poznih evociranih potencialov, npr. odseva dejstvo, da zdrav mlad človek spozna informativno vrednost pomembnega dražljaja katerekoli modalnosti v približno 300 ms po njegovi prezentaciji. Pozne evocirane potenciale *pogosto imenujemo tudi »z dogodkom povezani potenciali« (angl. event-related potentials, ERP). Evocirani potenciali omogočajo torej spremljanje korakov v senzorno-kognitivnem informacijskem procesiranju, odkrivajo pa tudi natančno funkcijsko organizacijo ter časovno aktivacijo anatomsko distribuiranih funkcijskih sistemov v možganih, vključenih v kognitivne funkcije.*

Učinkovito raziskovalno orodje predstavljajo tudi v elektrofizioloških študijah spomina. Poleg klasičnih študij, ki s pomočjo definiranih eksperimentalnih paradigem merjenje evociranih potencialov uporabljajo za proučevanje procesov delovnega spomina, pa danes ta metoda omogoča tudi vse večji vpogled v procese dolgoročnega spomina, npr. procese kodiranja in priklica informacij v epizodičnem spominu.

USTVARJANJE PROSTORA ZA PRVOOSEBNO RAZISKOVANJE – 1. DEL: RAZLOGI

Urban Kordeš
Univerza v Ljubljani, Pedagoška fakulteta
Kardeljeva ploščad 16, Ljubljana
urban.kordes@guest.arnes.si

POVZETEK
Predstavljen je koncept prvoosebnega raziskovanja in pobuda za vzpostavitev prostora v katerem bi lahko nastala skupnost prvoosebnih raziskovalcev. Razdelane so značilnosti takšnega prostora in opisane podobnosti ter razlike s klasično raziskovalno paradigmo.

Uvod

Prvoosebno raziskovanje (first-person research) je vse večkrat omenjena tema v sodobni kognitivni znanosti. Bolj kot postaja jasno, da informacijska (oziroma računalniška) metafora kognicije ne zadošča, bolj se kaže nuja za drugačnimi pristopi, s katerimi bi lahko raziskovali duševne procese, ki so nam eksistenčno najbolj blizu, pa so vseeno najmanj raziskani.

Prvoosebno raziskovanje ni novost. V tradiciji zahodne misli lahko z njim povežemo že Goetheja, pa psihološko introspekcijsko gibanje, fenomenologijo in še koga. V kognitivno znanost so ideje prvoosebnega raziskovanja prinesli Varela, Depraz, Vermersch (2003). Raziskovalci, ki se ukvarjamo s to temo čutimo, da potrebujemo prostor, kjer bo prvoosebno raziskovanje zaživelo kot samostojno raziskovalno področje. Slednje, zaradi svojih netrivialnih epistemoloških značilnosti morda sploh ne bo del znanosti, ampak se bo razvilo kot neodvisno gibanje. V teku so priprave za postavitev spletnega foruma, ki bo nudi prostor za razvoj prakse in kulture prvoosebnega raziskovanja – imenujemo ga »What it's like«, v nadaljevanju pa so na kratko predstavljene osnovne ideje na katerem temelji. Pričujočemu članku sledi še besedilo Mateja Černigoja z bolj konkretnimi smernicami za delovanje foruma.

Prvoosebno raziskovanje.

En izmed možnih načinov, kako lahko pojasnimo naše razumevanje prvoosebnega raziskovanja je razmislek o področjih, ki jih (klasično znanstveno) raziskovanje ne doseže. Obstajajo pojavi, ki jih ne moremo raziskovati z orodji klasične znanosti, ker ne izpolnjujejo osnovne predpostavke na kateri temelji – ne le znanstveno – opazovanje. Osnovna predpostavka o kateri govorimo je ponovljivost pojava oziroma kakšen drug način, ki zagotavlja intersubjektivno preverljivost. Z drugimi besedami: normalna predpostavka je, da je tisto kar opazujemo neodvisno od opazovalca in od njegovega stanja zavesti. Celo, ko znanost opazuje zavest, to počne z zgornjo predpostavko (predpostavlja pač, da opazuje procese, ki so skupni vsem ljudem in na tak način neodvisni od posameznega opazovalca). Za to, da lahko pojave opazujemo in opisujemo na tak način, jih moramo abstrahirati na količine, ki so preverljive (to pomeni, po možnosti merljive). In za to, da jih lahko abstrahiramo, moramo raziskovalčevo izkustvo »prečistiti«, t.j. iz njega izločiti samo tiste dele, ki jih lahko intersubjektivno preverjamo. Tisto, kar ostane in pade skozi sito znanstvene (objektivistične) metode so neponovljivi dogodki. Dogodki, kjer sta raziskovalec in raziskovano povezana v krožno zanko medsebojnega vplivanja in spreminjanja (ali pa sta kar eno in isto). Zaradi tega ne moremo računati na to, da bo opazovani pojav (ali opazovalec) v naslednjem trenutku oziroma pri naslednjem opazovanju še vedno isti. Poleg tega pa tudi ne moremo računati na to, da je opazovani pojav za vse opazovalce enak oziroma, da za vse sploh obstaja. To težavo z opazovanjem in opisovanjem je lepo izrazil Heidegger: »tisto, kar je najbližje našemu izkustvu, je najdlje od opisa«
Prvoosebno raziskovanje se posveča natančno temu področju – raziskovanju izkustva. Tako kot fenomenologi, obrne na glavo prej opisan razmislek. Zave se, da je izkustvo primarno in vse ostalo (npr.

objektivna resničnost) njegova podmnožica oziroma način njegove urejenosti. Prvoosebno raziskovanje se loteva vseh preiskovanih pojavov z vidika izkustva: npr. raziskovanje izkustva opazovanja, raziskovanje izkustva razmišljanja, raziskovanje izkustva početja nečesa, raziskovanje izkustva biti zavesten, raziskovanje izkustva izkustva…

Seveda takšna sprememba prinaša precejšnje težave in vprašanja: Je zadovoljiv propozicionalni opis izkustva sploh možen? Kakšna je resničnostna vrednost opisov dogodkov, ki so neponovljivi, ki jih raziskovanje spreminja in ki jih ne moremo intersubjektivno preveriti? Kakšen je smisel raziskovanja tako izmuzljivih področij?

Odgovor lahko začnemo s protivprašanjem: So problemi z objektvnostjo, možnostjo propozicionalnega opisa in podobni, dovolj močan argument, da bi se odpovedali načrtnemu in rigoroznemu raziskovanju najbolj intimnega dela? Morda pa ni ničesar več, kar bi lahko raziskovali, saj smo že tako ali tako popolni poznavalci svojega izkustva, njegovih mehanizmov in potencialov?

Pisec teh vrstic je prepričan, da se je mogoče in vredno podati na področje zavestnega, načrtnega in predvsem svobodnega raziskovanja prvoosebnega doživljanja. Sploh pa prvoosebno raziskovanje ni povsem različno od uveljavljenega, tretjeosebnega oziroma »pravega« znanstvenega raziskovanja. Kakšne so torej podobnosti in katere so razlike z klasičnim znanstvenim raziskovanjem?

Podobnosti:

- Glavno vodilo raziskovanja je radovednost, želja odkrivati, spoznavati, se učiti in početi to čim bolj sistematično.
- Tako kot pri tretjeosebnem, tudi pri prvoosebnem raziskovanju poskušamo zgraditi skupnost raziskovalcev.

Razlike:

Večina razlik temelji na dejstvu, da intersubjektivna preverljivost ne more biti več merilo za vključevanje izsledkov. Raziskovanje izkustva, kot rečeno, (lahko) spreminja izkustvo – raziskovalni proces ni ločen od raziskovanega pojava. Ko raziskujemo, se spreminjamo (Petranker to opisuje z besedami »becoming conscious differently«; Petranker, 2003). To pomeni, da nima smisla raziskovati s ciljem pridobivanja skupnega korpusa znanja, ampak raziskujemo zase. Glede na stalno možnost spreminjanja tudi ne smemo računati na končne rezultate našega početja v obliki končnih teorij ali modelov (kar pa še ne pomeni, da le-ti ne morejo nastati), zaradi tega je glavni poudarek na procesu in na minljivosti »odkritij«.

Prvoosebno raziskovanje, kot ga pojmujemo ne temelji več na upanju, da bodo rezultati raziskovanja intersubjektivno primerljivi. (To je točka, kjer se odmikamo od vseh drugih znanih prvoosebnih poskusov.) Lahko, da bo v procesu raziskovanja prišlo do strinjanja okrog rezultatov, lahko da bomo določene pojave celo raziskovali skupaj. Nikakor pa intersubjektivno strinjanje ali nestrinjanje ne more biti merilo za resničnost raziskave oziroma za njeno vključitev v raziskovalno skupnost.

Kako si predstavljamo skupnost prvoosebnih raziskovalcev in kaj jo bo držalo skupaj?

Kljub temu, da je prvoosebno raziskovanje namenjeno raziskovalcu samemu, to še ne pomeni, da ne potrebuje skupnosti, v kateri bi se raziskovalci lahko učili en od drugega in si utrjevali ter "čistili" namero svojega početja. Naš namen je ustvariti prostor, kjer bo možen razvoj kulture prvoosebnega raziskovanja.

To ne bo: prostor medsebojnega preverjanja. Ne bo prostor, kjer bi gradili medsebojno resničnost. Kot takšen bo njegova namera ravno nasprotna nameri večine človeškega komuniciranja, ki je medsebojno potrjevanje in grajenje skupne resničnosti.
To bo: Prostor, kjer bodo lahko raziskovalci objavili svoja raziskovanja. Ne zato, da bi jih drugi preverili, ampak zato, da jih lahko – skozi potencialna vprašanja – preverijo in nadaljujejo sami. Predvsem pa bo to prostor, kjer se bodo srečevali raziskovalci z isto namero. Prav namera *raziskovati svojo izkušnjo* bo vezni element skupnosti, ta namera (in ne rezultati ali cilji raziskav) bo tisto, kar si bomo medsebojno potrjevali in vzpodbujali.

Cilji posameznih raziskav niso merilo, prav tako rezultati niso merilo. Ker tudi namere raziskovalca ne moremo meriti (oz. je intersubjektivno preverjati) moramo graditi na *zaupanju*. Odnos, ki ga imamo do vsakega člana naše skupnosti in odnos, ki ga pričakujemo od vsakega člana je *zaupanje*, da sta delo in poročanje za raziskovalca, ki ju izvaja eksistencialno zavezujoča. To pomeni, da nista samo miselna igra, ampak se raziskovalec zaveda, da ga njegovo početje (lahko) spreminja. Prav pripravljenost na osebno spremembo lahko jemljemo kot nekakšno definicijo tega, kdaj je raziskovanje udeleženo.

Prostor:

Prostor, ki ga nameravamo ustvariti torej ne bo prostor preverjanja, kritiziranja, sklicevanja na… itd. V njem nameravamo gojiti *raziskovalski odnos* oziroma odnos *aktivnega sprejemanja*. Ta odnos lahko simbolično opredelimo s formulo:

raziskovanje = dopuščanje + pozornost (oz. zanimanje).

Kot vsako raziskovanje, je tudi prvoosebno sestavljeno iz pasivnega in aktivnega dela. Pasivni del je dopuščanje avtorjeve zgodbe, da je kakršna je, brez vpletanja opazovalčevih mnenj, predstav, predsodkov ali teorij (ta del verjetno ustreza fenomenološkemu postavljanju v okleopaje - *epochee*). Aktivni del pa je radovednost – sila, ki poganja raziskovanje.

Literatura

Depraz, N., Varela, F., Vermersch, P.: *On Becoming Aware – A Pragmatics of Experiencing*. John Benjamin Publishing, Amsterdam, 2003

Petranker, J.: *Inhabiting Conscious Experience: Engaged Objectivity in the First-Person Study of Consciousness*. Journal of Consciousness Studies, 10, Št. 12, December 2003

USTVARJANJE PROSTORA ZA PRVOOSEBNO RAZISKOVANJE – 2. DEL: IZVEDBA

Matej Černigoj
Oddelek za psihologijo, Filozofska fakulteta,
Aškerčeva 2, Ljubljana, Slovenija
Tel: +386 1 2411166, e-mail: matej.cernigoj@ff.uni-lj.si

POVZETEK
Prispevek razvija idejo o prostoru za prvoosebno raziskovanje zavesti v smeri konkretne izvedbe medmrežnega foruma. Predstavljeni so nekateri glavni tipi prispevkov v ta forum in osnovna pravila za objavljanje v njem.

Namero o prostoru za prvoosebno raziskovanje, ki jo v svojem prispevku razlaga Urban Kordeš, poskušamo uresničiti v obliki medmrežnega foruma, namenjenega skupnemu raziskovanju doživljanja. Predstavljamo si, da bi vsaka raziskava imela svojega začetnika oziroma nosilca, ki določi temo in smer raziskovanja. To naredi tako, da napiše prvo poročilo o raziskovanju lastnega doživljanja. Ostali udeleženci se nato priključijo k raziskavi s svojimi prispevki, predvsem v obliki vprašanj, pa tudi primerov lastnega izkustva. Nosilec nato odgovori na vprašanja oziroma komentira primere izkustva udeležencev, kar vodi v nova vprašanja in tako naprej. Raziskava se nadaljuje, dokler je nosilec ne prekine oziroma ostali udeleženci nimajo več vprašanj.

Zaradi enostavnosti izvedbe naj bi raziskave potekale linearno in ne razvejano. To pomeni, da se vsi prispevki ostalih udeležencev nanašajo na zadnji prispevek nosilca raziskave, njegov oziroma njen prispevek pa sintetično komentira oziroma odgovarja na vse prispevke ostalih udeležencev zadnjega kroga. Nosilec se lahko odloči tudi, da bo nekatere prispevke ostalih udeležencev ignoriral, če čuti, da za njegovo raziskovanje niso relevantni oziroma vodijo raziskavo v smer, v katero sam ne želi iti. Predpostavlja se tudi, da so ostali udeleženci seznanjeni s celotnim potekom raziskave, preden se odločijo sodelovati v njej, saj bi se sicer vprašanja verjetno pogosto ponavljala. Uredniki foruma nameravamo vse prispevke pred objavo pregledati in avtorje opozoriti na morebitna odstopanja od osnovne namere foruma.

Želimo si, da bi bili udeleženci čim bolj ustvarjalni v svojih prispevkih, saj tisto, kar šteje, ni oblika prispevkov, ampak njihova usklajenost z osnovno namero foruma. Kljub temu pa kot nekakšno splošno vodilo predlagamo nekaj standardnih oblik prispevkov, ki jih lahko udeleženci nato prosto prilagajajo svojemu načinu oziroma temi raziskovanja. Kot že omenjeno, naj bi se vsaka raziskava začela s prvim poročilom o individualnem raziskovanju doživljanja. To je lahko (med drugim) poročilo o dejanski fenomenološki raziskavi s strani nosilca, povzetek procesa razvoja in sprememb v strukturi njegovega doživljanja, ki se ni začel z namenom fenomenološkega raziskovanja, ali tudi dobro razvito vprašanje o delovanju lastnega doživljanja. V osnovi se vsebina raziskave lahko nanaša na lastno doživljanje v odnosu do nekega objekta ali pojavnega področja (recimo raziskovanje doživljanja barv), ali pa na lastno doživljanje kot tako (recimo raziskovanje cikličnih sprememb razpoloženja). Ne glede na vsebino pa mora prvo poročilo izražati eksistenčno pomembnost raziskave za njenega avtorja. S tem mislimo, da je nosilec v raziskavo vstopil s pripravljenostjo, da se bo v procesu raziskovanja tudi sam spremenil (glej prispevek Urbana Kordeša). Raziskovanje lastnega doživljanja kot takega sicer že nekako implicira eksistenčno povezanost, pa vendar želimo, da je ta tudi eksplicitno izražena in razložena. To še toliko bolj velja za raziskovanje doživljanja v odnosu do nekega objekta oziroma pojavnega področja, kjer eksistenčna zavezanost ni tako samoumevna.

V prvem približku si predstavljamo štiri glavne tipe prvih poročil, ki nastanejo kot kombinacija dveh presečnih dimenzij. Prva dimenzija je *preteklost-*

sedanjost. Nosilec se lahko odloči poročati o raziskovanju, ki je potekalo nekoč v preteklosti in je zdaj doživljano kot dokončano. Lahko pa se odloči poročati tudi o raziskovanju, ki poteka prav zdaj, katerega rezultati še niso znani in katerega del je tudi pisanje prvega poročila. Druga dimenzija je *struktura-proces*. Nosilec se lahko bolj osredotoči na opis strukture doživljanja, ne glede na to, kako se je ta struktura oblikovala, lahko pa se, nasprotno, osredotoči na opis procesa razvoja in sprememb lastnega doživljanja v odnosu do določenega objekta, osebnega problema, družbenega pojava ali česa podobnega. S kombinacijo teh dveh dimenzij dobimo štiri možnosti: i) opis strukture doživljanja, ki je trenutno doživljana kot uravnotežena oziroma zaključena; ii) opis procesa razvoja in sprememb doživljanja, ki se sedaj doživljan kot končan; iii) opis porajajoče se strukture doživljanja in iv) opis trenutnega procesa sprememb doživljanja. Ne glede na izbrani tip prvega poročila pa njegova objava na forumu implicira avtorjevo pripravljenost na nadaljevanje raziskave.

Način pisanja prvega poročila (kot tudi vseh ostalih prispevkov) mora biti v širokem smislu fenomenološki. To pomeni, da so vsa prepričanja in predpostavke "dane v oklepaj", v smislu, da so eksplicitno izpostavljene kot deli lastnega doživljanja in ne kot (objektivna) resnica. Reči: "Božja previdnost je bila, ki me je varno pripeljala skozi tisto težko obdobje," torej ni skladno z namero foruma, medtem ko: "Doživljal sem, kot da je bila božja previdnost tisto, kar me je varno pripeljalo skozi tisto težko obdobje," je. Uredniki foruma vidimo svojo glavno nalogo prav v opozarjanju avtorjev na prepričanja in predpostavke, ki se jim mogoče zdijo samoumevne.

Ostali udeleženci naj bi se raziskave udeleževali predvsem z vprašanji. Če njihova vprašanja ostajajo znotraj konteksta, ki ga vzpostavlja nosilčevo prvo poročilo ali nadaljnji odgovori – če torej, na primer, sprašujejo o pomenu določenega koncepta za nosilca, poizvedujejo o povezavi med dvema ali več temami ali poskušajo razumeti logiko nosilčevega opisa – so to enostavna vprašanja. Kompleksno vprašnje po drugi strani razširja polje raziskovanja s tem, da vanj vpeljuje nove vsebine in jih poskuša povezati z vsebinami, ki jih odpira nosilec sam. Sprašujejo, na primer, če so te nove teme za nosilca pomembne in če so, zakaj. Udeleženci se lahko v raziskavo vključijo tudi s primeri lastnega doživljanja, pri čemer pa je potrebna določena previdnost. Taki primeri so lahko zelo koristni za ilustracijo namena kompleksnih vprašanj, sami po sebi pa lahko vodijo v iskanje skupne resnice ("Meni se je zgodilo to in to; je to isto, kar se je zgodilo tebi?"), kar je v nasprotju z namero foruma.

Nosilčevi odgovori naj bi bili v splošnem napisani na isti način kot prvo poročilo: razlagajo ali podrobneje opisujejo njegovo doživljanje. Odgovori pa naj bi bili vendarle krajši od prvega poročila in usmerjeni na vprašanja, na katera se nanašajo. Lahko vključujejo tudi nove teme, ki niso bile izpostavljene v prvem poročilu, če se nosilcu raziskave to zdi smiselno. Zaželjeno je tudi, da nosilec nakaže, ali je odgovor na določeno vprašanje zahteval novo raziskovanje oziroma kreativno konstrukcijo, ali pa je bil zgolj priklican iz spomina. Lahko se zgodi tudi, da raziskovanje v forumu pomembno spremeni strukturo oziroma proces nosilčevega doživljanja. V takem primeru je na mestu novo daljše poročilo, za katerega pa velja vse enako kot za prvo poročilo.

Utemeljitev biološke inteligence kot elementarne kognitivne lastnosti vseh organizmov

Rok Krašovec, Igor Jerman
Bion, Inštitut za bioelektromagnetiko in novo biologijo
Stegne 21 SI-1000 Ljubljana
e-mail: rok.krasovec@bion.si

Povzetek

Prevladujoča mehanicistična biološka paradigma vidi življenje kot vznik iz danes veljavnih zakonov fizike in zamrznjenih nesreč; potrebe po kakih dodatnih mehanizmih oz. danes še skritih vzrokih oziroma zakonih ni. Prispevek poskuša dokazati, da je takšen konstruktivizem oz. redukcionizem nezadosten za razlago biološke inteligence.

Današnja paradigma vidi svobodno voljo kot iluzijo. Sprejemanje odločitev je torej makroskopska iluzija, ki je odgovor na naključne mikroskopske procese. To pomeni, da živi organizmi dolgujemo svoj obstoj ne samo elementarnim zakonom fizike in robnim pogojem zgodnjega univerzuma, pač pa tudi rezultatom nepredstavljivo dolgega zaporedja verjetnostnih dogodkov, ki bi se lahko končali tudi povsem drugače. Gibanje molekul zraka v steklenici bolj na levo kot na desno, v prihodnosti ne bo obveljalo kot nekaj zgodovinskega, se pa lahko pojavijo (ne)srečna naključja, ki imajo širše posledice za prihodnost organizma, a so omejena zgolj na določene regije prostora in časa.

Temelja danes veljavne paradigme sta vsaj dva. Prvi je zrasel v 40' letih prejšnjega stoletja, ko sta Luria in Delbruck (1943) nedvoumno dokazala obstoj naključnih mutacij, kar pomeni, da mutacije niso povezane s funkcijo gena in se pojavljajo s konstantno stopnjo, na katero selekcijske razmere v okolju ne vplivajo. Drug temelj pa je dojemanje vedenja v nadzorovanih pogojih laboratorija, kjer rastline, bakterije in večina živali v povprečju dajejo podobne odgovore. To naj bi bila posledica tako imenovanega avtonomnega vedenja oz. od okolja neodvisnega vedenja, katerega razumevanje je danes ključno za razvoj predvsem robotike. Znanost tako obravnava večino živih organizmov kot nadvse kompleksne robote sposobne adaptacije, ki pa nimajo prav nobene svobodne volje in so zato nesposobni reševanja problemov, notranjega ocenjevanja, sprejemanja odločitev, predvidevanje prihodnosti, spomin pa je vezan zgolj na informacije zapisane v genomu.

Temelji biološke inteligence

Če so organizmi zares programirani, da prepoznajo in odgovorijo na okolje okrog njih, potem bi rastlina in bakterijska celica morala kodirati odgovor na vsaj 10^{11} različnih za rast dopustnih (ne-letalnih) okolij. Vrednost smo dobili po oceni, da organizmi zaznavajo 10 abiotskih (svetloba, vlažnost, nivo CO_2 in ostalih plinov, različni parametri prsti, nivo in kvaliteta hrane in vode itd.) in 6 biotskih signalov (npr. prisotnost, odsotnost in identiteta sosedov, nivo različnih hormonov itd.) ter 5 diskretnih jakostnih razredov znotraj enega signala. Pri čemer je število signalov in jakostnih razredov podcenjeno, prav tako pa nismo upoštevali parametra kot sta smer signala in čas izpostavljanja signalu. Genetsko programiranje takšnega števila odzivov enostavno ni mogoča. Prepričani smo, da zgolj fleksibilnost organizmu lahko zagotovi usklajenost s pogoji v okolju.

Fleksibilnost pomeni, da zaznavanju okolja sledi procesiranje zaznane informacije in hkratno primerjanje informacij pridobljenih o okolju s svojim notranjim stanjem, ki ga definira tako trenutno stanje, kot tudi pretekle izkušnje. Ko je to opravljeno, organizem sprejme odločitev in izvede odgovor, ki je v tistem trenutku kar se da najbolj ekonomičen. Fleksibilnost je torej proces, ki ga razumemo kot biološko inteligenco in ga biologija pokriva s širokim pojmom reakcijske norme genoma.

Vendar ni vsako vedenje, pa naj bo še tako kompleksno in nam nerazumljeno, inteligentno. Tako na primer nastanek kristala, kjer atomi v kristalni mreži med seboj komunicirajo, ni prav nič inteligentno vedenje, saj kristal nima svobodne volje. Kristalizacija je posledica notranjih kemijskih in fizikalnih lastnosti atomov ter je izvedena povsem avtomatično. Prav tako so nukleinske kisline in proteini zunaj organizmov povsem brez svobodne volje in jih pojmujemo kot mrtev material. Še več, genom v celici je sam po sebi povsem inerten. Zapisi znotraj genoma se shranjujejo, berejo in spreminjajo le s funkcionalnim izražanjem ostalih celičnih sistemov, ki so v interakciji z DNA. V največji meri so to proteinski sistemi, dostopnost informacij znotraj genoma pa celice regulirajo tudi s spreminjanjem lokacije in topologije genoma.

Za to, kateri materiali izvajajo fleksibilno vedenje, so spoznanja molekulske biologije bistvena. Številne študije neizpodbitno kažejo, da npr. brezjedrni organizmi (prokarionti) uporabljajo omejeno število različnih genetskih naprav (genskih kompleksov), kot so dvo-komponentni regulatorni sistemi, LuxI-LuxR sistemi za zaznavanje kvoruma, fosfodiesteraze, serinske in treoninske kinaze, regulatorje tipa OmpR in sigma signalne poti (Hellingwerf in sod. 2005). Celice z jedri (evkariontske) imajo nabor naprav še večji. Prav tako je pomembno, da vse celice uporabljajo modularne proteine z velikim številom vhodnih in izhodnih domen, ki pa imajo izjemno konzervativne prenašalne domene. Takšna ohranjenost za prevajanje signalov pomembnih domen, vodi v redundanco odgovorov na določen signal iz okolja, saj med njimi prihaja do neizogibnih navzkrižnih pogovorov. Če tem proteinskim komponentam dodamo še ponavljajoče se genetske elemente in mobilne genetske elemente (Shapiro 2002) ter 98% celokupne celične RNA, ki ne kodira proteinov (Mattick in Gagen 2001), potem dobimo (še vedno) grobo sliko o kompleksnosti regulatornih procesov, ki določajo kateri protein bo sintetiziran, kdaj in kje. Prav tako se moramo zavedati, da je za učinkovito delovanje proteina, pomembna ne samo njegova sposobnost katalize, ampak tudi njegova premičnost in lokacija znotraj celice (Ryan in Shapiro 2003). Izjemen primer so proteini MinCDE, ki skrbijo za pravilno celično delitev bakterije *Escherichia coli*. Učinkovito delovanje presnovnih in regulatornih krogov je tako osnovano na kombinatoriki specifičnih vezalnih mest za množtvo zunanjih in notranjih signalov. Tako številne kombinacije vezalnih mest celici omogočajo zaznavanje okoljskih signalov in na koncu sprejemanje enostavnih odločitev, kot je prepisati določen nabor genov (operon), do izvedbe tistih precej bolj kompleksnih odgovorov. Poglejmo si to na zelo nazornem primeru.

Bakterijske celice se hranijo tako z laktozo kot tudi glukozo, vendar imajo slednjo raje. Če je v okolju le laktoza, ta deaktivira represorski gen znotraj operona Lac, CAP protein je aktiven in bakterija se lahko hrani z laktozo. Ko pa se poleg laktoze pojavi še glukoza, encimi ki razgrajujejo glukozo, zavrejo izražanje CAP proteina, to zavre razgradnjo laktoze in bakterija se hrani zgolj z glukozo. To je enostaven primer, kako bakterije na nek način 'zavohajo' hrano, procesirajo zaznane informacije in sprejmejo notranjo odločitev o tem, kateri set genov aktivirati, kar bo omogočilo hranjenje z bolj ljubim sladkorjem. Da ne bo pomote, razlog za izbiro glukoze je pač višja energijska korist (torej ekonomičnost), kot jo prinaša laktoza.

Kompleksna celična mreža, ki izkazuje občutljivost na množtvo okoljskih signalov, manipulira in kontrolira lasten tok informacij, kar je temelj biološke inteligence. Za biološko inteligenco tako potrebuješ delujočo mrežo komunikativnih celic, ki nabirajo latentne informacije iz okolja in od drugih organizmov, jih interpretirajo v eksistenčno pomembnem smislu, razvijejo splošno znanje in se učijo iz preteklih izkušenj.

Izražanje biološke inteligence

Vse kar lahko z današnjo tehnologijo opazujemo, je zgolj izražanje inteligence; gibanje in molekulsko procesiranje nista inteligenca, sta le njen odraz. A vendar ima splošno nepriznavanje inteligence svoje povsem znanstvene razloge. Trewavas meni, da je problem predvsem statistika, ki povpreči fiziološke odgovore in s tem eliminira variacije posameznika, ki jih določi kot eksperimentalno napako (Trewavas 2005). Na ta način se ignorira vedenje posameznika, ki je temeljna enota biološke inteligence. Navedimo primer. Ob aplikaciji gravitacijskega signala koreninice mačjega repa (*Phleum pratense L.*) vedno znova začnejo rasti vertikalno. Vendar so trajektorije samega odziva značilno razlikujejo med posamezniki, čeprav je končni rezultat vedno enak. Izkazalo se je, da na trajektorijo in ne na končni rezultat vpliva rdeča svetloba, kalcij, dotik, vlažnost, kisik, temperatura ter hormona etilen in avksin. To pomeni, da so laboratorijsko nadzorovani pogoji, kjer spreminjaš le en parameter, ostale pa ohraniš konstantne, veljavni za določevanje vedenja populacije, ne pa posameznika. Na temelju takšnih raziskav populacije (te so v večini), obstoja inteligence ni mogoče izključiti. Izražanje inteligence je torej nujno opazovati na posamezniku in v ustreznem okolju.

Izražanje inteligence bomo nakazali predvsem s primeri iz sveta bakterij in rastlin, saj v splošnem oboji veljajo za bitja brez kakršnekoli inteligence. Eden od pomembnih elementov inteligence je nedvomno *samoreferenca,* ki jo v evolucijskem smislu lahko obravnavamo kot primitivno stopnjo *samozavedanja*. Na primer, celica *E. coli* ve, kdaj je njena DNA poškodovana in s še neznanimi signali aktivira različne popravljalne sisteme. Prav tako zadrži delitev, dokler se popravilo ne zaključi in ko je popravilo zaključeno, celica to ve. Mnogi se sprašujemo, kako je lahko celoten genom ves čas na razpolago za prepoznavanje in popravilo poškodb in kateri faktorji prvi zaznajo poškodbo (Hanawalt 2001). Prav tako še vedno ne razumemo zakonitosti vstavljanja mobilnih genetskih elementov v tarčna zaporedja genoma, kar lepo demonstrira nerazumevanje adaptivnih mutacij, ki jasno izkazujejo višjo stopnjo regulacije kot naključne od rasti odvisne mutacije (Krašovec in Jerman 2002). Odličen primer so tudi bakterije *Paenibacillus vortex*, ki gradijo kompleksno strukturirano kolonijo z različno velikimi t.i. vrtinci. To so kondenzirane skupine bakterij, ki kolektivno rojijo okoli skupnega centra s hitrostjo okoli 10 μm/s. Ko posamezna bakterija vstopi v vrtinec najprej spozna, da pripada nečemu večjemu in svoje gibanje prilagodi v odvisnosti od stopnje rotacije celotnega vrtinca. To naredi tako, da se odzove na atraktivno kemotaksijo, ki jo izvajajo celice znotraj vrtinca. Poskusi kažejo, da posamezne bakterije in vrtinec kot celoto vedno znova zanaša stran od središča. Vzrok je odbijajoče kemotaktično signaliziranje bakterij, ki niso v vrtincu (Ben Jacob in sod. 2006). Podobno zanimiv primer je bakterijska komunikacija pred sporulacijo (Stephen 1998). Ko rastni pogoji postanejo preveč stresni, grampozitivne bakterije preidejo v inertne spore. Preden pa to storijo, stradajoče celice oddajo kemične signale, ki sporočajo drugim bakterijam, da so v stresu. Ko vsi predstavniki kolonije zaznajo sporočila in oddajo svoje odločitve v obliki drugih signalov, se sporulacija zgodi le, če je večina kolonije za.

Še višjo stopnjo od pravkar prikazane sposobnosti samoreference nakazujejo tudi številni primeri iz sveta rastlin. Rastline kontinuirano sprejemajo odločitve o tem, kje bodo korenine, poganjki in listi (Trewavas 2005). Tako npr. posamezne rastline zrastejo bolj v večjem volumnu prsti kot v manjšem, pri enaki količini hranil, kar kaže, da so sposobne zaznati volumen prsti. Rastlina to najverjetneje zaznava z informiranostjo o razporejenosti lastnih korenin, kar je biološko smiselno, saj s tem minimalizira tekmovanje sama s seboj. Kako rastlina prepozna tujo rastlino še vedno ni povsem znano, ve pa se, da ima svetloba, ki se odbije od zelenih rastlin, povečano razmerje med IR/rdečo svetlobo ter vsebuje več modre svetlobe kot normalno sonce. Mnoge rastline zaznavajo ta del spektra in ustrezno regulirajo položaj in površino lastnih listov, ter s tem maksimirajo količino svetlobe. Pomenljiv je poskus, ko so s kirurško ločitvijo ene rastline naredili njen klon in ju po nekaj tedenski ločenosti dali v skupno zemljo. Oba klona sta naredila več korenin, ki so bile hkrati tudi daljše, kar je znak, da sta se prepoznala kot tujca. Pri tem je zanimivo, da je rastlina po presaditvi v novo zemljo ohranila spomin na svoje prejšnje sosede še nekaj mesecev do enega leta. Nadalje, če so veje preraščene, rastlina sprejme odločitev, ki temelji na količini povrnjenih energijsko bogatih ogljikovih hidratov.

Če je ta premajhen, aktivno zamaši žilni sistem te veje in koreninske surovine usmeri k drugim delom rastline.

Značilen znak inteligence je zmožnost predvidevanja prihodnosti. Na primer, odločitve rastline, ki ima za posledico rast določenih vej in ne drugih, temeljijo na neke vrste špekulaciji o povratku z energijo bogatih ogljikovih hidratov v prihodnosti in niso toliko odvisne od trenutnega stanja v okolju (Trewavas 2005). Npr. *Podophyllum peltatum* raste v podrasti gozda in sprejema odločitve o razvejitvi in cvetenju vnaprej in to z uporabo mnogih informacij iz okolja. Podobno številna drevesa zmernega pasu odločajo o številu cvetov leto vnaprej in če je pomlad hladna ali sušna, se cvetni popki enostavno izrežejo. S tem se število plodov prilagodi predvidevanju rastline o pogojih v poletnem času. Takšno vedenje rastlin je podobno kot ga poznajo živali, ki predvidijo količino porabljene energije za iskanje hrane in koliko bo s tem iskanjem energije pridobila. Takšen model napovedi naj bi imele ima tudi bakterije (Trewavas 2005).

Izjemen primer celičnega računanja predstavlja velik ameboidni organizem *Physarum polycephalum*. Ta ima očitno sposobnost izračunati minimalno dolžino med dvema točkama znotraj labirinta, v katerega so na začetek in konec postavili agarski blok s hrano (Nakagaki in sod. 2000). Poti do hrane so bile štiri, dolge 33, 41, 44 in 45 mm. Točen položaj in dolžina panožice sta bila v vsakem poskusu drugačna, a je organizem vedno znova izbral najkrajšo pot.

Če v znanosti in javnosti bakterije in rastline nimajo statusa inteligentnih bitij, je povsem drugače pri sprejemanju inteligence pri ptičih, predvsem družini vranov (sem sodijo npr. vrane, šoje, krokarji in kavke) in papagajev (Emery in Clayton 2004). Njihova inteligenca je potrjena in je višja kot pri ostalih ptičih ter se povsem primerja z nekaterimi velikimi opicami, saj vključuje vzročno sklepanje, fleksibilnost, domišljijo in predvidevanje prihodnosti. Študije tako kažejo, da vrani izdelujejo in s smislom uporabljajo orodje ter skrivajo hrano. Slednje vedenje zahteva poleg spomina tudi procesiranje informacij o lokaciji, tipu in kvarljivosti hrane. Npr. predstavnik vranov (*Nucifraga columbiana*), ki živi na visoki nadmorski višini, skrije do 30.000 borovih semen na širokem prostoru, odkrije pa jih tudi do 6 mesecev kasneje. Prav tako so vrani sposobni projekcije lastne izkušnje na drugo ptico oz. sposobni so simulacije notranjega pogleda te ptice, kar že kaže na obstoj uma oziroma zametka umske inteligence. Vrani nekatere probleme rešijo celo hitreje kot človek (Emery in Clayton 2004).

Z razlogom se nismo veliko posvečali inteligenci opic, kitov in slonov, pa tudi ne socialnim žuželkam, saj je obstoj inteligence pri njih bolj splošno sprejeta. Povejmo samo najnovejše zaključke, da inteligenca človeka ni rezultat nekih kvalitativnih razlik, ampak bolj posledica izboljšanja že obstoječih kvalitet, predvsem hitrosti procesiranja informacij. Razlike v možganskih strukturah med človekom ter primati, delfini in sloni so namreč zanemarljive (Roth in Dicke 2005).

Zaključek

Vrnimo se še zadnjič na protitežnostno (gravitropno) vedenje rastlin, katerega glavni namen je pridobiti čim več hrane. Končni kot, pod katerim bo veja ali korenina, je namreč zelo različen, kljub temu, da je optimalen le en sam. To pomeni, da se divje rastline in bakterije lahko učijo le s poskusom in napako, saj so signali v naravi izredno spremenljivi. Končni kot korenine je torej odvisen od pogojev v okolju in sprejetih notranjih odločitev, ki pa niso avtomatizirane (Trewavas 2005).

Prilagajanje okolju torej ni program zapisan v genomu, pač pa dinamičen proces, kjer celica sklopi interno shranjene informacije, z informacijami pridobljenimi iz okolja. Temu sledi procesiranje in odgovor. Seveda celice nujno potrebujejo genom, saj le-ta kodira naprave, ki zaznavajo in prevajajo signale ter na koncu izvedejo odgovor. A biološka inteligenca ni materija, ampak sposobnost dajanja zunaj pridobljeni informaciji določen vsebinski pomen, ki se tiče preživetja in ekonomije življenja. Brez te lastnosti organizem pač ne more preživeti, saj so praktično vsi odgovori živih organizmov povezani s pridobivanjem hrane in zmanjševanjem stresa.

Biološka inteligenca je lastnost celotnega sistema, je torej emergentna in je decentralizirana. Ne gre jo vezati na neka centralna tkiva, saj kolonije socialnih žuželk, rastline in bakterije izkazujejo vse znake inteligence, in to navkljub dejstvu, da nimajo možganov. Ker se predvideva, da se je razvoj možganov v živalih zgodil zaradi razmerja med plenom in plenilci, je popolnoma jasno, da inteligenca izboljša preživetje in poveča verjetnost za razmnoževanje vseh organizmov.

Za konec, dokler se prevladujoča mehanicistična biološka paradigma ne nadgradi, bodo v javnosti vedno znova krožile razlage življenja tipa *inteligentni dizajn* ali *kreacionizem,* kjer je motiv iskanja vrzeli v znanstvenem dojemanju narave v celoti sporen in popolnoma nesprejemljiv.

Literatura:

Ben Jacob, E., Shapira, Y., Tauber, A.I. (2006). Seeking the foundations of cognition in bacteria: From Schrodinger's negative entropy to latent information. PHYSICA A, 359: 495-524.

Emery, N.J., Clayton, N.S. (2004). The mentality of crows: Convergent evolution of intelligence in corvids and apes. Science, 306: 1903–1907.

Hanawalt P.C. (2001). Controlling the efficiency of excision repair. Mutation Research-DNA Repair, 485: 3-13.

Hellingwerf, K.J. (2005). Bacterial observations: a rudimentary form of intelligence? Trends in Microbiology, 13: 152-158.

Krašovec, R., Jerman, I. (2002). Is a sort of intelligence at work in bacteria? Zbornik C5. mednarodne multi-konference Informacijska družba IS'2002, Kognitivne znanosti (ed.) Repovš G., Gams M. & Detela A., Ljubljana, 58-60.

Luria, S.E., Delbrück, M. (1943). Mutations of bacteria from virus sensitivity to virus resistance. Genetics, 28: 491-511.

Mattick, J.S., Gagen, M.J. (2001). The evolution of controlled multitasked gene networks: the role of introns and other noncoding RNAs in the development of complex organisms. Molecular Biology & Evolution, 18: 1611-1630.

Nakagaki, T., Yamada H., Toth A.. (2000). Maze solving by an amoeboid organism. Nature, 407: 470.

Roth, G., Dicke, U. (2005). Evolution of the brain and intelligence. Trends in Cognitive Science, 9: 250-257.

Ryan, K.R., Shapiro, L. (2003). Temporal and spatial regulation in prokaryotic cell cycle progression and development. Annual Review of Biochemistry, 72: 367-394.

Shapiro, J.A. (2002). Repetitive DNA, genome system architecture and genome reorganization. Research in Microbiology, 153: 447-453.

Stephen, C. (1998). Bacterial sporulation: a question of commitment? Curr. Biol., 8: 45–48.

Trewavas, A. (2005). Green plants as intelligent organisms. Trends in Plant Science, 10: 413-419.

Je elementarna kognitivna lastnost imenovana biološka inteligenca zakonitost ali naključje?

Rok Krašovec, Igor Jerman
Bion, Inštitut za bioelektromagnetiko in novo biologijo
Stegne 21 SI-1000 Ljubljana
e-mail: rok.krasovec@bion.si

Povzetek

Biološka inteligenca je dinamičen proces, kjer celica sklopi interno shranjene informacije z informacijami pridobljenimi iz okolja in tako slednjim da vsebinski pomen. Temu sledi sprejetje notranje odločitve in izvedba odgovora, ki je tako usklajen z okoljem, kar posamezniku izboljša verjetnost za preživetje. V tem prispevku nameravamo predstaviti argumente za tezo, da je ta fleksibilnost, ki potrjuje obstoj svobodne volje v vseh živih bitjih, zakonitost, izhajajoča iz osnovnih zakonov narave, ki obstojajo že od nastanka življenja naprej.

Le sistem z mrežo komunikativnih enot, ki nabirajo latentne informacije iz okolja in od drugih organizmov, jih interpretirajo v eksistenčno pomembnem načinu, razvijajo splošno znanje in se učijo iz preteklih izkušenj, je inteligenten. Danes poznamo le eno vrsto sistema, ki to zmore in to je živ sistem. Da mu to uspe potrebuje vsaj senzorne in regulatorne proteine, genom s svojo spreminjajočo se arhitekturo ter cis in trans regulatornimi zaporedji in kratke regulatorne RNA molekule, ki ne kodirajo proteinov, a so aktivne v regulaciji in kontroli celičnih procesov. Fleksibilen odziv na okolje je lastnost celote in ne zgolj določene materije, saj so vse naštete komponente zunaj celice mrtve in tam izvajajo vedenje značilno za avtomate. Če je biološka inteligenca zakonitost, potem mora imeti univerzalne temelje. Poglejmo si argumente.

Univerzalna sestava celic

Prevladujoča mehanicistična biološka paradigma je izjemno uspešna v identifikaciji in določevanju biokemijskih ter biofizikalnih lastnostih materije živih organizmov. Tako pravi, da imamo prav vsi prebivalci Zemlje enako organizirane nukleinske kisline (DNA in RNA), skorajda identičen genetski kod ter da imamo rajši levosučne aminokisline (ak) in desnosučne ogljikove hidrate. Prav tako smo vsi grajeni na osnovi ogljika, potrebujemo tekočo vodo in v vseh celicah je temeljna interakcija med DNA in proteini. Malo manj znano dejstvo pa je, da so celične komponente potrebne za izvajanje osnovnih celičnih procesov v npr. bakterijah in človeku mnogo bolj podobne, kot bi pričakovali glede na razliko v evolucijski starosti obeh vrst. Številne študije namreč kažejo, da se biološke strukture v evoluciji lahko pojavljajo neodvisno (brez skupnega prednika) in to v filogenetsko povsem ločenih vrstah, kar imenujemo konvergentna evolucija, strukture pa homoplazije (konvergence). Navedli bomo nekaj takšnih primerov, ki so pomembni za biološko inteligenco, pri čemer bomo pazili, da bomo argumente omejili na vrste, katerih skupni prednik je tako oddaljen, da ni mogoče, da bi te lastnosti že posedoval. Enako bomo pazili, da ne bomo navajali primitivnih oblik, kjer neka struktura nazaduje in torej zgolj navzven deluje kot konvergenca.

Homoplazije pomembne za biološko inteligenco

Če ima protein na voljo 20 aminokislin in je dolg npr. 100 ak, potem je 20^{100} možnih primarnih zaporedij, ki jih ta protein zaseda. Če bi le en protein na milijon njih imel primerno topnost in bi od teh le en na milijon imel zahtevano kemično aktivnost, potem bi bilo število razpoložljivih proteinov z dolžino 100 ak še vedno večje kot je število vseh zvezd. A so proteini navadno daljši od 100 ak. Ta zares gigantski potencial možnih oblik in rešitev imenujemo *hiperprostor* (Conway Morris 2003), iz katerega pa živi organizmi udejanjijo zares majhen delež. Pomembno je vedeti, da hiperprostor ne obstaja zgolj za proteine, pač pa tudi za RNA, DNA, tkiva, organe, skelet itd.

Na splošno velja, da funkcijo proteina določa specifičnost nekega mesta znotraj njega, vendar je funkcija pogosto odvisna tudi od arhitekturnih oblik proteina, ki pa se zelo rade ponavljajo. Na primer domene odgovorne za prenos signalov so izjemno konzervativne, kar nazorno dokazuje zamenjava periplazemske domene proteina PhoQ bakterije *Escherichia coli* s periplazemsko domeno PhoQ proteina celic *Pseudomonas aeruginosa* (Lesley in Waldburger 2001). Navkljub razlikam v strukturnem odgovoru proteina PhoQ v obeh vrstah, hibriden protein še vedno normalno reagira na magnezij. To je direkten dokaz funkcionalnosti modularne organizacije proteinov in potrjuje obstoj univerzalnih pravil v prevajanju signala.

T.i. molekulske konvergence so znane za številne proteine, neodvisen razvoj je na primer dokazan za evkariontsko serinsko proteazo tripsin in bakterijski subtilizin. Oba proteina imata povsem drugačno tridimenzionalno strukturo, kar je argument, da sta se razvila iz nesorodnega predniškega encima ter da je narava odkrila biokemijski mehanizem, po katerem delujeta navedena encima, vsaj dvakrat. Poznana je konvergentna evolucija aktivnih centrov encimov kot sta laktat dehidrogenaza in papain. Potem je tu neodvisni evolucijski izvor peptidaz, arhitekture aminoacil-tRNA sintetaz, citokinaz in mnogih drugih proteinov. Prav tako so biokemijski procesi, ki so udeleženi v proteinsko vezavo nukleotidov, konvergentni. Strukturi kot sta alfa in beta sodček, naj bi prav tako nastali konvergentno (reference najdete v Conway Morris 2003).

Nazoren je primer podobnosti hemoglobina v človeku in cianobakterijah. Klasično gledano je to posledica skupnega predniškega proteina, a rezultati nagibajo tehtnico precej bolj k neodvisnemu evolucijskemu izvoru (Watts in sod. 2001). Pomembno se je prav tako zavedati, da imajo proteini lahko povsem drugačno primarno zaporedje ak, a imajo efektivno povsem identično funkcijo. Odličen primer tega je mioglobin, kjer je velika verjetnost, da se je v cianobakterijah in bičkarjih razvil neodvisno od mioglobina sesalcev in bakterij, saj navkljub drugačnemu primarnemu zaporedju, opravlja enako funkcijo. Potem je tu konvergentnost molekulske arhitekture bakteriorodopsina s človeškim rodopsinom (vidni pigment), čeprav je pri njiju primarno zaporedje aminokislin in funkcija povsem drugačna; pri bakterijah se uporablja za pogon protonske črpalke.

Navkljub sofisticiranosti sinaps, v katerih sodeluje, je acetilholin starodavna molekula (Wessler in sod. 1999). Imajo jo bakterije in rastline. V bičkarjih je acetilholin ključen za konjugacijo, čemur sledi izmenjava genetskega materiala. Zanimivo je, da so nevropeptidi, kot je hormon kortikotropin in beta endorfinu podobne molekule ter dopamin prisotni že v bičkarjih. Prav tako je pomenljiva univerzalnost natrijevih, kalijevih in kalcijevih kanalov. Prvi so osrednji element živčevja pri človeku. Natrijeve kanale imajo npr. spužve, a ne poznajo akcijskih potencialov. Drugače je pri sončecu *Actinocoryne*, (rod *Heliozoa*) za katerega je znana hitra kontrakcija filamentov in stebla, ki jo sproži akcijski potencial, predvsem odvisen od natrija. Natrijevi kanali imajo vlogo tudi v bakterijah, pri dihanju in gibanju bičkov.

Molekulska konvergenca tako kaže na globlje vzorce v evoluciji in kaže, da so ključne lastnosti DNA in proteinov skupne tako bakterijam kot človeku. To pomeni, da njuno delovanje zgolj na določen način že vnaprej določa razvoj in naravo kasnejših kompleksnih struktur. Poglejmo si primere.

Je človek res unikum na Zemlji?
Soočenje z znanstvenimi dokazi o kompleksnih strukturah človeka in ostalih bitij na planetu hitro pokaže, da hominidne lastnosti niso tako unikatne, kot si ljudje radi domišljajo. Lastnosti kot so dvonožna hoja, izdelovanje orodja, veliki možgani, kultura, vokalizacija in preciznost ročnega oprijema so se v evoluciji večkrat pojavile in to neodvisno.

Poglejmo najprej, v čem se naši možgani razlikujejo od najbolj razvitih živali, kot so kiti, sloni in primati. Absolutna in relativna velikost naših možganov ne odstopa glede na naštete vrste. Encefalizacija (EQ) kaže, da so človeški možgani 7-8 krat večji od pričakovane vrednosti, kar je največ med vsemi, a imajo tudi neke kapucinke višji EQ kot šimpanzi in gorile, kar zmanjša edinstvenost tega parametra. Volumen cerebralnega korteksa človeka je precej manjši kot ga imajo sloni in večji kiti, tako v absolutnem kot v relativnem smislu. Prefrontalni korteks, kot center mišljenja in planiranja, v človeku ni prav nič večji kot pri ostalih primatih, pri slonu in kitih je celo večji. Ljudje imajo največjo gostoto kortikalnih nevronov, a strokovnjaki na tem področju menijo, da je bistven parameter kapaciteta procesiranja informacij oz. hitrost prevodnosti kortikalnih vlaken, ki se določi s premerom mielinskih vlaken (Roth in Dicke 2005). Mielinska kortikalna vlakna so precej debela v primatih in tanjša v slonih in kitih. Manjši premer pomeni manjšo hitrost, pri slonih in kitih pa hitrost še dodatno zmanjša višja razdalja med nevroni. Ljudje imamo tako najvišjo prevodnost med vsemi vrstami. Nekateri so zato mnenja, da je velikost naših možganov optimizirana, saj bi nadaljnje povečevanje zvišal razdaljo med nevroni, kar bi zmanjšalo hitrost procesiranja. Torej, če je inteligenca človeka zares najvišja, potem ni rezultat nekih kvalitativnih razlik, ampak bolj posledica izboljšanja že obstoječe sposobnosti procesiranja informacij. Možgani človeka so namreč zanemarljivo drugačni od drugih primerljivih vrst (Roth in Dicke 2005).

Vendar dolga tradicija kaže, da ljudje pri sebi vedno znova najdemo lastnosti, ki naj bi jih druge živali ne imele. Najbolj izpostavljena je bila dolgo izdelava in uporaba orodja, ki jasno izkazuje inteligenco in namen. Danes je jasno, da orodje izdelujejo ne samo opice, pač pa tudi vrani in celo delfini, ki so v evolucijskem smislu na nek način v slepi ulici, saj jim vodno okolje preprečuje razvoj napredne tehnologije. Tako na primer samotarske samice delfinov izbrskajo spužve, si jih 'prilepijo' na gobček ter z njo rijejo po oceanskem dnu (Smolker in sod. 1997). Motiv za to vedenje je verjetno ta, da spužva deluje kot naravna rokavica in jo med ritjem varuje pred strupenimi živalmi.

Potem sta kot človeški unikat pogosto citirana skladnja in slovnica jezika. Poglejmo si spet primer delfinov, za katere je znano, da imajo silno kompleksno vokalizacijo (Marino 2002). Skupina npr. 12 delfinov ima skupni tip piska, vsak posebej pa razvije še dodatne majhne spremembe piska, ki ga ločijo od ostalih v skupini. Zanimiv je tudi način, kako se mladi delfini naučijo vokalizacije. Proces je podoben kot pri človeku, najprej blebetanje, presežna produkcija zvokov in na koncu redukcija k bolj standardnemu repertoarju. No, najbolj pomembni pa so zaključki študije, ki kažejo, da je delfine moč naučiti razumevanja stavkov in izvajanja primernih dejanj (Conway Morris 2003). Poskus je vključeval dva delfina, ki so jih naučili umetni jezik, sestavljen iz umetnih piskov (dovolj podobnih in hkrati drugačnih, kot jih sama drugače uporabljata) in gibov človeške roke. Izkazalo se je, da delfina razumeta ne samo enobesedni opis določenega predmeta, ampak sta razumela tudi zaporedje besed (skladnjo) in pomen (semantika), četudi so besede npr. obrnili. Delfina sta prav tako razumela človeške gibe, ki kažejo na določen del njihovega telesa. Geste človeka imajo za delfina določen pomen, kar kaže, da imajo ti organizmi sposobnost abstraktnega mišljenja. Seveda poskus ne potrjuje, da imajo delfini slovnico, ali da jo bodo nekoč razvili, a kaže da so za kaj takega povsem usposobljeni.

Glede zavesti, obstoja imitacije, prevare in teorije uma pri živalih, danes konsenza ni (Roth in Dicke 2005). Je pa popolnoma jasno, da delfini samega sebe prepoznajo v ogledalu, kar je nedvomno visoka stopnja samorefleksije, ki verjetno v subjektivnem prostoru teh živali dejansko funkcionira kot določena stopnja samozavedanja (Reiss in Marino 2001).

Potem je velikokrat omenjena družbena ureditev in ljudska kultura kot nekaj povsem unikatnega. A npr. delfini obvladujejo družbena razmerja z vsaj 100 osebki in tudi ljudmi (pomoč pri ribištvu v Mavretaniji in Braziliji) ter poznajo super-zavezništva. Podobno kompleksne so ureditve v šimpanzih in slonih, npr. znana je konvergenca med glavači in sloni, tako v kompleksnosti družbene ureditve, varovanju mladičev, inteligenci, spominu in dolgoživosti. Prenašanje kulture je dobro znana za morske sesalce in ptiče. Kiti na ta način prenašajo vokalizacijo in prehranjevalno vedenje. Podobno je pri slonih, kjer so najstarejše slonice najmodrejše in se najlažje zapomnijo slone iz drugih skupin ter tako prenašajo družbeno znanje naprej v svoji družini (McComb in sod. 2001). Kultura je torej prav tako konvergentna, ali drugače, razvoj kulture je očitno zakonit in v določenih razmerah neizogiben.

Mnogi menijo, da je ključni korak v procesu hominizacije sprememba gibanja. Začelo naj bi se s pogonskimi zadnjimi nogami in sprednjimi rokami namenjenimi hranjenju in oprijemu. Temu je sledila mobilnost rok in vznik dvonožne hoje. Dvonožna hoja je sama po sebi zelo zahtevna, saj zahteva fino uglašenost vestibularnega sistema notranjega ušesa, kar zagotavlja ravnotežje. Pojavila se je kmalu po odcepitvi od skupnega prednika, torej pri nekakšnemu šimpanzu podobnem organizmu, popolno pa se je razvila šele v *Homo erectus*. Vendar fosili kažejo, da so se dvonožna hoja, ročna spretnost in tudi veliki možgani razvili neodvisno več kot enkrat (Conway Morris 2003). Odličen primer so opice živeče v geografski izolaciji na otokih Sredozemlja, ki naj bi poznale tako dvonožno hojo kot tudi ročni prijem, obe lastnosti pa naj bi bila konvergentnega izvora, saj opica ni imela stika s takrat že živečim direktnim prednikom človeka, avstralopitekom. Ročna spretnost pa naj ne bi bila omejena zgolj na višje primate. Primere manipulacije s sprednjimi okončinami je opaziti tudi pri nekaterih žabah, vrečarjih, lemurjih in glodavcih, vendar konsenza ali je to konvergenca, ni (Iwaniuk in Whishaw 2000). Navkljub dejstvu, da ljudje izviramo iz določenih afriških opic, hominidne evolucije ni mogoče konstruirati kot evolucijsko tračnico. Jasno je le, da smo edini potomci in preživeli izmed hominidov, ki so kadarkoli obstajali na planetu.

Zaključek

Vse kar je skupno za bakterije in človeka je moralo nastati zelo zgodaj v evoluciji, zasnove so morale obstajati že kar ob nastanku življenja. Inteligenca človeka ima izjemno hitrost procesiranja informacij, ki je neprimerljivo hitrejša kot pri bakterijah. A konzervativnost v pravilih prevajanja signala, v temelju povsem enaka interakcija med DNA in proteini v prokariontskih in evkariontskih celicah, številne molekulske konvergence aktivnih centrov in biokemijskih mehanizmov itn. kažejo, da je inteligenca človeka le nadgradnja elementarne biološke lastnosti, ki jo imajo že bakterije. Lahko bi rekli, da je inteligenca tipa človek evolucijsko neizogibna, a zahteva dolgo trajajočo t.i. habitabilno cono, kjer planet naseljen z živimi bitji ni izpostavljen vesoljskim kataklizmam (Conway Morris 2003).

Evolucija k vedno hitrejšem procesiranju informacij in povečevanju fleksibilnosti je torej visoko verjetna in v veliko primerih celo napovedljiva. Vse našteto po našem mnenju potrjuje, da je biološka inteligenca zakonitost in ne naključje in je morala biti v primitivni obliki prisotna že ob samem nastanku življenja.

Chyba, C.F., Hand, K.P. (2005). Astrobiology: The study of the living universe. Annu. Rev. Astron. Astr. 43: 31-74.

Conway Morris S. 2003. Life’s Solution: Inevitable Humans in a Lonely Universe. Cambridge Univ. Press. 464 pp.

Iwaniuk, A.N., Whishaw, I.Q. (2000). On the origin of skilled forelimb movements. Trends in Neurosciences 23: 372-376.

Lesley, J.A., Waldburger C.D. 2001. Comparison of the Pseudomonas aeruginosa and Escherichia coli PhoQ sensor domains - Evidence for distinct mechanisms of signal detection. Journal of Biological Chemistry, 276: 30827-30833

Marino L. (2002). Convergence of complex cognitive abilities in cetaceans and primates. Brain Behavior and Evolution, 59 (1-2): 21-32.

McComb, K., Moss, C., Durant, S.M., Baker, L., Sayialel, S. (2001). Matriarchs as repositories of social knowledge in African elephants. Science, 292 (5516): 491-494.

Reiss, D., Marino, L. (2001). Mirror self-recognition in the bottlenose dolphin: A case of cognitive convergence. Proc. Natl. Acad. Sci. U.S.A., 98 (10): 5937-5942

Roth, G., Dicke, U. (2005). Evolution of the brain and intelligence. Trends in Cognitive Science, 9: 250-257.

Smolker, R., Richards, A., Connor, R., Mann, J., Berggren, P. (1997). Sponge carrying by dolphins (*Delphinidae*, *Tursiops* sp.): A foraging specialization involving tool use? Ethology, 103 (6): 454-465.

Watts, R.A., Hunt, P.W., Hvitved, A.N., Hargrove, M.S., Peacock, W.J., Dennis, E.S. (2001). A hemoglobin from plants homologous to truncated hemoglobins of microorganisms. Proc. Natl. Acad. Sci. U.S.A.., 98 (18): 10119-10124.

Wessler, I., Kirkpatrick, C.J., Racke, K. (1999). The cholinergic 'pitfall': Acetylcholine, a universal cell molecule in biological systems, including humans. Clinical And Experimental Pharmacology And Physiology, 26 (3): 198-205.

ISKANJE INTEGRATIVNE METODE – PRIMER RAČUNALNIŠKE METAFORE

Olga Markič
Oddelek za filozofijo, Filozofska fakulteta,
Aškerčeva 2, Ljubljanja, Slovenija
olga.markic@guest.arnes.si

POVZETEK

V članku je predstavljena računalniška metafora kot možen okvir za sodelovanje različnih disciplin pri raziskovanju kognitivnih procesov. Pri tem pristopu je poudarek je na konstruiranju modelov, ki naj bi pripomogli k razumevanju posameznih kognitivnih fenomenov, povsem pa je zanemarjen subjektivni, prvoosebni pristop.

Uvod

Interdisciplinarno raziskovalno področje kognitivnih znanosti se je oblikovalo v petdesetih letih 20. stoletja, kot temeljne discipline pa so bile vključene nevrologija, psihologija, računalništvo, lingvistika in filozofija. Področje raziskovanja je obsegalo vrsto človekovih aktivnosti – prepoznavanje vidnih in slušnih vzorcev, pomnjenje, učenje, obvladovanje jezika, odločanje in reševanje problemov, ki jih uvrščamo med spoznavne (kognitivne) procese. Dandanes se je razširil tako predmet raziskovanja –v okviru kognitivnih znanosti se preučujejo različni duševni procesi, tudi čustva in družbeno delovanje, kot tudi polje disciplin, saj se v raziskovanja vključujejo tudi znanstveniki s področja fizike, kemije in biologije, kot tudi antropologi, sociologi in kulturologi.

Temeljno vprašanje kognitivnih znanosti je bilo, kako integrirati te raznolike pristope, saj se vsaka od disciplin problemov loteva s svojega zornega kota in uporablja svoj strokovni jezik in svoje metode. Izhodišče, ki je pripeljalo do začetkov skupnega raziskovanja, je bila računalniška metafora, hipoteza o analogiji med digitalnim računalnikom in umom. Po tej analogiji je mišljenje neke vrste simbolno računanje. Osnovna hipoteza tega pristopa je, da sta tako računalnik kot um informacijska sistema, ki dobivata informacije iz okolice, jih hranita in obdelujeta ter nato posredujeta rezultate. Kognitivni problem, ki je predmet raziskovanja, pa se s pomočjo funkcionalne analize preučuje na treh ravneh opisa: na vsebinski (semantični) ravni, na algoritmični (sintaktični) ravni in na ravni fizične realizacije. Pri razumevanju in razlagi kognitivnih procesov pa ima osrednjo vlogo konstrukcija modelov.

Računalniška metafora

Pri opisu in razlagi kognitivnih procesov so znanstveniki začeli uporabljati nove pojme, ki so prihajali iz računalništva, kot na primer program, procedura, algoritem, hierarhičen nadzor, shema. Poleg tega, da je imel računalnik vlogo nosilca metafore, je po drugi strani predstavljal orodje, s pomočjo katerega so potekale simulacije določenih kognitivnih procesov, kot na primer reševanje problemov, priklic iz spomina, prepoznavanje vidnih vzorcev. Zaradi te dvojne vloge računalnika je prihajalo in še prihaja do mnogih nejasnosti. V grobem bi lahko glede na status oziroma vlogo, ki jo pripisujejo računalniku, opredelili dve skupini. V prvi so tisti (npr. Fodor, Pylyshyn, Simon in Newell), ki postavljajo hipotezo, da mentalno procesiranje dobesedno je računanje (computation) in da v človeškem duhu neprestano poteka hitro in v veliki meri nezavedno iskanje, spominjanje in sklepanje, oziroma bolj splošno manipuliranje s simboli. Na enak način, kot je v računalniku zakodirana vsebina računalniških reprezentacij - simbolov, je tudi v možganih zakodirano znanje. V obeh primerih gre za fizično uprimerjene simbolne strukture. Zagovorniki tega stališča menijo, da je človeško mišljenje manipuliranje s stavki notranjega jezika misli. Pri tem poudarjajo, da je bistveno to, da gre za manipulacijo s simboli, da pa je realizacija v možganih lahko (in tudi je) precej drugačna kot pri današnjih računalnikih. Kognitivni znanstveniki iz te skupine (klasična simbolna kognitivna znanost) smatrajo, da um dobesedno je računalnik - manipulator simbolov.

Druga skupina, v katero na primer sodita znani raziskovalec možganov Karel Lashley in filozof John Searle (1992), pa meni, da je računalnik le še ena od vrste metafor v zgodovini filozofije in psihologije, ki naj bi pripomogle na poti k razumevanju narave uma, mišljenja, zaznavanja in drugih kognitivnih procesov, a za katere že zdaj vemo, da so zgrešene (npr. s pomočjo argumenta "Kitajska soba"). Te metafore tako zgolj odsevajo sodobno stanje v znanosti in tehnologiji in so v uporabi le relativno kratek čas, dokler jih ne izrinejo nove. Naj naštejem nekaj največkrat omenjenih zgledov (glej npr. Valentine, 1992). V osemnajstem in v začetku devetnajstega stoletja so prevladovale metafore iz mehanike. Tipični predstavnik je bil La Mettrie z delom “Človek stroj” (L'Homme machine, 1747), pa tudi prve študije fiziologov so se zgledovale pri mehaniki. Prav tako je pri sodobni fiziki za opis delovanja duha iskal inspiracijo Freud (pretok energije, elektromagnetizem). Iz začetka stoletja je znana Sherringtonova metafora telefonske centrale za centralni živčni sistem. Ker nanjo lahko gledamo kot na črno škatlo, je predstavljala motivacijo za behaviorizem. Metafore iz znanosti in tehnologije lahko najdemo tudi v parapsihologiji, recimo, pojav radia je sprožil uporabo z njim povezanih pojmov, kot so npr. valovi, oddajanje. Omenjene metafore v današnji psihološki znanosti ne igrajo več vidnejše vloge, ohranile so se le v vsakdanjem govoru, kjer jih velikokrat uporabljamo, ne da bi se jih sploh zavedali. Na primer, “Manjka mu kolešček v glavi.”, “Petru je pa jermen dol padel.”, Maji je prekipelo.”, “Popustili so ji vsi ventili.”, “ Z Markom sva na isti valovni dolžini.”.

Ti dve stališči predstavljata skrajnosti: prvo zanika, da bi v kognitivni znanosti sploh šlo za metaforo. Na tisti ravni opisa, ki je pomembna za kognitivno znanost, um dobesedno je računalnik in operacije dobesedno so računanje – manipulacija s simboli . Drugo stališče obravnava tako osrednji pojem računalnika kot vse z njim povezane pojme metaforično. Ti pojmi bi kot zanimive in uporabne metafore sicer res lahko spodbudili oblikovanje novih hipotez ali celo pripeljali do novih odkritij, vendar pa sami niso realistični opisi kognitivnih procesov.

R. Boyd (1993) se izogne obema skrajnostima in opozarja na posebno vlogo metafor v znanosti pri oblikovanju znanstvene teorije. Take metafore imenuje teorijsko konstitutivne metafore. Ena izmed koristi, ki jo prinašajo, je uvajanje nove teoretične terminologije na področja, kjer je pred tem te še ni bilo. Naloga metafore je, da priskrbi jezikovne kategorije, ki opisujejo vzročno in pojasnjevalno pomembne značilnosti sveta. Kot pravi, je “uporaba metafor eno izmed mnogih sredstev, na voljo znanstveni skupnosti, da bi opravila nalogo prilagoditve jezika vzročni strukturi sveta. … je naloga take ureditve našega jezika, da naše jezikovne kategorije “režejo svet v njegovih stičiščih” (Boyd, 1993, str. 483). Z računalniško metaforo so znanstveniki pridobili pojmovni aparat, s katerim poskušajo opisati in razložiti delovanje uma. Računalniški izrazi kot so računanje, algoritem in shema, se v kognitivni teoriji nanašajo na dejanske procese oziroma entitete.

Boyd meni, da je bistvena značilnost teorijsko konstitutivne metafore njena odprtost. To pomeni, da je znanstvenik povabljen k raziskovanju podobnosti med značilnostmi prvotnih (v našem primeru računalnik) in drugotnih predmetov (v našem primeru um), tudi takih, ki še niso povsem razumljene. Funkcija konstitutivnih metafor je usmerjena predvsem v nadaljnje raziskovanje, ki naj bi omogočilo novo razumevanje teoretsko relevantnih vidikov podobnosti. Ker ne moremo v naprej vedeti, kakšne rezultate bodo prinesle raziskave, zato tudi ni mogoče v naprej napovedati ali zanikati popolne eksplikacije teorijsko konstitutivnih metafor.

Menim, da bi stališče lahko še radikalizirali in dodali, da lahko teorijsko konstitutivne metafore, kot izrazi nove teorije drugotnega področja, povratno vplivajo na samo raziskovanje prvotnega področja. Interakcija med prvotnim in drugotnim področjem tako lahko pripelje do novih odkritij in do konstitucije novih teorij na obeh področjih. Zdi se mi, da se nekaj takega že dogaja. Tako ne gre le za enosmerno povezavo, pri kateri kognitivni psihologi jemljejo iz računalništva, ampak proces poteka tudi v drugi smeri. Raziskovanja kognitivnih znanstvenikov so vzpodbudila računalničarje k novim pristopom v programiranju (npr. nevronske mreže), ki se zgledujejo po delovanju možganov in ki potem preko takih novih modelov vodijo tudi do novih modelov kognitivnih procesov.

Za razumevanje analogije med računalnikom in umom je pomembno, da se zavedamo ravni, na kateri je hipoteza postavljena. Kognitivni znanstveniki govore o treh ravneh opisa kognitivnih procesov: semantični, sintaktični in ravni strukturalne arhitekture (fizični ravni). Za razlago sta pomembni semantična in sintaktična raven, saj um predstavlja množico mentalnih reprezentacij, nad katerimi potekajo sintaktično določene operacije. Raven strukturalne arhitekture možganov po mnenju klasičnih kognitivistov ni pomembna za psihološko razlago in predstavlja domeno nevroznanosti. Tudi če bi lahko odprli glavo in pogledali v možgane, v njih ne bi našli majhnih simbolov. Podobno, kot je računalniški program implementiran v strojni opremi, naj bi bil tudi kognitivni program implementiran v možganih. Klasični kognitivizem tako postavlja dve posebni reprezentacijski ravni - sintaktično in semantično, ki sta neodvisni od ravni nevrobiologije. Stališče klasične kognitivne znanosti je, da psihologijo zanima funkcionalna raven - iskanje ustreznih psiholoških razlag naj bi bilo podobno iskanju ustreznih programov - ne pa raven realizacije v možganih. Zato naj bi bila psihologija avtonomna glede na nevroznanost.

Tak pristop temelji na teoretičnih predpostavkah, ki so močnejše kot je temeljna hipoteza o človekovem umu kot informacijskem sistemu. Razumevanje računalniške metafore kot odprte teorijsko konstitutivne metafore omogoča, da se raziskovanja informacijskih procesov preučuje na različnih ravneh. Relativno od pogleda znanstvenika je, kaj šteje za funkcionalno in kaj za strukturalno. Iz čisto praktičnega vidika je trenutno skoraj nemogoče, da bi modeli v podrobnostih zajemali različne ravni. Znanstveniki, ki modelirajo višje kognitivne procese, npr. sklepanje in procesiranje v naravnem jeziku, ne posvečajo velike pozornosti, kaj se takrat dogaja s posameznimi nevroni. A to še ne pomeni, da se morda kasneje ne bo izkazalo, da je za razlago potrebno upoštevati tudi to raven. Izjemno zanimivi empirični rezultati s področja nevroznanosti in nevropsihologije so tako že pripomogli k boljšemu razumevanju kognitivnih procesov in motenj, ki nastopajo pri posameznih funkcijah, na primer motnje pri prepoznavanju predmetov (agnosia) ali pa motnje branja in pisanja (disleksija).

Zaključek

Izhodišče, ki je za osrednjo raziskovalno hipotezo sprejelo predpostavko, da je kognitivni sistem informacijski sistem, je z računalniško metaforo ponudilo okvir za interdisciplinarno delo, ki pa se je izkazal za pomanjkljiv. Prvič je vprašljiva že sama predpostavka, saj mnogi menijo, da je preveč ozka in ne omogoča razumevanja in razlage vseh duševnih procesov, predvsem subjektivnih zavestnih doživljajev (Chalmers), in drugič, tudi če jo sprejmemo, se še vedno kaže problem integracije znanja različnih parcialnih uvidov. Pri raziskovanju v kognitivnih znanostih sodelujejo znanstveniki iz zelo različnih področij: naravoslovje, računalništvo, medicine, družboslovje in humanistika, zato je iskanje skupnega jezika in integracija znanja veliko težja kot pri raziskavah, kjer sodelujejo znanstveniki različnih disciplin znotraj naravoslovja (npr. kemija in biologija), družboslovja ali humanistike. Radikalno rešitev problema preučevanja duševnih procesov bi predstavljal strogo redukcionistični pristop tako v metafizičnem kot tudi v znanstveno teoretskem smislu, po katerem je edina prava razlaga na ravni nevrobiologije (Bickle, P. M. Churchland). Po tej "radikalni nevronski teoriji" (Gold, Stolyar) so vse znanosti, ki se ukvarjajo z višjo ravnijo opisa (npr. psihologija) zgolj pragmatični in metodološki pristopi, ki bodo z razvojem nevroznanosti postali nepotrebni. Manj radikalno rešitev sprejemajo tisti ("naturalistični koevolucijski pristop" (Hardcastle, P.S. Churchland) in "minimalna nevrofilozofija" (Walter)), ki menijo, da se različne funkcije pojavijo na različnih ravneh in da nevroznanost potrebuje višjo raven (npr. psihologijo, filozofijo), na kateri si zastavljamo vsebinska vprašanja, ki predstavljajo vodilo v raziskovanju. Tak pristop je pluralen in sprejema hipotezo o računalniški metafori kot o enem izmed možnih pristopov, vendar se ne omejuje samo na raziskovanje kognitivnih procesov kot informacijskih procesov in išče integracijo tudi z drugačnimi paradigmami raziskovanja, npr. fenomenološko.

Literatura

Boyd, R. (1993), “Metaphor and theory change: What is “metaphor” a metaphor for?” v A. Ortony (ur.), *Metaphor and Thought*. Cambridge University Press, Cambridge, 481-532.

Chalmers, D. (1996). *The Conscious Mind*, Oxford University Press.

Churchland, P.M., (1989), *A Neurocomputational Perspective: The Nature of Mind and the Structure of Science*, MIT Press, Cambridge, MA.

Churchland, P.S. (1986), *Neurophilosophy*, MIT Press, Cambridge.

Fodor, J. A. (1987), *Psychosemantics*, MIT Press, Cambridge, MA.

Gold, Stolyar. (1999). "A neuron doctrine in the philosophy of neuroscience*", Behavioral Brain Sciences.*

Hardcastle, V.G. (1996). *How to Build a Theory in Cognitive Science*, State Univ. of New York Press.

Searle, J. R. (1992). *The Rediscovery of the Mind*, The MIT Press.

Walter, H. (2001). *Neurophilosophy of Free Will*, MIT.

Evaluation of the semantic similarity of the words denoting emotions

Cveta Martinovska
Department of computer science, European University -R. Macedonia
Anton Popov bb, 1000 Skopje, Macedonia
e-mail: cveta.martinovska@eurm.edu.mk

ABSTRACT

This paper presents the results of an experiment designed to investigate the semantic similarity of various words denoting emotions. The data of this psycholinguistic experiment bring evidence about the organisation of the emotional space which is considered to be circular in the psychological theories. The results support the theory for the polarity of the primary emotions as well as the circular structure of the emotional space in the long-term memory.

Emotions are not an easy concept to study. In any of the disciplines that study emotions there is no agreement concerning the number or nature of the basic emotions. Some authors suggest that emotions should be conceptualised as dimensions, like pleasure, arousal and dominance, or as emotional categories, such as disgust, expectancy, etc. There are many categorizations of primary emotions (Ortony and Turner, 1990). Plutchik identified eight primary emotions emphasizing their relations to adaptive biological processes. Arnold expanded the number of primary emotions to eleven based on their relations to action tendencies. Watson postulated that there are three types of basic emotional reactions fear, rage and love. Ekman and Friesen recognized six universal facial expressions. Izard emphasized the survival role of emotions and identified ten primary emotions through the facial expressions.

Plutchik (1980, 1997) proposed circular ordering of the primary emotions, similar to that of the colours. Figure 1 shows the ordering of primary emotions given by Plutchik.

Figure 1. Circular ordering of primary emotions proposed by Plutchik

According to Plutchik "primary emotions can be conceptualised in terms of pairs of polar opposites" and "all emotions vary in their degree of similarity to one another" (Plutchik, 1980). For example, shame and guild are more similar, in comparison with happiness and disgust. Another important aspect concerning the representation of emotions is that they vary in the intensity. For example, there is difference in the intensity between fear and panic. Considering the intensity as a separate dimension, the emotional space is regarded as a three-dimensional.

A lot of words are used in every language to denote various emotional states. Some of them belong to the subjective language, others to the language of behaviour or to the functional language. For example, fear and anger in the subjective language, correspond to escape and attack in the language of behaviour and to protection and destruction in the functional language. The words that are used in this experiment belong to the subjective language.

As an appropriate method for obtaining the organisation of the expected multidimensional space, multidimensional scaling is used. This method was applied to discover the structure of the cognitive space for terms about professions, sicknesses and colours (Gerganov, 1987).

This work describes an experiment for obtaining the model of the human memory for emotions. The approach is based on the evaluation of the semantic similarity of the concepts denoting emotions. The results might be useful for developing an agent architecture that can handle cognitive and emotional aspects of behaviour.

Model of the emotional space

In the experiment subjects are instructed to evaluate the semantic similarity of various words denoting emotions. Actually subjects define similarity relations between emotional concepts. The set of emotional concepts used in the experiment consists of primary and secondary emotions from the subjective language. This set together with the similarity relation forms an undirected graph

$$G_K=(T, S)$$

where T is the set of emotional concepts and S stands for the similarity relation between the emotional concepts defined as

$$S \subseteq T \times T.$$

The graph that represents the organisation of the emotional space is shown in Figure 2. This model illustrates the structure created over the emotional concepts. Arcs denote that two concepts are related on the basis of their similarity.

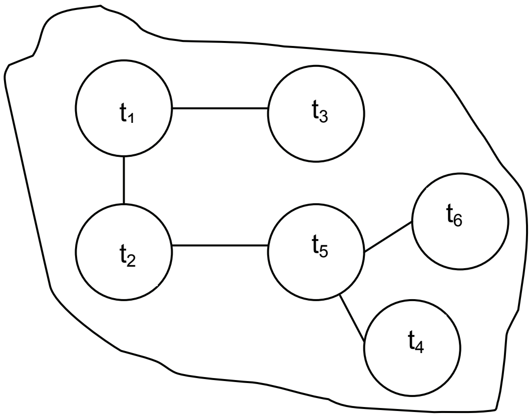


Figure 2. Graph representing the subject's organisation of the emotional space

Multidimensional scaling theory

Multidimensional scaling (Kruskal and Wish, 1978) theory postulates that judgements about the similarity of the members in a set of objects are done according to the integral feature, which can be decomposed to several primary features. Similar objects are represented in the space by two points located close together, and dissimilar objects by two points far apart. The space is usually a two- or three-dimensional Euclidean space but in some cases might have more dimensions. The distance between the points can be expressed through the projections on the axes, in the Euclidean metric,

$$d_{ij} = \sqrt{\sum_{m=1}^{n} (a_{im} - a_{jm})^2}$$

where d_{ij} is a distance between the points i and j, a_{im}, a_{jm} are projections of the points i and j on axis m, n is a number of axes or space dimensions.

When k objects are used in the experiment, there are $\frac{k(k-1)}{2}$ equations. Left parts of the equations are known distances, obtained through the method of one-dimensional scaling. The unknown parameters in this system of equations are a_{im} (i=1,2,....,k; m=1,2,...,n). Because the number of the axes n is smaller than the number of the objects, this system of equations can be easily solved.

Use of the Euclidean metric for the distances between the objects in the cognitive system is not always the best choice. Different formulas are proposed for different empirical data

$$d_{ij} = \begin{cases} \left[\sum_{m=1}^{n} \left|a_{im} - a_{jm}\right|^{1}\right]^{1/1} & \text{– city block metric} \\ \left[\sum_{m=1}^{n} \left|a_{im} - a_{jm}\right|^{2}\right]^{1/2} & \text{– Euclidean metric} \\ \left[\sum_{m=1}^{n} \left|a_{im} - a_{jm}\right|^{l}\right]^{1/l} - 1 & \text{metric of Minkowski} \end{cases}$$

where d_{ij} is a distance between the points i and j, a_{im}, a_{jm} are projections of the points i and j on axis m, n is a number of axes, l is an exponent that determines the kind of the metric.

Kruskal gives the criterion for determining the most adequate metric for certain empirical data. He proves that the following functional called stress, has a minimum for that value of l that is adequate metric for the empirical data:

$$S = \sqrt{\frac{\sum_{i<j} (d_{ij} - \hat{d}_{ij})^2}{\sum_{i<j} \left(d_{ij} - \bar{d}\right)^2}}$$

where $\hat{d}_{ij}$ is a distance between the points i and j, obtained theoretically using suitable metric, d_{ij} is an empirical evaluation of the similarity between the objects i and j, $\bar{d}$ is a mean value of all the distances.

One variant of the multidimensional scaling is INDSCAL (individual multidimensional scaling). The idea in INDSCAL is that for different subjects, or under various perceptive conditions the axes of multidimensional space will have different weights. The formula for distances in INDSCAL is

$$d_{ij}^{(p)} = \left[\sum_{m=1}^{n} w_{pm} \left|a_{im} - a_{jm}\right|^{l}\right]^{1/l}$$

where $d_{ij}^{(p)}$ is the distance between the points i and j for a subject p or a condition p, a_{im}, a_{jm} are projections of the points i and j on axis m, w_{pm} is the weight of the axis m for a subject p or a condition p, n is a number of axes in the space, l is a kind of a metric.

The dyads that are used in the multidimensional scaling have to be scaled according to their semantic (dis)similarity.

Experiment

Multidimensional scaling method is used as a methodology for investigating how adults understand the relationship between various concepts of emotions.

Material

Primary emotions like fear, anger, happiness and sadness, as well as other more or less similar to them and some that represent variations in the intensity of the emotions, were used as a data set.

These emotions are not chosen according to any psychological theory. They are just a starting point for creating models of agents that display competent actions, goal-directed behaviour and appropriate emotions. Some of the emotions are caused by goal failure or success, like sadness and joy, and others are related to the attitude of another agent, as remorse and pride.

The twenty-six terms, shown in Figure 3 were written on a slip of paper.

1. fear
2. anger
3. greed
4. fury
5. regret
6. pity
7. anxiety
8. hate
9. respect
10. pride
11. gratification
12. happiness
13. disgust
14. resentment
15. remorse
16. grief
17. panic
18. jealousy
19. sadness
20. envy
21. expectation
22. sympathy
23. shame
24. pain
25. surprise
26. love

Figure 3. Emotions used in the experiment

Subjects

In the experiment 11 subjects were asked to participate and none used to have any mental diseases. The average age of the subjects was 34 years and varied in the range from 27 to 60 years.

Procedure

The slips of paper with 26 terms were given to all the subjects. They were instructed to read the terms that denote emotions carefully and to form groups from emotions they consider to be similar. Groups that consist of only one term were allowed as well as a group that contains all of the terms. Subjects were told that they might revise their solutions and might work as long as they want. They had to write the groups on the blank slips of paper.

Results

The free classification data were converted into the similarity matrix. The algorithm for converting the data obtained with a free classification method into a similarity matrix is given by Miller. The similarity matrix was processed using non-metric multidimensional scaling analyses (SYSTAT). The Euclidean model was used and two analyses were requested, the first with two and the second with three dimensions. Two-dimensional plot is presented in Figure 4. The model is built using the data given in Table 1.

Table 1. Coordinates for two-dimensional model

variable	dimension 1	dimension 2
1. fear	0.91	0.41
2. anger	-1.21	-0.68
3. greed	-1.32	0.27
4. fury	-0.29	-0.64
5. regret	0.26	-1.08
6. pity	1.05	-0.90
7. anxiety	0.89	-0.04
8. hate	-0.64	-0.50
9. respect	-0.03	1.17
10. pride	-0.50	0.73
11. gratification	-0.14	0.90
12. happiness	0.08	0.52
13. disgust	-0.58	-1.09
14. resentment	-0.63	-0.79
15. remorse	0.21	-0.80
16. grief	0.85	-0.14
17. panic	1.14	0.13
18. jealousy	-0.79	0.12
19. sadness	0.50	-0.18
20. envy	-1.54	0.14
21. expectation	0.35	0.21
22. sympathy	0.15	0.88
23. shame	-0.54	0.54
24. pain	1.32	-0.11
25. surprise	0.66	0.24
26. love	-0.16	0.69

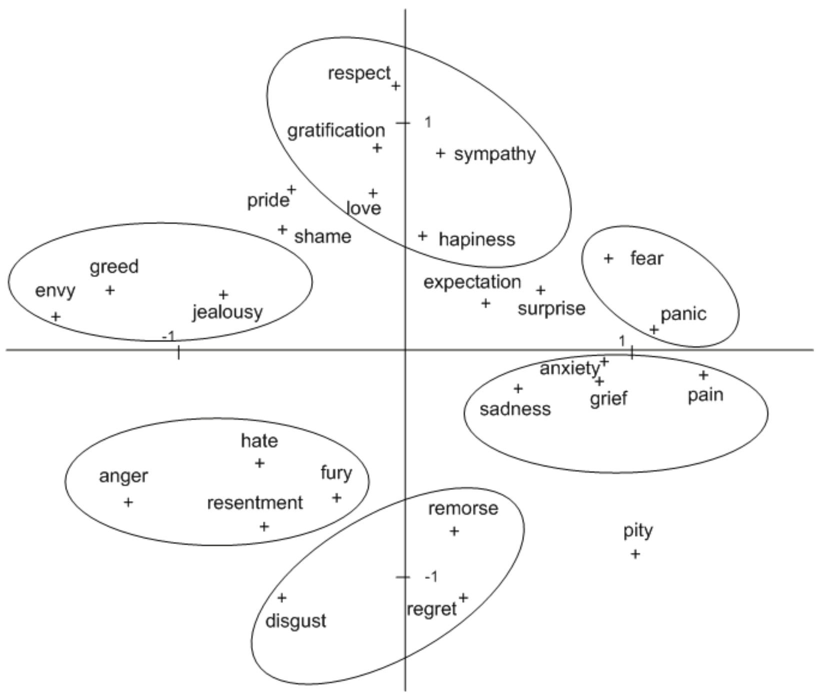


Figure 4 Two-dimensional plot based on the results of the multidimensional scaling

Discussion

The two-dimensional plot of the emotional space shown in Figure 4 supports the hypotheses for the polarity of the emotions. It presents an evidence that in the long-term memory emotions are organised according to the principle of polarity: happiness is against sadness, fear against anger and disgust against greed.

There are six groups of emotions clearly separated around the primary emotions: happiness, sadness, fear, anger, disgust and greed. These results differ from the model of Plutchik represented in Figure 1, where these six emotions together with expectation and surprise are regarded as primary and opposite emotions. Also, surprise is treated as more similar to fear and sadness, while anticipation is more similar to anger and joy.

The differences between obtained results and the Plutchik's model are probably due to using words for emotions that are not enough representative.

I expected that the three-dimensional plot will express the intensity differences. There are some variations in the third dimension, for instance between remorse and regret, between sympathy and love, etc. The intensity differences are slightly expressed and further investigations with more appropriately chosen terms could bring more evidence.

The results support the findings for the polarity of the primary and other emotions, as well as the circular structure of the emotional space in the long-term memory.

References

Gerganov, E. (1987) Pamet i smisl. Izdatelstvo “Nauka i izkustvo”, Sofia, Bulgaria

Kruskal, J. and Wish, M. (1978) Multidimensional scaling. Sage publications

Ortony, A. and Turner, T. J. (1990) What’s basic about basic emotions? Psychological review, 97, 315-331

Plutchik, R. (1980) Emotion: A Psychoevolutionary synthesis. Harper and Row, New York

Plutchik, R. and Conte, H. (1997) Circumplex models of personality and emotions, American psychological association, Washington

ZAVEST IN PSIHOTERAPIJA

As. mag. Miran Možina, spec. psihiater, psihoterapevt,
Fakulteta za socialno delo,
Topniška 31, 1000 Ljubljana, Slovenija
tel 041748812
miran.mozina@fsd.uni-lj.si

ABSTRACT

Povzetek
Freudovo načelo »zdravljenje prek ozaveščanja« nosi v sebi protislovja. Za terapevtsko spremembo večkrat klientova zavest ni zaželena, je lahko celo kontraproduktivna. Psihoterapevti smo pri delu z ljudmi vedno znova pred težko preizkušnjo, kako se izogniti pastem zavestnega namena in kako ohraniti milino.

1 UVOD

Aldous Huxley (1) je rad poudarjal, da je osrednji problem človeštva iskanje miline. Živali kažejo v svojem vedenju preprostost, naivnost, ki jo je človek izgubil. Človekovo vedenje je skvarila prevara – celo samoprevara – namena in samozavedanje. Človek je izgubil »milino«, ki so jo živali ohranile. V skladu s Huxleyem menim, da je tudi v psihoterapiji zavest lahko ovira in da je iskanje miline eden osrednjih izzivov za vsakega psihoterapevta.

2 KLIENTOVA ZAVEST IN TERAPEVTSKA SPREMEMBA

Svoje psihoterapevtsko izobraževanje sem leta 1985 začel v okviru idej kibernetike drugega reda in konstruktivizma. Zavest in nezavedno v psihoterapiji je bila od vsega začetka moje edukacije pomembna tema, ko smo postavili pod vprašaj osrednjo Freudovo tezo, da je glavni terapevtski cilj ozaveščanje potlačenih motivov in kompleksov, ki so nesprejemljivi za superego. Če terapevt v tem uspe, lahko pride do ozdravitve. To bi lahko na kratko izrazili s formulo: **zdravljenje preko ozaveščanja**.

Na protislovja te formule so opozarjali tudi drugi (2): »V psihoanalizi se predpostavlja, da potlačevanje leži v osnovi nevrotičnih in psihosomatskih motenj in da se posameznik, čeprav nezavedno, vendar kar najbolj aktivno (celo za ceno čustvenega stresa in somatskih motenj), poskuša upreti temu, da bi se potlačeni motivi in kompleksi pojavili v zavesti. Kako uspe psihoanalitik odstraniti te odpore? Je potlačevanje zgolj 'napaka' nezavednega? Nikakor, psihoanalitiki so vedno upravičeno smatrali, da je potlačevanje eden najpomembnejših obrambno varovalnih mehanizmov, ki varuje zdravje in vedenje pred kolapsom. Zakaj se to nenadoma pokaže kot nepotrebno?

Toda ali je bilo zares 'nenadoma'? Vsi vemo, da bomo, v kolikor poskušamo ukazati bolniku, naj se zavestno sooči s potlačenimi doživetji, ne da bi pred tem z njim sistematično psihoterapevtsko delali, vključno z jačanjem njegovih zavestnih psiholoških struktur, naleteli na močan odpor. Razen tega taki poskusi povzročijo, da bolnik zavzame do postopka negativen stav, in lahko vodijo do poslabšanja njegovega stanja (celo do samomora). Praviloma je učinkovit uvid rezultat dolgotrajnega psihoterapevtskega dela. Glede na to menimo, da je uvid bolj *posledica* in kriterij ozdravitve kot pa njen *vzrok*. Ozdravitev je posledica … dolgotrajnih empatičnih stikov, ki obnovijo bolnikovo sposobnost za neposredno čutno doživljanje sveta in usposobijo njegove obrambne mehanizme. Naj poudarimo to misel: bolj uvid preko ozdravitve kot pa ozdravitev preko ozaveščanja."

Tudi psihoterapevtski opus Miltona H. Ericksona nam je služil kot spodbuda pri raziskovanju primerov, ko je bila zavest za terapevtsko spremembo nezaželena in je bila koristna ti. »terapevtska amnezija« (3). Nekega dne je npr. v Ericksonovo ordinacijo vstopila ženska in oklevala preden je sedla. Pozorno je ogledovala vsak stol v sobi, da ne bi sedla na napačnega. Na ta način je nazorno pokazala svojo težavo, zaradi katere je prišla k terapevtu. Morala se je izogibati določeni vrsti stolov. Glede tega je bila pretirano obsesivna. Kamorkoli je šla, je morala natančno proučevati stole. Ne le da je bila pretirano zavestna, ampak si je na ta način tudi onemogočala užitek, ki ga lahko ima vsak ob brezskrbnem sedanju. Erickson je uporabil hipnozo, da ji je ponudil idejo o postopnem osvobajanju od prisile. Hkrati je poudaril pomen hipnotske amnezije – ni hotel, da bi se spomnila njegovih sugestij. Hotel je odvrniti njeno pozornost, zamotiti njeno zavest glede ključne terapevtske naloge: da bi postala bolj spontana. Saj bi drugače lahko njeno zavestno prizadevanje blokiralo spontanost. Ujela bi se v paradoks – bodi bolj spontana! Tako je odšla iz ordinacije z občutkom, da se v pogovoru z Ericksonom ni zgodilo nič terapevtskega.

Nekega dne pa je nepričakovano opazila, da je sedla, ne da bi prej pregledovala stole. Naenkrat se ji je posvetilo, da to pravzaprav počne že nekaj časa. To jo je spodbudilo, da je razmišljala naprej in presenečena ugotovila, da že nekaj časa hodi v kino s prijateljem, česar prej nekaj let ni zmogla. Prav tako je po mnogih letih odšla na koncert. Ko je kasneje Ericksonu poročala o pozitivnih spremembah, je poudarila, da ni mogla ugotoviti, kdaj točno je prisila pregledovanja stolov popustila. Po njeni razlagi je začela sedati svobodno in prijetno avtomatično.

H kritičnemu odnosu do vloge zavesti v psihoterapiji (in širše v zahodni kulturi) me je v mojem prvem izobraževanju spodbudil tudi študij Batesonovih del, predvsem njegov članek Zavestni namen nasproti naravi (4). »Zavest je organizirana v smislu namena. Je naprava kratkega dosega, ki vam omogoča hitro priti tja, kamor želite. Ne omogoča vam delovati z največjo možno modrostjo v smislu življenja, pač pa slediti najkrajši logični ali vzročni poti, da bi prišli do tistega, kar želite naslednje. To pa je lahko večerja, lahko je Beethovnova sonata, lahko je seks. Predvsem pa je lahko denar ali moč… Zavestni namen ima danes (ob podpori moderne tehnologije) moč, da zamaje ravnotežje telesa, družbe in živega sveta okoli nas.«

Tako smo obrnili pozornost od klienta na nas same, terapevte in se spraševali, kako se lahko v terapiji izognemo pastem pretirane zavestne namenskosti. Naš učitelj Graham Barnes (5) nam je poročal o svoji raziskavi z vozniki formule 1, v kateri je odkril, da se večinoma že nekaj dni pred dirko umaknejo v karanteno. Postopno razvijejo posebno stanje zavesti, tako da potem na dirkalni stezi doživljajo ti. disociacijo – vozijo njihove oči, roke, noge, medtem ko zavestno iz razdalje opazujejo sebe med vožnjo. Nekateri so poudarili, da je vsako vpletanje zavesti med dirko lahko smrtno nevarno, ker bi bili v zavestni vožnji prepočasni. Zaupati so morali »avtomatskemu pilotu«. Barnes nam je njihove izkušnje ponudil kot analogijo za to, kakšno držo naj bi kot terapevti razvili med terapevtskim delom. V skladu z Batesonom nam je pri delu z ljudmi namesto napuha povezanega z zavestnim namenom svetoval ponižnost, ker je vsaka interakcija s klientom tako kompleksna, da je zavest lahko bolj moteča kot ne in bomo lahko pri delu z ljudmi zleteli iz piste, če ne bomo bolj zaupali nezavednemu procesu.

3 TERAPEVTOVA ZAVEST V PSIHOTERAPIJI

Freud (6) je poudaril, da bi moral terapevt poslušati svojega klienta s »prosto lebdečo pozornostjo«:

»To … zajema odsotnost terapevtovega truda, da bi usmeril pozornost na karkoli posebnega in terapevtovo vzdrževanje enake mere umirjene, tihe pozornosti – »prosto lebdeče pozornosti«… Tako hitro kot posameznik preudarno usmeri pozornost do določene mere, začne postavljati ene dele pred druge; določeni deli se fiksirajo v umu s posebno jasnostjo, drugi pa ostanejo zanemarjeni. V tej selekciji posameznik sledi svojim pričakovanjem in nagnjenjem. To pa je ravno tisto, kar se ne sme zgoditi… Če posameznik v selekciji sledi svojim pričakovanjem, obstaja nevarnost, da ne bo našel nič drugega kot tisto, kar je že znano. In če posameznik sledi svojim nagnjenem, karkoli bo zaznaval bo z veliko verjetnostjo ponarejeno.«

Ta opis se v veliki meri ujema s stanjem »začetniškega uma«, kot so ga definirali v zen psihologiji (glej spodaj). Terapevt naj bi se prizadeval, da njegova pričakovanje ne usmerjajo pozornosti k izbranim vidikom materiala. Kljub njegovi vrednosti, pa ima Freudov opis tudi pomanjkljivosti. Freud ni opisal notranjih procesov, s katerimi terapevt razvija in doseže »prosto lebdečo pozornost«. Ostajal je tudi znotraj »psihologije ene osebe«, kjer je opazovanje osredotočeno bolj na klienta kot na terapevtski odnos.

Theodore Reik (6), ki so ga v psihoanalitski literaturi spregledali, je najbolje izdelal Freudovo idejo o »prosto lebdeči pozornosti«. Navezal se je na Freuda in poudaril, kako je pomembno, da terapevt ne dovoli, da se pozornost veže na določeni vidik opazovanega polja, ker to omejuje njegovo zaznavanje. Terapevt naj bi začasno odložil kritično presojo in s tem omogočil, da se lebdeči vtisi porajajo v pozornosti. Svojo pozornost naj bi usmeril tudi navznoter in prisostvoval porajanju podatkov iz svojih osebnih izkušenj. Ker mnoge nianse medosebne komunikacije izražamo in zaznavamo na nezavednih nivojih, lahko terapevt samo z vpogledom navznoter in s poslušanjem s »tretjim ušesom« resnično razume svojega klienta.

Če predpostavke oblikujejo posameznikovo zaznavanje, potem je za terapevta nujno, da se nauči, kako se lahko predpostavk zaveda in jim dovoli, da po porajanju lahko tudi poniknejo. Bion (6) je posredoval prej omenjeno idejo v obliki protislovnega nasveta, da se mora terapevt vsakemu srečanju približati »brez spomina in želje«. Mojster zena Suzuki (6) je govoril o tej disciplini kot o kultiviranju začetnikovega uma: »Če je tvoj um prazen, potem je vedno za nekaj pripravljen, je odprt za vse. V umu začetnika so mnoge možnosti, v umu eksperta pa le redke.« V tradiciji budistične meditacije, ki udejanja prisotnost, so »začetniški um« poimenovali disciplino »ne vedeti« in »gola pozornost«.

Martin Buber (7) je izpostavil pomen sposobnosti, da vsak trenutek obravnavamo kot nov trenutek, in ohranjamo odprtost za to, kar nam lahko le-ta razodene v vsej svoji celovitosti in v vseh svojih posebnostih. »Kljub vsem podobnostim, ki jih vsaka življenjska situacija ima, tako kot novorojeni otrok, kaže tudi obraz, ki ga še nismo srečali in ga nikoli več ne bomo. To zahteva od tebe odziv, ki ga nisi mogel vnaprej pripraviti. Ne zahteva ničesar, kar je preteklost. Zahteva prisotnost, odgovornost; zahteva tebe.«

Terapija je nenehen pretok trenutkov, ki se stkejo v smiselno celoto v procesu konstruiranja. Terapevt s konstruiranjem osmišlja terapevtski proces, hkrati pa tudi uokviri svoje možnosti za odzivanje na porajajoče trenutke v odnosu, ki nudijo nove možnosti. Terapevt, ki se lahko odreče svojemu trenutnemu razumevanju dogajanja in se osredotoči na to, kar se poraja tukaj in zdaj, bo v svojem odzivanju bolj fleksibilen in prilagojen trenutni situaciji. Zavedanje osebnih predpostavk, ki delujejo v določenem trenutku, omogoča terapevtu, da je bolj prisoten. Hkrati večja prisotnost zahteva tudi to, da terapevt ne izhaja iz predpostavk, ki običajno vzorčijo njegovo zaznavanje, vnašajo red in omogočajo večjo varnost. Cena, ki jo mora terapevt pogosto plačati za razvijanje »začetniškega uma«, je večji strah, še posebej takrat, ko se v odnosu zgodijo motnje, ki načnejo njegov občutek lastne vrednosti.

Popredmetenje ali odsotnost razlikovanja med posameznikovimi konstrukti in fenomeni, ki ležijo v ozadju in jih konstrukti prezentirajo, je najpogostejši nesporazum, ki ga srečamo v vsakdanjem življenju in predstavlja temeljni izziv za terapevte. Kot terapevti se moramo neprestano boriti proti poskusom fiksacije, popredmetenja tega, kar se dogaja med nami in klienti. Nenehoma se moramo boriti proti temu, da se sočamo s strahom, negotovostjo v nejasnih situacijah, tako da poskušamo ohraniti občutek varnosti in občutek kompetence s popredmetenjem procesa.

Zgoraj navedeno še posebej velja za terapevte začetnike, ki se vsak trenutek borijo za porajajoči se občutek kompetence. Hkrati pa isti skušnjavi podležejo tudi izkušeni terapevti, ki težko priznajo, da za določene situacije nimajo odgovorov. Večja izkušenost terapevtu tudi olajšuje delovanje iz navade in rutine.

Popredmetenje se lahko kaže tudi tako, da kliente razumemo kot primerke posebnih diagnostičnih kategorij ali osebnostnih motenj. To ne pomeni, da nam poznavanje vzorcev, ki se ponavljajo, ne pomaga, hkrati pa lahko zamudimo priložnost, da spoznamo enkratnega klienta v danem trenutku. Popredmetenje se lahko nanaša tudi na opis klientovega notranjega doživljanja, ki ga ne moremo razumeti le kot hipoteze, temveč mu pripisujemo stvarni obstoj. In še ena oblika popredmetenja – ko težko sprejmemo, da nekaj, kar je veljalo za odnos med nami in klientom v določenem trenutku, ne velja več v naslednjem trenutku.

4 ZAKLJUČEK

Bateson meni (8), da je problem miline v temelju problem integracije in tisto, kar naj bi se integriralo, so različni deli uma – še posebno tiste številne ravni, ki jih na eni strani imenujemo »zavest« in na drugi strani »nezavedno«. Če hočemo najti zdravilo za bolezen zavestnega namena in doseči milino, se morajo razlogi srca integrirati z razlogi razuma. Umetnost je zanj del človekovega iskanja miline. Menim, da je psihoterapija v najboljših trenutkih umetniško, estetsko doživetje, doseganje miline, kjer zavestni um igra le majhno vlogo.

»Gre za tisto, kar je Freud imenoval kraljeva pot v nezavedno. V mislih je imel sanje, menim pa, da bi morali združiti sanje, ustvarjalnost umetnosti, poezijo in podobno. Mednje pa bi vključil še najboljše od religije. Vse to so dejavnosti, v katere je posameznik vključen kot celota. Umetnik lahko ima zavesten namen, da bo prodal sliko, morda celo zavesten namen, da jo bo naredil. Pri slikanju pa mora nujno sprostiti napuh v korist ustvarjalne izkušnje, v kateri njegov zavestni um igra le majhno vlogo.« (9)

Literatura

(1) Bateson G (1972). Steps to an Ecology of Mind. New York: Ballantine Books: 128.
(2) Bassin FV, Rotenberg VS, Smirnov IN (1983). On Guenter Ammons Principle of Social Energy: Analysis of the Methodological Basis. Dyn Psychiat; 16: 14-48.
(3) Short D, Erickson BA, Erickson Klein R. Hope & Resiliency. Norwalk: Crownhouse: 51.
(4) Bateson G (1991). Zavestni namen nasproti naravi. Nova revija 10; 105/106: 211-217.
(5) Barnes G (1994). Justice, Love and Wisdom. Zagreb: Medicinska naklada: 186.
(6) Safran J D, Muran JC (2000). Negotiating the Therapeutic Alliance. New York: Guilford Press.
(7) Buber M (1999). Dialoški princip. Ljubljana: Društvo dvatisoč.
(8) Bateson G (1972). Steps to an Ecology of Mind. New York: Ballantine Books: 129.
(9) Bateson G (1991). Zavestni namen nasproti naravi. Nova revija 10; 105/106: 217.
[1] 435-440. 1993.

Realna moč zavesti

Metod Škarja, Igor Jerman, Robert T. Leskovar
Inštitut Bion
Stegne 21, SI-1000 Ljubljana
e-mail: metod.skarja@bion.si, igor.jerman@bion.si, robert.leskovar@bion.si

Povzetek

Dolgoletno raziskovanje dr. Williama Tillerja dokazuje, da ima zavest, zlasti preko osredotočenega namena, lahko tudi robusten vpliv na fizikalno dogajanje. Tak primer je bistveno povečanje števila prebojev v posebni napravi, ko je nanjo usmerjena človeška pozornost z namenom spodbuditi ta efekt. Njegove raziskave tudi kažejo, da je preko osredotočenega namena možno »programirati« preproste elektronske naprave, tako da se v njihovi bližini zgodi določena sprememba v ciljnem sistemu, npr. dvig ali spust pH vrednosti za določeno stopnjo. Opažena je korelacija med delovanjem takih naprav, tudi na razdaljo več kot 10.000 km, kot tudi prenos značilnega delovanja s programirane na neprogramirano napravo. Še več, čez čas se prostor, kje je taka naprava bila nameščena, sam navzame teh lastnosti, tako da opaženi pojavi potekajo tudi brez prisotnosti naprave.

Glede na izkušnje sklepa, da del prostora lahko spremeni svoje lastnosti, tako da je v njem možna povečana sklopitev s poljem zavesti. Poleg običajne U(1) simetrije,značilne za naš fizični svet, naj bi v takih delih prostora le-ta prehajal v stanje višje, SU(2) simetrije. Poleg običajnega 4-razsežnega prostor-časa (D prostor) se valovni del pojavov (kot npr. pilot-wave v De Brogliejevi interpretaciji kvantne mehanike) dogaja v recipročnem k oziroma kot ga imenuje R-prostoru. Zavest ima večji vpliv na R-prostor. Med prostoroma vedno obstaja določena interakcija, ki pa se lahko z ustreznim pogojevanjem (conditioning) D-prostora znatno poveča.

Na Inštitutu Bion smo s posebnim merjenjem odziva organizmov na bližnje električno polje in prevajanjem tega vpliva skozi organizem prišli do zanimivih ugotovitev, ki kažejo, da vpliv stanja organizma na ta odziv preglasi sicer bolj pričakovan prevladujoči vpliv razmeroma konstantnih splošnih fizikalnih lastnosti organizma.

Uvod

Navadno vpliv zavesti na razne procese na fizični ravni raziskuje parapsihologija. Čeprav večinoma uporablja zelo striktno znanstveno metodologijo (npr. dvojno slepe teste), njenim rezultatom uradna znanost večinoma ne zaupa, deloma tudi zaradi kompleksnosti same eksperimentalne situacije, ki na vhodni in/ali na izhodno strani vključuje ljudi s svojo presojo, in pogosto ne enoznačnih rezultatov. Poskusov, kjer bi z zavestnim namenom skušali direktno vplivati na kak načeloma preprost in razumljiv fizikalni proces, ni veliko. Med temi so zelo znani večletni poskusi z zavestnim vplivanjem na naključne generatorje pod vodstvom dr. Jahna na Princetonski univerzi (Jahn 1997). Ti poskusi kažejo sicer po velikosti zelo majhen, a stabilen in statistično visoko značilen efekt.

Na splošno velja prepričanje, da so efekti neposrednega zavestnega vpliva, če že so, bodisi zelo majhni, ali pa nastopajo v tako kompleksnih situacijah, kjer je posamezne vplive zelo težko ovrednotiti in razločiti. V takih primerih navadno obstaja tudi množica alternativnih razlag, ki zavestnemu vplivu oporekajo. Vendar pa je v daljšem raziskovalnem obdobju znanstveniku Williamu Tillerju in njegovim sodelavcem uspelo izvesti vrsto eksperimentov, ki kažejo, da so možni tudi robustni efekti namenskega zavestnega vpliva na razmeroma preproste fizikalne procese (Tiller 2001a, b, 2005). Dr. William Tiller je sicer eden svetovno najbolj priznanih raziskovalec na področju raziskovanja kristalov s prek 250 članki in 3 knjigami s tega področja in je bil 34 let profesor na Stanfordski univerzi. Vzporedno s tem pa se je posvečal tudi prej omenjenim raziskavam. Značilnost vseh njegovih eksperimentov je, da vključujejo zavesten usmerjen namen (torej kaj želimo z vplivom doseči), ne le nekega splošnega zavestnega vpliva ali vplivanja preko bližine določene osebe. V pogojih, ko je bil poskus izveden pod enakimi pogoji, le da je oseba pozornost usmerila drugam ali pa vplivala le preko bližine, so efekti praviloma izostali.

Poskusi, ki kažejo na neposreden vpliv usmerjenega namena

Nekaj poskusov, ki so pokazali efekt , je sledečih. Posebej senzitivizirana kamera (senzitivizirana v smislu, da so pred tem miselno vplivali nanjo z določenim namenom) je poleg običajnih predmetov pokazala še razne zamegljene obrise, sicer bolj nejasne slike okolice pa so uspele tudi, če je bil objektiv kamere pokrit. V posebni napravi za štetje prebojev v stanju tik pod prebojnim pragom (v tem stanju čez daljši čas, lahko več dni, ni bilo nobenih prebojev), je potem, ko je oseba usmerila pozornost nanjo z namenom, da se preboji zgode, le-ti resnično začeli dogajati z veliko pogostostjo (Tiller 1990). To se je dogajalo ne glede na to, ali je bila oseba blizu ali daleč, pomemben pa je bil osredotočen namen. Pri poskusih z otroci je opazil, da ti zaznavajo več kot odrasli (z leti so to sposobnost izgubili). Pri osebah z večjimi psihičnimi sposobnostmi je opazil da občasno generirajo nenormalno visoke razelektritvene pulze, ne samo na telesu, ampak tudi med pari plošč v svoji okolici (Tiller 1995). Za razvoj kasnejšega modela je pomembno opažanje, da npr. pri prehodu svetlobe skozi prizmo ali leče otroci poleg običajnega snopa, ki se uklanja oziroma lomi, vidijo še en dodaten snop, ki pa se obnaša ravno obratno; kot bi bilo steklo optično redkejše od zraka.

Največ poskusov so opravili s preprostimi elektronskimi napravami (to je bil vezje z elektronskimi elementi in napajanjem, a brez zaključenega tokokroga in kakšne posebne funkcije), v katere pa so s posebnim postopkom, ki je vključeval globoko umiritev in osredotočen namen, skušali miselno vtisniti določeno delovanje na določen proces ali stanje (IIED-*intention imprinted elect. device*, UED-*unimprinted elect. device*). To je bil npr. dvig ali spust pH vrednosti za eno stopnjo v vodi (Tiller 1999b, 2000a), vpliv na encimsko aktivnost (Tiller 2000b) in spremembo razmerja ATP/ADP v celicah ličink vinskih mušic. Vsi ti poskusi so dali pozitiven efekt z načrtovano spremembo pH in s ca 25% spremembo opazovane količine v zadnjih dveh primerih.

Vzporedno s tem so prišli še do vrste zanimivih spoznanj. Tako je nepogojena naprava (UED) po določenem času (nekaj dni) postala pogojena, če je bila v bližini IIED (100m stran). Napravi, zaviti v Alu folijo in postavljeni v ozemljeno Faradayevo kletko, pa se je to ni zgodilo (v opazovanem času 3 mesecev). Po 3 mesecih je namenski vtis v IIED začel počasi popuščati in treba ga je bilo obnoviti. Opazili so tudi, da je za to, da se efekti izrazijo, potreben pogojen prostor (KP), kar se zgodi s prisotnostjo IIED. Ko je prostor dovolj pogojen, ta deluje na opazovani proces, tudi če IIED odstranimo (opazovano do 1-2 leta). Zanimiva so bila tudi opažanja, da npr. zamenjava kosa opreme povzroči takojšen odziv pri opazovanem procesu, ki se stabilizira šele čez določen čas. To pomeni, da tudi vsa oprema v okolici postane pogojena. Opazili so tudi efekt eksperimentatorja, in sicer bolj je bil le-ta entuziastičen, boljši so bili rezultati. V zvezi s pogojevanjem prostora so opazili tudi neke vrste fazni prehod. Na začetku je pogojenost prostora po odstranitvi IIED počasi upadala, po več ponovitvah pa je dosegla stabilno raven in ostala daljši čas nespremenjena tudi brez IIED.

Pogojenost prostora so opazili tako, da je na začetku potrebno nekaj časa, da IIED začne delovati (v do takrat nepogojenem prostoru (NP)). KP tudi zazna prisotnost IIED na razdaljo več metrov in začne prenašati njegov vpliv. Pri opazovanih procesih v takem prostoru so se pojavile tudi razne oscilacije, korelirane povsod znotraj njega. V takem prostoru je bil vpliv S in J pola magneta na opazovani proces različen, kar se ni zgodilo v NP.

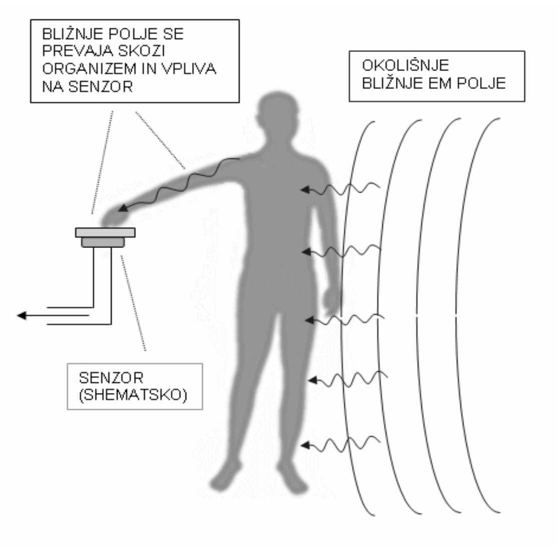
Naslednja faza poskusov je potekala na isti način, a na različnih lokacijah po svetu (Tiller in sod. 2003, Tiller 2001, 2005; tu so te poskuse uspešno replicirali tudi drugi). Tu so se pokazale nove zanimive lastnosti. Očitno se je vzpostavilo informacijsko prepleteno (entangled) polje (IPP), tako da so na vseh kontrolnih mestih (UED) opazili enako pH obnašanje, prišlo pa je tudi do vzpostavilo informacijske prepletenosti med IIED in UED, in to na razdaljah od 3 do 10.000 km. Prenosnik za to ni moglo biti EM valovanje, pa tudi ščitenje z mu-metalom ni moglo preprečiti te povezanosti.

Recipročni prostor kot kanal za komunikacijo z zavestjo

Pomen teh rezultatov je v tem, da kažejo, da del prostora lahko spremeni svoje lastnosti, tako da je v njem možna povečana sklopitev s poljem zavesti. V svojem modelu predlaga, da poleg običajne U(1) simetrije,značilne za naš fizični svet, v takih delih prostora le-ta prehaja v stanje višje, SU(2) simetrije (Tiller 2001b, 2005). V pogojih te simetrije so npr. možni magnetni monopoli. Poleg običajnega 4-razsežnega prostor-časa (D prostor) se valovni del pojavov (analogija je npr. pilot-wave v De Brogliejevi interpretaciji kvantne mehanike) dogaja v recipročnem **k** oziroma kot ga imenuje Tiller v R-prostoru (Tiller 1999a; tu vidimo analogijo tudi z recipročno mrežo pri kristalih, ki se naravno pojavi pri opisu sipanja valovanj na le-teh). Zavest ima večji vpliv na R-prostor. Med prostoroma v vsakem primeru obstaja določena interakcija, ki pa se lahko z ustreznim pogojevanjem D-prostora znatno poveča. Predlaga tudi posebne delce, ki to interakcijo prenašajo.

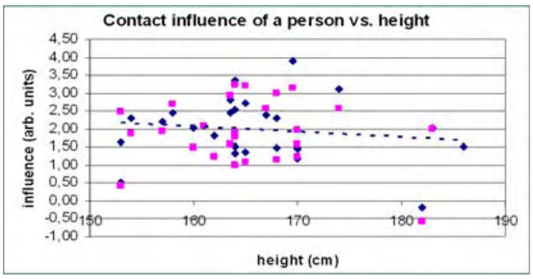
Naši poskusi z absorpcijo in emisijo bližnjega polja

Na Inštitutu Bion smo v seriji poskusov, kjer smo merili odziv organizmov na bližnje električno polje in prevajanjem tega vpliva skozi organizem naprej, prišli do zanimivih ugotovitev. Ti kažejo, da vpliv stanja organizma na ta proces preglasi sicer bolj pričakovan prevladujoči vpliv osnovnih fizikalnih parametrov tega procesa (Škarja in sod. 2005). Organizem v polju približno lahko opišemo kot anteno, ki sprejema in oddaja vpadajoče valovanje. Pri tem električno gledano glavno vlogo igrajo splošne lastnosti organizma, kot so njegova prevodnost, upornost, višina, masa itd. Po sestavi smo si ljudje zelo podobni, saj o našem zdravju in počutju odločajo molekule, ki so sicer prisotne v zelo majhnih koncentracijah glede na celotno količino snovi. Zato smo upravičeno pričakovali, da bo efekt odvisen predvsem od prej navedenih splošnih parametrov in ne toliko od trenutnega stanja organizma. Shematski prikaz meritve prikazuje spodnja slika.

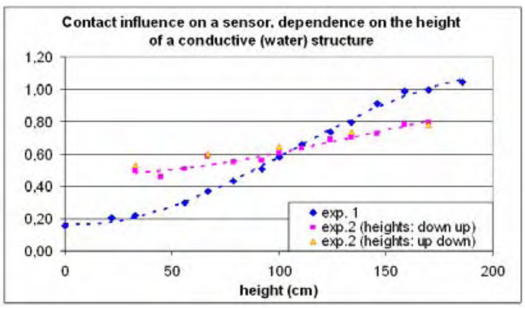


Slika 1: Shematski prikaz meritve z absorpcijo in emisijo bližnjega polja.

Vendar so poskusi pokazali, da ljudje zelo variirajo med seboj, in to v nikakršni korelaciji s prej navedenimi količinami. Kot glavno korelacijo bi pričakovali korelacijo med oddanim signalom in višino, a ta se je pokazala celo kot rahlo negativna, še bolj negativna pa je bila z maso in površino. Spodnji graf prikazuje ta primer z višino, še eden niže pa primer meritev, ko smo ljudi nadomestili z naraščajočim vodnim stolpom. V tem primeru smo dobili skoraj idealno korelacijo med signalom in višino.

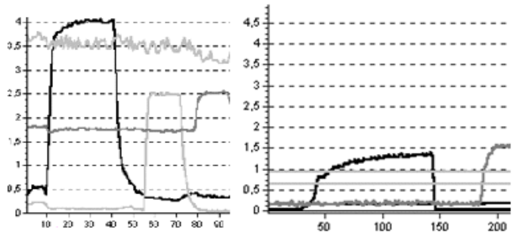


Slika 2: odvisnost signala od višine oseb



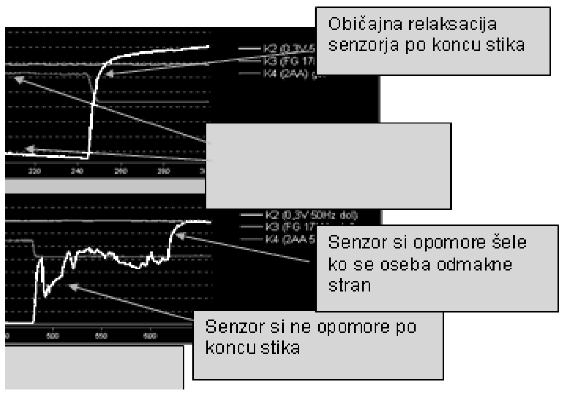
Slika 3: odvisnost signala od višine vodne strukture

Zanimivo, kot največjo smo dobili 50% antikorelacijo med višino signala in starostjo oseb. Poleg te smo opravili še številne druge raziskave. Tako smo opazili, da lahko počitek, popitje različnih vod, fizična aktivnost ipd zelo spremenijo višino signala. Že samo opažanje časovnega poteka signala nas je navedlo do tega, da tu ne gre samo za običajen električni odziv (ki mora biti praktično trenuten). Po vklopu polja smo opazili vse od hitrega pa do zelo počasnih odzivov, ko je signal potreboval tudi več 10s, da je dosege l končno vrednost. Primer običajnega in nenormalno počasi naraščajočega signala prikazuje spodnja slika.



Slika 4: Primer običajnega (levo, črna linija) in nenormalno počasi naraščajočega signala po vklopu polja.

Občasno smo opazili tudi bolj anomalne pojave. Eden od njih je bil, da se je po daljših neprekinjenih merjenjih signal na senzorju enostavno porušil in se ni povrnil nazaj, dokler je oseba stala v bližini (razdalja od senzorja je sicer bila taka, da normalno ni imela nobenega vpliva nanj). Tak primer skupaj z normalnim prikazuje spodnja slika.



Slika 5: Nenormalna porušitev signala na senzorju (spodnji del slike) v primerjavi z normalnim potekom (zgornji del).

Diskusija

Naši eksperimenti kažejo kar nekaj sorodnosti z lastnostmi, ki jih je pri svojih eksperimentih opazil Tiller. Opazili smo močno odvisnost izmerjenih signalov od postopkov (počitek, pitje vode, fizična aktivnost), ki malo spremenijo stanje organizma v smislu njegovih splošnih parametrov. Poleg tega smo opazili pojave, ki spominjajo na pogojevanje prostora in predmetov (Sliki 4 in 5) in ki jasno kažejo, da tukaj ne gre le za običajno električno delovanje.

Naši in Tillerjevi eksperimenti lahko osvetlijo tudi problem ponovljivosti pri tovrstnih eksperimentih. Z dolgotrajnim delom na nekem problemu lahko namreč v okviru določenega laboratorija oziroma raziskovalnega mesta dosežemo tudi določeno stopnjo pogojenosti prostora, tako da vedno laže dosegamo določene eksperimentalne izide. Ko pa skuša nekdo drug take eksperimente ponoviti drugje, le-ti pogosto ne uspejo. Ti poskusi dajejo določeno znanstveno podlago tudi pogostim pritožbam raziskovalcev na teh področjih, da oseba z negativno naravnavo (ki npr. preverja eksperiment) lahko s tem dejansko negativno vpliva na izid.

Zanimivo je tudi primerjati te poskuse, zaključke in razlago z modelom kvantne teorije polja na področju organizmov in možganov (glej prispevek za to konferenco, Škarja 2006, in reference tam). Kvantna teorija polja v okviru organizmov obravnava (pod)sisteme, ki so v tesnem stiku oziroma interakciji drug z drugim. Zato se v okviru teh sistemov lahko razvije kvantna dinamika, ki vzpostavi red dolgega dosega in skrbi za notranjo urejenost organizmov. Za prenos tega reda je namreč potreben primeren ustrezno organiziran medij. V organizmu je to predvsem voda z vsemi biomolekulami ter znotraj in zunaj celičnimi strukturami kot je citoskeleton.

Zlasti pri Tillerjevih eksperimentih pa si težko predstavljamo, da bi ta princip urejanja igral pomembno vlogo, saj gre za vplive, ki se prenašajo na večje razdalje in po prostoru ter materialih (zrak, običajne trdne snovi), ki se zdi neprimeren za vzpostavljanje ustrezne kvantne dinamike. Le-ta bi namreč morala informacijsko dovolj močno povezati vse relevantne dele sistema v povezano celoto. Zato ti poskusi dejansko lahko nakazujejo popolnoma nove aspekte realnosti.

Reference

- Jahn R. G., B. J. Dunne, R. D. Nelson, Y. H. Dobyns in G. J. Bradish, *Correlations of Random Binary Sequences with Pre-Stated Operator Intention: A Review of a 12-Year Program*, Princeton Engineering Anomalies Research (PEAR), School of Engineering and Applied Science, Princeton University, **1997**.
- Škarja, M., Jerman, I. in Leskovar, R.T., Changes of electric potential of sensors due to near field contact with organisms. V: POKORNÝ, J. (ur.). *Coherence and electromagnetic fields in biological systems*: abstract book. Prague: Institute of Radio Engineering and Electronics, str. 76-78, **2005**
- Škarja M., Kvantna teorija polja, možgani in zavest, poslano za *Kognitivna znanost: 9. mednarodna multikonferenca Informacijska družba IS 2006*, oktober **2006**
- Tiller, W.A., A Gas Discharge Device for Investigating Focused Human Attention, *J. of Scientific Exploration* 4 (2), 255, **1990**.
- Tiller, W.A., E.E. Green, P.A. Parks in S. Anderson,. Towards Explaining Anomalously Large Body Voltage Surges on Exceptional Subjects, Part I: The Electrostatic Approximation, *J. Scientific Exploration* 9331, **1995**
- Tiller, W.A., Towards a Predictive Model of Subtle Domain Connections to the Physical Domain Aspect of Reality: The Origins of Wave-Particle Duality, Electric-Magnetic Monopoles and the Mirror Principle. *J. Sci. Expl*. 13, 41, **1999a**.
- Tiller, W.A. in W.E. Dibble, Jr., Electronic Device-Mediated pH changes In Water, *J. Sci. Expl*. 13, 155, **1999b**.
- Tiller, W.A., M.J. Kohane in W.E. Dibble, Jr., Can an Aspect of Consciousness Be Imprinted Into an Electronic Device?, *Integrative Physiological and Behavioral Science*, 35, 140, **2000a**.
- Tiller, W.A. in M.J. Kohane, Anomalous Environmental Influences on In Vitro Human Enzyme Studies, Part II: Some Electronic Device Effects, *Subtle En. & En. Med*. 11 (2), 99, **2000b**.
- Tiller, W.A. in W.E. Dibble, Jr., New Experimental Evidence Revealing an Unexpected Dimension to Materials Science and Engineering, *Mat. Res. Innov*. 5, 21-34, **2001a**
- Tiller, W.A., W.E. Dibble, Jr. in M.J. Kohane, *Conscious Acts of Creation: The Emergence of a New Physics*, Walnut Creek, CA: Pavior Publishing, **2001b**
- Tiller, W.A., W.E. Dibble Jr., R. Nunley in C.N. Shealy, "Towards General Experimentation and Discovery in "Conditioned" Laboratory Spaces, Part I: Experimental pH-Change Findings at Some Remote Sites", *Special Energy Issue of The Journal of Alternative and Complementary Medicine*, Dec. **2003**.
- Tiller, W.A., W.E. Dibble Jr. in J.G.Fandel, *Some Science Adventures with Real Magic*, Walnut Creek, CA: Pavior Publishing, **2005**

ALTERNATIVA "MONADIČNI" PARADIGMI KOGNICIJE: KONCEPT SOCIALNO PORAZDELJENE KOGNICIJE

Andrej Ule
Filozofska fakulteta, Univerza v Ljubljani
Aškerčeva 2, 1000 Ljubljana, Slovenia
Tel: +38612411102
Fax: +38612411495
andrej.ule@guest.arnes.si

Abstract: The alternative to the 'monadic' paradigm of cognition: the concept of socially distributed cognition is presented. I discuss the need for the broadening of the established 'monadic' concept of cognition in the cognitive science with the concept of distributed cognition and present the Hutchin's 'ethnographic' research on the distributed cognition.

Key words: cognitive science, distributed cognition, monadic paradigm, shared knowledge.

V dosedanji kognitivni znanosti še vedno prevladuje "monadični" pristop k raziskovanju in razlagi kognitivnih pojavov, zlasti zavesti. To je pristop, ki motri kognitivne pojave zgolj v "mejah" posameznika ali posameznega kognitivnega organizma in jih skuša razložiti z mehanizmi, algoritmi delovanja, komputacijami, nevralnimi procesi, ki potekajo v njem. Čeprav so zlasti koncepti paralelno porazdeljene kognicije presegli to gledanje s tem, da so uvedli množico relativno avtonomnih kognitivnih agentov, ki v medsebojnem sodelovanju "proizvajajo" kognitivne ali njim podobne fenomene, pa so ti agensi, na primer posamezni procesorji še vedno sestavni del enega skupnega organizma. Podobno tudi Minskyjeva zamisel o "družbi uma" (society of mind) ni prebila tega okvira pojmovanja kognicije, saj je "družba uma" le metafora za pojasnitev delovanja človeških možganov kot neke vrste notranje družbe relativno avtonomnih nevralnih agensov (agentov), ki skozi svoje nenehno medsebojno preigravanje, tekmovanje za prvenstvo v mentalnem polju in medsebojno komuniciranje ter paralelistično reševanje problemov "proizvajajo" fenomen zavestnosti [10]..

V zadnjih 15 letih se je vendarle pojavilo nekaj alternativnih pristopov k kogniciji, ki resneje obravnavajo "družbenost" kognicije, pa tudi zavesti. Če ti pristopi držijo, potem se nakazuje nov "paradigm shift" v kognitivni znanosti, namreč preskok od individualističnih k socialnim modelom razlage in raziskovanja kognitivnih procesov in pojavov. Najpomembnejši pristopi te vrste so po mojem mnenju koncept socialno porazdeljene kognicije, koncepti kolektivne intencionalnosti in koncept skupinske racionalnosti (timsko mišljenje in odločanje). Med bolj "ezoterične" verzije socialnega pristopa k kogniciji sodijo razmišljanja o nadosebni zavestnosti, o kolektivni zavesti, kolektivnem umu ali duhu, ki pa tudi niso povsem brez soli ali neznanstvena. V sodobni kognitivni in socialni psihologiji so že dolgo znani še nekateri drugi, "klasični" socialni pristopi k razlagi duševnih pojavov, kognicije in zavesti, na primer Vigotskijeva socialna teorijo razvoja in poteka mišljenja skozi ponotranjanje komunikacijskih procesov med ljudmi [17] in podobna Meadova teorija simbolnega interakcionizma [11}.

Tu bom na kratko predstavil koncept socialno porazdeljene kognicije, ki se mi zdi najbolj neposredna alternativa monadičnim konceptom kognicije in zavesti. Oprl se bom na raziskave Edwina Hutchinsa o porazdeljeni kogniciji.

Temeljna zamisel distribuirane kognicije je v tem, da imajo kognitivni sistemi, ki vključujejo več posameznikov kognitivne lastnosti, ki se razlikujejo od kognitivnih lastnosti posameznikov, ki sodelujejo v sistemu [12]. Druga ideja je, da je individualna kognicija posameznikov zelo spremenljiva in redundantna. Skupno delujoči posamezniki imajo lahko razne vrste znanja in se v reševanju skupnih nalog angažirajo v interakcijah, ki jim omogočajo izkoriščanje različnih kognitivnih in informacijskih virov. Posedujejo razne oblike "podeljenega" znanja (shared knowledge), ki jim omogoča, da se sproti prilagajajo ranim načinom komuniciranja (tako da se na primer izognejo nepotrebnim redundancam v procesu). Tretja glavna ideja je porazdelitev dostopa do informacij v kognitivnem sistemu. Podeljeni dostop in porazdeljeno znanje omogočata koordiniranje pričakovanj med člani skupine, kar povratno omogoča koordinirano delovanje.

Raziskovanje porazdeljene kognicije uporablja več metod: natančne analize video in avdio posnetkov realnega dogajanja v skupinah, simulacije dogajanja v računalnikih, zlasti ob pomoči teorije nevralnih mrež in eksperimente v laboratoriju. Izbira metode je odvisna od tega, na kaj se predvsem koncentriramo v raziskovanju (kaj je enota opazovanja in kakšna raven kognitivnega sistema nas zanima). Na ta način lahko raziščemo pojave, ki niso dostopni običajni kognitivni znanosti, na primer kompleksne medsebojne odnose med ljudmi in artefakti v njihovem skupnem delovanju, raziskovanje napak in razlomov v delovanju kognitivnih sistemov. Še vedno je precej težav v integraciji raziskav sistemov na makroravni (na primer raziskovanje učenja v institucijah) z raziskavami na mikroravneh (raziskave medosebnih interakcij). Problem je, kaj so tedaj primerne enote analize in primerne razlage raziskanih problemov. Nadaljnji problem je v tem, da te raziskave niso lahko osvojljive in izvedljive. Terjaji veliko minucioznega opazovanja, analitičnega dela in zapleten računalniški in formali support. Celo zelo kratke sekvence interagiranja v kognitivnem sistemu so lahko zelo pomenljive in kompleksne. Zato raziskovalci vneto iščejo bolj enostavne in bolj pragmatične metode [12].

Sisteme družbeno porazdeljene kognicije lahko raziskujemo na različnih ravneh, na ravni posameznih enot kognitivnega sistema (na primer posameznikov, posameznih računalnikov ali procesorjev), na ravni interakcij med enotami sistema ali na ravni sistema kot celote. Na vsaki ravni analize identificiramo množico kognitivnih lastnosti in te lastnosti razložimo s pomočjo procesov, ki spreminjajo stanja sistema [12].

Morda ključni tekst o socialno porazdeljeni kogniciji je Hutchinsovo delo "Cognition in the Wild" [4]. Poleg tega dela so pomembne še druge raziskave Hutchinsa in njegovih kolegov (npr. [5, 6].

Hutchins [4] je teoretično in empirično raziskal različne načine medsebojnega kognitivnega usklajevanja ljudi v skupinah. Predlaga, da delovanja ljudi ne primerjamo z enostavnimi mrežami, kjer bi posameznik predstavljal v sebi nerazločeno enoto kognitivne predelave informacij, posamezniki pa so medsebojno povezani z enim komunikacijskim kanalom. To je močno preenostaven model komuniciranja, ki neupravičeno reducira kompleksnost porazdeljene kognicije med ljudmi.
Hutchins ponuja alternativni model človeške kognicije. Ne zanika tega, da človeška kognicija vsebuje pridobivanje in predelavo simbolov, vendar poteka kot paralelno porazdeljen proces med ljudmi, simboli in raznimi artefakti. Ne zanika tega, da del te dejavnosti poteka tudi v možganih (zavesti) posameznikov, a to je sestavni del širših kognitivnih procesov, ki je tudi sam organiziran kot družba v malem. Simboli so najprej v svetu zunaj nas, šele potem v naših glavah [4: 370]. S to idejo se je Hutchins ujel s starejšimi idejami Vigotskega, Meada in drugih simbolnih interakcionistov [11, 15, 17], a jim je dal sodobnejšo obliko in vsebino.

Po njegovem mnenju že vsak posameznik sam v sebi predstavlja notranjo nevralno mrežo, ki jo sestavlja več relativno samostojnih kognitivnih in delovanjskih podsistemov.

Posameznik predstavlja družbo v malem, v lastni glavi (in telesu) preigrava družbo. Šele kot takšna družba v malem, ki že v sebi deluje vzporedno porazdeljeno, vstopa posameznik v komuniciranje in sodelovanje z drugimi osebami. Celotno komunikacijsko omrežje je potemtakem omrežje omrežij. Različne osebe komunicirajo med seboj po različnih kanalih hkrati (to je podobno širokopasovnemu komuniciranju pri sodobnih paralelno povezanih računalnikih, na primer tistih, ki omogočajo internetsko mrežo). Komuniciranje po posameznem kanalu povezuje posamezne kognitivne ali delovanjske podsisteme posameznikov.

Hutchins je zgradil svoj pojem porazdeljene kognicije na podlagi obsežne raziskave poteka krmarjenja ladje, ko se bliža pristanišču ali pljuje blizu obale. Sam je bil namreč mornariški častnik in pilot, ki je nato postal kognitivni psiholog in antropolog. Prepričljivo je pokazal, da krmarjenje večjih ladij ne more biti le delo posameznika, na primer krmarja ladje, temveč je rezultat celotnega krmarskega tima. Navigacijski tim deluje kot neke vrste "družbeni računalnik", ki deluje po načelih delovanja paralelno porazdeljenih komputacijskih procesov. Hutchinsov pojem porazdeljene kognicije zajema več kot le kolektivno kognicijo ljudi v skupini. Ne zajema namreč le posameznikov, temveč tudi instrumente in druga pomožna sredstva, ki omogočajo kognicijo, na primer pravilne izračune.

Pri tem ta sredstva niso le zunanji pomočniki sicer notranjih (mentalnih) kognitivnih procesov v posameznikih, temveč so del porazdeljenega kognitivnega procesa. Kognitivni proces je porazdeljen med ljudi in artefakte, ki pomagajo v kogniciji. Danes nam veliko avtomatiziranega kognitivnega dela odvzamejo računalniki, vendar ne vsega. Še vedno odločilni del porazdeljene kognicije med ljudmi pripada ljudem.

Na podlagi empiričnega raziskovanja kognicije v skupinah kot tudi računalniških modelov socialne kognicije je Hutchins ugotovil, da je kognitivno optimalno takšno delovanje skupin, ki fleksibilno kombinira iskanje koherentnih stališč (reprezentacij) v skupinah (sistemih) in iskanje alternativnih in konkurenčnih stališč pri posameznikih oz. posameznih delih sistema.

V vsakem distribuiranem kognitivnem sistemu lahko identificiramo množico kognitivnih lastnosti, ki jih skušamo razložiti s pomočjo interakcijskih procesov in transformacij stanj sistema. Komputacije predstavljajo gibanje reprezentacijskih stanj skozi medije, ki jih dopušča sistem. Mediji reprezentiranja so lahko tako znotraj kot zunaj posameznih kognitivnih akterjev, zato se lahko nanašajo tako na notranje (na primer posamezne spominske vtise) kot na zunanje reprezentacije (slike, diagrame, zapiske, podatkovne baze idr.). Reprezentacijska stanja se nanašajo na to, kako se v poteku vedenja/delovanja sistema spreminjajo razni izvori informacij in znanja [12]. Kognitivni proces je porazdeljen na več načinov: med člani skupine, med notranjimi in zunanjimi strukturami, v članih skupine (notranje kognitivno omrežje nevralnih procesorjev) ter v času (prejšnji dogodki lahko spreminjajo kasnejše dogodke). Ta vidik porazdeljene kognicije je najpomembnejši za razvoj človekovih spoznavnih in miselnih zmožnosti, pa tudi za dinamiko skupinskega delovanja, mišljenja in odločanja. Kognitivni vidiki socialnega delovanja se povezujejo z drugimi psihološkimi in socialnimi vidiki v kompleksne celote "porazdeljenih učinkov", tako nastajajo na primer kognitivno-emocionalni timi ali pa v kompleksne oblike povezav med ljudmi, računalniki in drugimi artefakti.

Kakšen je pomen raziskovanja porazdeljene kognicije za kognitivno znanost. Tu se strinjam s Hutchinsonivi ugotovitvami o razvoju kognitivne znanosti in njenih perspektivah? Po njegovem mnenju se je klasična računalniška metafora izčrpala in to zato, ker so kognitivni znanstveniki "pozabili" na njen inherentno socialni izvor. Model računalniškega procesiranja informacij oz. simbolov je namreč abstrakcija delovanja ljudi v fizičnem in socialnem okolju, ne pa abstrakcija iz kognitivnega delovanja posameznika ali njegovih možganov [4: 363-5]. Upravljanje s simboli po algoritemskih pravilih je namreč tisto, kar na primer počnejo matematiki, ko uporabljajo različne simbole na papirju, tabli, računalnikih, ali ko komunicirajo med seboj o svojih ugotovitvah in dokazih. To pa je prej primer paralelno porazdeljene kognicije, ki se odvija med njimi kot tudi med njimi in raznimi artefakti kot pa primer "monadične" dejavnosti posameznika.

Algoritemski prikaz upravljanja s simboli je abstrakcija od te dejavnosti, ko jo je prvotna kognitvna znanost projicirala nazaj v glavo (možgane ali duha) posameznika in potem pozabila na to projekcijo. Arhitekura fizikalnega simbolnega sistema zato po Hutchinsu ni model individualne kognicije, temveč model delovanja sociokulturnega sistema, iz katerega smo "izvzeli" človeške akterje [12: 363]. Eden od stranskih učinkov te abstrakcije je bilo, da so iz kognitivnega procesa izvzeti realni dejavniki človeške kognicije, možgani ljudi pa so zamenjani z računalnikom. Vse kar je ostalo od ljudi, je bila abstraktna meja med notranjostjo in zunanjostjo, ki se je tolmačila kot razmerje med simboli in fenomenalnim svetom, ki ga simboli "reprezentirajo". V ideji modularnosti simbolnega kognitivnega sistema je bila kognicija ločena od motornega sistema in od sistemov percepcije. To je neupravičena ločitev, ki je bila nujno potrebna zato, da upraviči domnevo o kogniciji kot mehaničnem procesu predelave simbolov.

Hutchins se zavzema za natančne opise "odružbene" in "otelešene" kognicije, ki jim pravi "kognitivna etnografija". Naši vsakdanji pojmi in predstave kot tudi številni znanstveni modeli kognicije o kogniciji ne ustrezajo temu, kar kažejo raziskave dejanskega poteka kognicije "v živo". Do danes so razni avtorji opravili nekaj pomembnih študij te vrste, naj omenim zlasti zanimivi modeli in raziskave kolektivnih kognitivnih procesov v znanstvenih skupinah [3, 7, 8, 9, 14, 17]. Precej je tudi študij o paralelno-porazdeljenih učnih procesih, zlasti v povezavi z računalniki [13]. Obstaja tudi več formalnih modelov socialno-kognitivnih procesov, zgrajenih na teoriji PDP procesov, teorij distribuiranega znanja in na teoriji nevralnih mrež [1, 2]. Poglavitni problem je, kako formalno predstaviti različne vrste porazdeljenega znanja in prehod od implicitnih (nezavednih) v eksplicitne (zavestne) oblike kolektivnega znanja.

Literatura:

[1] Dillenbourg, P., Self, D. A. (1992): A Computational Approach to Socially Distributed Cognition. *European Journal of Psychology of Education*, 7/4.

[2] Fagin, R., Halpern, J. Y., Moses, Y., Moshe, Y. V. (1995): *Reasoning About Knowledge*. MIT, Cambridge/M.

[3] Giere, R. (2002): Scientific Cognition as Distributed Cognition. V: P. Carruters, S. Stich, M. Siegal (ur.), *The Cognitive Basis of Science*. Cambridge Univ. Press, Cambridge.

[4] Hutchins, E. (1995): *Cognition in the Wild*. MIT, Cambridge/M.

[5] Hollan, J., Hutchins, E., Kirsch, D. (2000): Distributed Cognition: Toward a New Foundation for Human-Computer Interaction Research. *ACM Transactions on Computer-Human Interaction*, 7(2

[6] Hutchins, E., Klausen, T. (1996): Distributed Cognition in an Airline Cocpit. V: D. Middleton, Y. Engeström (ur.), *Communication and Cognition at Works*. Cambridge Univ. Press, Cambridge.

[7] Knorr-Cetina, K. (1999): *Epistemic Cultures. How the Sciences Make Knowledge.* Harvard Univ. Press, Cambridge/M.

[8] Kornfeld, W. A., Hewitt, C. E. (1981): Scientific Community Metaphor. V: *IEEE Transactions on Systems, Man and Cybernetics, 1.*

[9] Latour, B., Woolgar, S. (1986): *Laboratory Life. The Construction of Scientific Facts.* Rinceton Univ. Press, Princeton/NJ.

[10] Minsky, M. L. (1986): *The Society of Mind.* Simon & Schuster, New York.

[11] Maed, G. (1997): *Um, Sebstvo, Družba*. Krtina, Ljubljana.

[12] Rogers, Y., Scaife, M. (1997): Distributed Cognition.]http://www.sv.cict.fr/cotcos/pjs/TheoreticalApproaches/DistributedCog/DistCognitionpaperRogers.hrt#

[13] Salomon, G.(ur.) (1993): *Distributed Cognitions: Psychological and Educational Considerations.* Cambridge University Press, New York.

[14] Thagard, P. (1993): Societies of Minds: Science as Distributed Computing. *Studies in History and Philosophy of Science*, 24

[15] Ule, A. (2002): Common Knowledge in Science. V: G. Meggle (ur.), *Social Fact & Collective Intentionality*. Hänsel-Hohenhausen AG, Frankfurt/M.

[16] Ule, M. (2004): *Socialna psihologija*. FDV, Ljubljana.

[17] Vigotski, L. N. (1977): *Mišljenje i govor*. Nolit, Beograd.

Zbornik 9. mednarodne multikonference
Proceeding of the 9th International Multiconference

INFORMACIJSKA DRUŽBA IS 2006

INFORMATION SOCIETY IS 2006

Mejne kognitivne znanosti

Borderline Cognitive Sciences

Uredili / Edited by

Janek Musek, Mari Osredkar, Igor Kononenko,
Barbara Novak Škarja, Matjaž Gams

http://is.ijs.si

11. oktober 2006 / 11th October 2006
Ljubljana, Slovenia

PREDGOVOR

Drugo leto zapored prirejamo konferenco Znanstveno o verovanju in po prvem letu so izkušnje zelo pozitivne. O teh delikatnih temah smo se odkrito pogovorili in izmenjali mmenja in s tem pokazali, da je strpnost ne samo možna, ampak da sodelovanje odpira možnosti za reševanje tistih poglavitnih problemov današnje družbe, kjer moramo stopiti vsi skupaj.

Duhovno doživljanje sveta in verovanje je pomemben vidik človekove eksistence v vseh dobah in v vseh kulturah, vključno z današnjo. Vendar je bila ta, za človeka tako izjemno pomembna tema, znanstveno skoraj zanemarjena. Res je zato več razlogov, med njimi tudi dejstvo, da gre pri duhovnosti in verovanju za kompleksne pojave, ki jih je težko znanstveno raziskovati. Kljub temu pa seveda ne moremo reči, da znanstvenih raziskav na tem področju ni.

Pričujoča konferenca je namenjena prav obravnavi tistih aspektov verovanja in duhovnosti, ki so posebno zanimivi z znanstvenega vidika. Tako želi prispevati k interdisciplinarnemu znanstvenemu obravnavanju tematike, ki doslej vsaj v Sloveniji še ni bila znanstveno predstavljena na ta način.

Konfrenca zajema prispevke, ki se lotevajo problematike verovanja in duhovnosti z vidikov več znanosti, teologije, kognitivne znanosti, filozofije, psihologije, zgodovine in drugih znanosti, tako družbenih kot naravoslovnih. Vsebino prispevkov bi lahko okvirno razdelili v tri dele. Del prispevkov posreduje znanstvene preglede raziskovanja na področju verovanja in duhovnosti, v delu prispevkov se pojavljajo teoretski pogledi in razmišljanja avtorjev o temah, povezanih s predmetom konference, so pa tudi prispevki, ki govorijo o izsledkih empiričnega raziskovanja na področju vernosti in duhovnosti. Poleg predstavitve posameznih referentov želi konferenca seveda spodbuditi tudi širšo znanstveno razpravo o verovanju in duhovnosti v našem znanstvenem in kulturnem okolju. Temu je poleg tekoče diskusije ob prezentacijah posameznih referentov namenjena tudi široka diskusija obravnavane tematike v sklopu okrogle mize.

Z vsem tem naj bi bil dosežen glavni namen konference, to pa je seveda promocija in poglobitev znanstvenega obravnavanja problematike verovanja in duhovnosti. Še zlasti je to pomembno za naš znanstveni in kulturni prostor, v katerem je bila znanstvena obravnava te problematike doslej dokaj skromna, dolgo časa pa celo potiskana ob stran ali drugače omejevana. Konferenca naj bi bila korak na poti k izravnavanju tega primanjkljaja in naj bi spodbudila več znanstvene aktivnosti, osredinjene na temo verovanja in duhovnosti tudi v prihodnje.

Janek Musek

Programski odbor

Predsednik: prof. dr. Janek Musek, Filozofska fakulteta, Oddelek za psihologijo
prof. dr. Matjaž Gams, Inštitut Jožef Stefan
prof. dr. Igor Kononenko, Fakulteta za računalništvo in informatiko
doc. dr. Mari Jože Osredkar, Teološka fakulteta
Barbara Novak Škarja, Duhovna univerza

VABLJENI PREDGOVOR

Najprej najlepša hvala in hvala za povabilo vsem skupaj na konferenco o kognitivnih znanostih / znanstveno o verovanju. Mislim, da je konferenca zelo pomembna, saj skuša združevati spoznanja in vedenja mnogih vsebin v neko novo celovito vedenje. Tu se srečujemo s spoznanji naravoslovja in humanistike, s spoznanji in percepcijo, različnostjo posameznika ter družbe. Duhovno življenje je pomembno za razvoj posameznika samega, kot tudi za družbo. Zato lahko vsak znanstvenik, predvsem kognitivni znanstvenik, in preko njega cela znanost pripomore k poglabljanju spoznanj o kompleksnosti in povezanosti sveta in človeka v tem svetu. Današnja kognitivna znanost ne zavrača možnosti eksistence nečesa ali nekoga, do katerega (o čemer) s svojim dotedanjim oziroma dosedanjim vedenjem in spoznanji, kot tudi s posameznimi poskusi, meritvami, še ni ničesar dokazala ali se do tega ni opredelila. Pri raziskavah se vedno pogovarjamo ponavadi v nekem jeziku, ki je različen za vsakega, vendar je med nami raziskovalci bolj ali manj en sam jezik, jezik znanosti, zato je njegova ontologija osnova, na kateri gradimo vas naša spoznanja in vse naše pogovore. Če že govorimo o spoznanju stvari ali dogodka, vemo, da je verjetnost določenega spoznanja vezana na čas in vedenje v tem času, kot tudi na verjetnost dogodka, ki povzroči naše spoznanje. V vsakdanjem življenju se srečamo s pojavi, katerih obstoja, zaradi redkosti pojavljanja, se dostikrat niti ne zavedamo. Na področju fizikalnih znanosti prihajamo do novih in novih vsakodnevnih spoznanj, na primer do spoznanja redkih pojavov, na primer »protonov nizkih energij«. To so pojavi o katerih nekoč, dobrih 10, 20 let mi ne bi govorili kot o znanstvenem pojavu. Tipičen primer takega pojava je tudi vsakdanji telefon, ki ga imate v žepu, o katerem bi lahko 100, 200, 300 let nazaj govorili kot o čudežu. To pomeni, da na področju fizikalnih ved, ali pa sploh naravoslovnih ved, lahko govorimo tudi o nekih hipotetičnih modelih, ki nas vodijo do novih spoznanj. Zato v procesu spoznavanja stvarstva ne smemo izključevati možnosti obstoja pojavov, ali na primer hipotetičnih nizko-energijskih delcev, če s sedanjim vedenjem pojava obstoja še ne znamo dokazati. Pred 300 leti bi vas morda zažgali na grmadi kot heretika, če bi govorili, da boste vašo sliko poslali z enega konca sveta na drug konec in se hkrati pogovarjali. To pomeni, da sta naša percepcija in naša spoznavnost tesno vezana na prostor in čas tega spoznavanja. Kot posamezniki pa tudi težko govorimo o univerzalni obliki spoznanja in vedenja, zato lahko govorimo o spoznanju iste stvari zelo različno. Cilj znanosti je tudi, da poenoteno ontološko pristopi k spoznavanju in spoznanju, da znanstveno-teoretično pristopa k bistvu stvari, ki jo odkriva, opazuje a je ne spreminja.

Prof. dr. Jurij Tasič

ZUNAJTELESNE IZKUŠNJE KOT INDIKACIJA TRANSFIZIČNE RAZSEŽNOSTI

Darja Cvek Mihajlović
Duhovna univerza
Zavod za izobraževanje, vzgojo, razvoj in kulturo
Ruska 13, 1000 Ljubljana, Slovenija
+386 1 4339303
darja.cvek@cdk.si

Abstract
Out-of-body experiences (OBE) are quite common, especially spontaneous ones. These experiences are suggesting that there might be a dimension beyond phyisical. This article is an attempt to identify the conditions in which they occur. What could be the possible factors that lead to OBE? And what is the relation between spontaneous and induced OBE? There's also a short description of a questionnaire which could, among other things, give some information about the connection between practicing meditation and OBEs.

Definicija in pogostnost zunajtelesnih izkušenj

Angleška psihologinja Susan Blackmore je definirala zunajtelesne izkušnje (v nadaljevanju ZTI) kot osebne izkušnje, v katerih se zdi, da ljudje doživljajo svet iz točke zunaj svojega telesa. Tovrstno izkušnjo je imelo od 5 do 35 ljudi od stotih vsaj enkrat v življenju (Blackmore, 1982).

Do izkušnje pride, ko človek izgubi stik z dovajanjem senzoričnih informacij iz telesa, hkrati pa se še vedno zaveda (Blackmore, 1988; LaBerge, Levitan 1988).

Pim van Lommel (2004) je raziskoval obsmrtne izkušnje in v tem sklopu tudi ZTI, kot eno od prvih faz v procesu umiranja. ZTI je definiral kot verodostojno percepcijo telesa iz položaja zunaj telesa in nad njim. Ljudje imajo izkušnjo, da so se "slekli iz svojega telesa kot iz starega plašča" in na njihovo presenečenje obdržali svojo lastno identiteto z zmožnostjo zaznavanja, čutenja in zelo jasnega zavedanja. Take izkušnje so znanstveno pomembne, saj zdravniki, medicinske sestre in sorodniki lahko preverijo, kar so poročali, da so zaznavali, ko so bili zunaj telesa.

William Buhlman (2001) je v mednarodni raziskavi v petih letih dobil 16.000 odzivov ljudi iz 32 narodnosti, ki so imeli ZTI. Dokumentira tudi 45 ZTI, ki so jih doživeli otroci od 4. leta starosti do najstniških let.

Povprečna razširjenost ZTI se giblje od 10 % med navadno populacijo do 25 % med študenti (Palmer, 1974). Veliko primerov je v določenih subpopulacijah, na primer 42 % med shizofreniki (Blackmore, 1986; Alvarado, 1986). Napačno bi bilo sklepati, da se ZTI tipično pojavlja pri hudih psihiatričnih motnjah ali nevrološki patologiji. Ravno nasprotno, večina poročil o ZTI prihaja od običajnih ljudi in iz vsakodnevnih življenjskih situacij.

ZTI doživljajo ljudje po celem svetu, različnih starosti, obeh spolov, z različnim etičnim, kulturnim, religiološkim ozadjem, različnih stopenj izobrazbe in socialno–ekonomskega stanja (Green, 1968; Palmer, 1974).

Razvrstitev ZTI

ZTI lahko v grobem razdelimo v 2 skupini:

- ZTI, do katerih je prišlo naravno in postopno - v spanju, bolezni, izčrpanosti
- ZTI, ki so se zgodile na silo in nenadoma – nesreča, anestezija, dušenje ali namerna, hotena ZTI.

Enako delitev uporablja dr. Robert Crookall (1966).
Mednarodna akademija za zavest (International Academy of Consciousness, v nadaljevanju IAC) pa razvršča ZTI v 3 kategorije glede na okoliščine v trenutku same izkušnje: poleg

spontanih (v naravnem spancu ali pa v budnem stanju s polnim zavedanjem) in **prisilnih** (zaradi telesne poškodbe, intenzivne bolečine, dušenja, nezavesti zaradi nesreče, hude bolezni, anestezije, med operacijo, ruvanjem zoba, porodom, pri obsmrtnih izkušnjah, pri uživanju drog) še **prostovoljne** (inducirane namenoma) (Vieira, 2002).

Raziskave: v kakšnih okoliščinah lahko pride do ZTI

Na podlagi številnih raziskav lahko ugotovimo, da se ZTI zgodijo skoraj v vsakršnih situacijah.

- V eni od raziskav je več kot 85 % vprašanih povedalo, da so doživeli ZTI, ko so počivali, spali ali sanjali (Blackmore, 1984).
- Druge raziskave so pokazale, da je večina ležala v postelji in počivala ali pa so bili bolni; manjši odstotek ljudi pa je bil pod vplivom droge ali zdravil (Green, 1968; Poynton, 1975; Blackmore, 1984).
- Večina Greenovih primerov ZTI se je zgodila, ko so ljudje ležali (75%). 18 % jih je sedelo, ostali pa so hodili, stali ali pa se niso več spomnili.
- Nekatere ZTI izhajajo iz podobnih pogojev kot spalna paraliza. Le-ta se pojavi, ko se človek zbuja iz REM spanja ali pa pada vanj, in še posebej v spancu, ki ni posebno globok (zaradi bolezni, zvokov v drugem prostoru, čustvenem stresu, izčrpanosti ali pogostega zbujanja). Pokazalo se je, da ljudje, ki imajo ZTI, imajo pogosto tudi lucidne sanje, sanje, v katerih letijo in padajo ter sposobnost nadziranja sanj (Blackmore, 1984; Glicksohn, 1989; Irwin, 1988).
- Green je prišel do naslednjih rezultatov: 12 % ljudi je takrat spalo, 32 % jih je bilo v nezavesti in 25 % jih je bilo povezanih s psihološkim stresom – zaradi strahu, skrbi ali preobremenjenosti.

Nekateri primeri kažejo na to, da je možno, da je zavest zunaj telesa, telo pa je normalno aktivno še naprej. Green navaja nekaj primerov motoristov, ki so se pri veliki hitrosti znašli nad svojimi motorji in gledali, kako njihova telesa vozijo motorje (do nesreče ni prišlo). Piloti letal, ki letijo na višjih višinah, so se (morda zaradi odsotnosti vibracij in enoličnosti senzoričnih stimulacij) znašli zunaj letala in se trudili priti nazaj. Veliko pogosteje pa je, da je medtem telo sproščeno in neaktivno. Mišična sproščenost je tako bistven del izkušenj večine ljudi.

Psihološki dejavniki

Glede psiholoških dejavnikov lahko ugotovimo le, da so poročila o ZTI subjektivne narave. Vsekakor pa gre za osebne izkušnje, ki pri večini ljudi pustijo globok pečat in odstrejo novo polje izkušenj.

Od leta 1980 se psihologi bolj ukvarjajo z ZTI in proučujejo psihološke in druge dejavnike, ki so prisotni pri takih izkušnjah. Našli so zelo malo zanesljivih dejavnikov, povezanih s starostjo, spolom ali religiozno usmeritvijo. Psihološke spremenljivke, kot so absorbcija, nagnjenost k fantaziranju, lucidne sanje, spominjanje sanj in druge, pa kažejo na pomen notranjega kognitivnega procesa v povezavi z ZTI zaradi pozitivnega odnosa do izkušnje (Alvarado, 1986).

Inducirane ZTI

Z uporabo različnih tehnik so nekateri razvili sposobnost izstopanja z zavestjo iz telesa. Skupne lastnosti spontanih in induciranih ZTI so vibriranje, čutenje energij in nenavadni glasni zvoki. Včasih tik pred ZTI nastopi telesna paraliza (Salley 1982; Irwin 1988).

Pogosto so spontane ZTI zelo jasne in bolj podobne vsakodnevnim izkušnjam v stanju budnosti kot pa sanjam. Na človeka pustijo globlji vtis. Mnogim se je zmanjšal strah pred smrtjo, njihovo splošno psihološko počutje in socialni odnosi pa izboljšali. 95 % bi jih rado ponovno doživelo ZTI.

Crookall (1970) poroča, da so imeli tisti s spontano ZTI večjo jasnost in širino zavedanja, tisti s prisilno ZTI pa bolj omejeno, zmedeno in zamegljeno, z elementi, ki so podobni sanjam.

Nevrolog dr. Olaf Blanke (Univerzitetna bolnišnica v Ženevi, Švica, *Laboratory for Presurgical Epilepsy Evaluation and Functional Brain Mapping Laboratory*) je opisal, da je imela njegova pacientka z epilepsijo inducirano ZTI. Ta izkušnja se je odvijala, ko so inhibirali aktivnost možganske skorje z bolj intenzivno zunanjo električno stimulacijo nevronskih mrež v predelu gyrus angularis. Hipotetično bi to lahko pomenilo, da sta dezintegracija telesne senzorike in vestibularne informacije pomembna dejavnika pri povzročitvi ZTI (Blanke, Ortigue, Landis, and Seeck 2002). ZTI se lahko pojavi iz podobnih vzrokov kot epileptični napad (Burrowes in Bromfield, 1998).

Na čem temelji indukcija ZTI

Iz opisov spontanih ZTI se pri indukciji ZTI skuša omogočiti podobne pogoje in okoliščine – vhode v transfizično razsežnost.

Mednarodna akademija za zavest (IAC) (Vieira, 2002) je na podlagi dolgoletnih izkušenj ugotovila, da največkrat pride do ZTI ob naslednjih pogojih (ob tem poudarijo individualnost človeka in pomen lastnega raziskovanja):

- **Zunanji:** temperatura največ 19 ali 20 stopinj Celzija, zasenčene luči, glasnost do 60 decibelov, čim manj senzorične stimulacije, ohlapna bombažna oblačila, idealni čas je od polnoči do 3. ure zjutraj, ustrezen prostor, kjer se dobro počutimo.
- **Fizični ali fiziološki:** ležanje na hrbtu, vsaj 2 uri po obroku, nič čaja ali kave pred indukcijo, zadovoljene fiziološke potrebe, globoka fizična sproščenost, prehodne nosne poti.
- **Psihološki:** brez strahu, vznemirjenosti, skrbi ali drugih čustvenih stanj, izogibanje gledanju nasilnih filmov ali prepiru pred poskusom indukcije ZTI, motivacija – koncentracija - volja (miren in osredotočen razum), zdrava radovednost.

Indukcijske metode (natančno so razložene na številnih spletnih straneh) so globoka sprostitev, imaginacija in koncentracija. Idealno stanje je stanje fizične sproščenosti (najlažja je progresivna mišična relaksacija) ali celo katalepsije, skupaj z miselno budnostjo. Učinkovite so dihalne tehnike, programiranje sanj, avdio–vizualna stimulacija, senzorična izolacija ali senzorična preoobremenitev (učinek je dezorientacija in izguba občutka za prostor in čas), že omenjena električna stimulacija možganov, zaužitje kemičnih snovi.

ZTI in ljudje, ki trdijo, imajo parapsihološke sposobnosti

Večinoma so običajni ljudje imeli naravno ZTI, ljudje s parapsihološkimi lastnostmi pa so opisali svoje izkušnje s podobnimi elementi kot so pri prisilni ZTI (Crookall, 1970).

Carlos Alvarado pa je v svojih raziskavah ugotovil, da je povezava med ZTI in zunajčutnimi zaznavami (ekstrasenzorno percepcijo) šibka (1982).

Vprašalnik za klasifikacijo dejavnikov, ki lahko pripeljejo do ZTI

Poleg informacij iz knjig, člankov in s spletnih strani sem za klasifikacijo dejavnikov pripravila vprašalnik, ki obsega razčlenitev notranjih in zunanjih dejavnikov pri spontani ZTI:

1. **NOTRANJI DEJAVNIKI**: stanje fizičnega telesa in njegove posebnosti, psihološko stanje, življenjsko obdobje, predhodne izkušnje s transfizično razsežnostjo.
2. **ZUNANJI DEJAVNIKI**: dogodki in situacije, ki delujejo kot sprožilec ZTI.

Vprašalnike izpolnjujejo slušatelji Duhovne univerze in Mednarodne akademije za zavest (IAC) v Londonu. Analiza rezultatov sledi v kratkem.

Na Duhovni univerzi, kjer je pomemben del praktičnega dela meditacija, smo iz izkušenj pri aplikaciji tehnik za inducirano ZTI in po prvem pregledu vprašalnikov ugotovili, da obstaja povezava med pogostostjo ZTI in meditacijo.

Zaključek

Navedene izkušnje in raziskave nakazujejo na možnost permanentne neodvisnosti ali vsaj manjše odvisnosti zavesti od telesa, ki pa je v običajnih okoliščinah neprepoznavna. Iz raziskav je razvidno, da gre za izkušnje, ki so neodvisne od socialnih, religioznih ali nazorskih dejavnikov. Hkrati je razvidno tudi, da ne gre za domišljijska stanja.

Zaradi objektivnih kazalcev doživljanja ZTI (realnost videnja krajev in dogodkov, ponovljivost in preverljivost, lucidnost) lahko sklepamo, da obstaja nekakšna transfizična razsežnost. Nadaljnje raziskave v tej smeri pa bodo sčasoma lahko potrdile ali ovrgle teorijo obstoja te razsežnosti bivanja.

Bibliografija:

- Carlos S. Alvarado, ESP During Out-Of-Body Experiences: A Review of Experimental Studies, *Journal of Parapsychology*, september 1982.
- Carlos S. Alvarado, Research on Spontaneous Out-Of-Body Experiences: A Review of Modern Developments, 1960-1984, in Betty Shapin & Lisette Coly (eds.), *Current Trends in Psi Research.* New York: Parapsychology Foundation, 1986.
- Susan J. Blackmore, Beyond the Body: an Investigation of Out-of-Body Experiences. London: Heinemann, 1982.
- Susan J. Blackmore, A Postal Survey of OBEs and Other Experiences, *Journal of the Society for Psychical Research*, februar 1984.
- Susan J. Blackmore, A theory of lucid dreams and OBEs. In Gackenbach, J. and LaBerge, S., (Eds.), Conscious Mind, Sleeping Brain, p. 373-387. New York: Plenum,1988
- Blanke O, Ortigue S, Landis T, Seeck M.: Stimulating illusory own-body perceptions. The part of the brain that can induce out-of-body experiences has been located. *Nature*, 2002.
- William Buhlman, The Secret of the Soul. New York: HarperCollins Publishers, 2001.
- Robert Crookall, The Study and Practice of Astral Projection. New York: University Books, 1966.
- Robert Crookall, Out-of-the-Body Experiences. New York: University Books, 1970.
- J. Glicksohn, The structure of subjective experience: Interdependencies along the sleep-wakefulness continuum. Journal of Mental Imagery, 13: 99-106, 1989.
- C. E. Green, Out-of-the-body experiences. London: Hamish Hamilton, 1968.
- H. J. Irwin, Out-of-the-body experiences and dream lucidity. In Gackenbach, J. and LaBerge, S., (Eds.), Conscious Mind, Sleeping Brain, New York: Plenum, 1988.
- LaBerge, S., Levitan, L., Brylowski, A., & Dement, W.: Out-of-body" experiences occurring during REM sleep. Sleep Research, 1988.
- Pim van Lommel, About the Continuity of our Consciousness, *Brain Death and Disorders of Consciousness*, Machado, C. in Shewmon, D.A. New York, Boston, Dordrecht, London, Moscow: Kluwer Academic/ Plenum Publishers, Advances and Experimental Medicine and Biology *Adv Exp Med Biol*., 2004.
- J. C. Poynton: Results of an out-of-the-body survey. In Poynton, J. C. (ed.) Parapsychology in South Africa. Johannesburg: South African Society for Psychical Research, 1975.
- R. D. Salley, REM sleep phenomena during out-of-body experiences. Journal of the American Society for Psychical Research, 76, 1982.
- Waldo Vieira: Projectiology, A Panorama of Experiences of the Consciousness outside the Human Body. International Institute of Projectiology and Conscientiology, 2002.

Spletne strani:

- www.williamjames.com/Folklore/ASTRAL.htm
- www.paranormal.about.com/gi/dynamic/offsite.htm
- www.lucidity.com/SleepAndCognition.html
- www.meta-religion.com/Neurology/OBEs/obe_and_the_soul.htm

VERA IN TEORIJA NAVEZANOSTI TER VZAJEMNE REGULACIJE AFEKTOV

Tomaž Erzar, Katarina Kompan Erzar
Teološka fakulteta, Univerza v Ljubljani
Frančiškanski družinski inštitut
Podiplomski program Zakonska in družinska terapija
Prešernov trg 4, 1000 Ljubljana, Slovenia
Tel: +386 1 2006760; fax: +386 1 2006766
e-mail: tomaz.erzar@guest.arnes.si

POVZETEK

Teorija navezanosti (*attachement theory*) predstavlja v polju razvojnih in psihoterapevtskih raziskav že nekaj desetletij enega najbolj prodornih raziskovalnih programov. Navezanost v diadi mati-otrok je samo vrh ledene gore, ki jo sestavljajo medgeneracijske in medosebne oblike povezanosti in afektivne uglašenosti med družinskimi člani. V luči novo odkrite globine medčloveške povezanosti se dosedanje znanstvene metode in rezultati v polju odnosov ne izkažejo le za nepopolne in delne, ampak za orodja narcisističnega zanikanja in popačenja relacijske podobe človeka, ki nas vedno znova preseneti, še zlasti, ko jo primerjamo z religioznimi modeli odnosa med človekom in Bogom.

1 OTTO NEURATH: LADJA ZNANOSTI

Eden zagovornikov ti. protokolarnih stavkov in član Dunajskega krožka logičnih empiristov Otto Neurath je podal slikovito prispodobo znanstvenega dela, ki je odprla vrata moderni epistemologiji: »We are as sailors who are forced to rebuild their ship on the open sea, without ever being able to start fresh from the bottom up. Wherever a beam is taken away, immediately a new one must take its place, and while this is done, the rest of the ship is used as support. In this way, the ship may be completely rebuilt like new with the help of the old beams and driftwood–but only through gradual rebuilding [1]. Ta konstruktivistična podoba znanosti je danes splošno uveljavljena: znanost je ladja, ki pluje na morju preverljivosti, toda na obzorju ni več kopnega, ladja plove brez smeri in brez cilja; empirični podatki so vedno podloženi s teorijo, opazovanje ne določa enoznačno teoretične nadstavbe, med vejami znanosti ni nobene hierarhične urejenosti, razvoj znanosti je kontingenten in zgodovinsko pogojen. V zvezi s tem je Neurath zelo zanimiv avtor, saj v njegovi podobi znanosti še ni videti niti splošnega pesimizma glede znanosti in njenega napredka niti notranjega razkola glede epistemičnega subjekta spoznanja, kar sta značilni pridobitvi povojne epistemologije. Neurath kritizira ti. pseudoracionalističnega tolmačenja znanosti, ki poskuša v domeni teoretičnega delovanja odpraviti moment čiste odločitve, tveganja, izbire, naključja in medčloveške solidarnosti. Znanost je zanj medosebna, zavestna, na opazovalno podlago oprta aktivnost, ki sama po sebi vodi k odpravi nasilja in nepravičnosti v družbi. Moment čiste izbire je samo način, kako se v znanosti takorekoč sam po sebi, zgolj zaradi notranje strukture znanstvenega preveranja, odpre prostor za etično delovanje in proletarsko emancipacijo: »Scientific attitude and solidarity go together« [2]. Ključno za novo držo znanosti po Neurathu je, da sebi in drugim subjektom prizna mejo, ki je metafizika v svoji narcisistični samozaverovanosti in nasilnosti ni hotela priznati, kar pomeni, da prizna negotovost svojega početja ter svojo nevednost. V tem smislu gre razumeti tudi njegovo idejo, da je met kocke v določenih okoliščinah najbolj poštena pot do ohranjanja svobode in nevtralnosti.

2 NESOIZMERLJIVOST ZNANSTVENIH PARADIGM

V popularni podobi logičnega empirizma bomo zaman iskali socialni, emancipatorični moment, ki je pri Neurathu, kot vidimo, osrednji. Ta vidik bomo oluščili iz marksistične vizije znanosti in človeka ter postavili vprašanje, ali ladijska ekipa, sodelovanje med ljudi na ladji, odnosi, pomagajo preživeti udarce vetrov in morja in ali in kako vplivata emocionalno vzdušje ter povezanost med ljudmi na to, čemur bi danes marsikdo rekel programirano drsenje v katastrofo ali nepremišljena znanstvena avantura. Raziskave v psihopatologiji nas že vrsto let opozarjajo na pogubne učinke kroničnega stresa ne samo na funkcionalnost in počutje ljudi, ampak na izbruh fizičnih bolezni; ter na dolgoročne prepletene vplive travm, katastrofalnih pričakovanj, depresivnosti in odvisnosti [3]. To sliko pa je treba še poglobiti: vzdušje odnosov in način povezovanja so se že vpisali v gradnjo in plovbo, vse, kar je na ladji materialnega, je že posredovano z odnosi, četudi to še ni reflektirano v vednosti ali metodi. Ladja in plovba se spreminjata hkrati z odnosi, ki so vtkani v sleherni košček ladje. Še več, in to velja zlasti za humanistične in družboslovne discipline, odnosnost popolnoma prevlada nad materialnostjo, se vpisuje vanjo, če to hočemo ali ne, jo sooblikuje in ji daje smer, kakor to dokazuje nevroznanost, ki kaže, kako se afektivna strukturiranost odnosov vpisuje neposredno v nevrofiziološko strukturo možganov [4].

Neurath si je očitno lahko zamišljal socialno revolucijo, ni pa si mogel misliti, da bi tudi v znanosti govorili o revolucijah ali menjavah paradigme [5]. Kuhn je nakazal, da revolucije v znanosti vnesejo v mišljenje protagonistov neke paradigme čustveno spodrezanje ter ogroženost. Kuhn privzame, da se normalna znanost in normalni znanstvenik upira spremembam, revolucijam, tveganju, izzivom in se stalno brani, vedno napade prinašalca slabih novic in ne vzame novice resno. Ideja, da so znanstvene paradigme med seboj nesoizmerljive (*incommensurable*), očitno ni prinesla s seboj samo tega, da se nam danes zdijo razprave o vrednotah v različnih paradigmah povsem nemogoče in brezplodne, ampak da smo se navadili tudi na to, da so si paradigme med seboj sovražne in da si spodnašajo tla pod nogami. Od kod ta negativna podoba narcisistično ogroženega znanstvenika, ki je bila za Neuratha še povsem nezamišljiva? Deloma se napaja iz novoveške drže do sveta: da bi razumel knjigo sveta, človek moderne dobe ne potrebuje nikogar, ampak samo metodo branja, črkovanja; svet je zanj na razpolago, uporaben, z njim dela, kar hoče [6]. Novoveška znanost se je lotila premagovanja groze empiričnega, ne da bi iskala oporo v medosebem, ne da bi mislila medosebno niti da bi ga metodološko upoštevala. Enako velja za filozofijo, ki se je v novem veku spremenila v deklo znanosti. Obema je skupna drža, ki izključi medosebnost, postavi v središče posameznika, ki kljubuje naravi, ljudem in kaosu, in kakor pravi Descartes, ne zaupa nikomur razen sebi in svoji gotovosti. In zdi se, da ta drža močno odmeva tudi v današnji samopodobi ljudi v znanosti [7].

3 NARCISISTIČNA DRŽA ZNANOSTI

Ob tem si ne moremo kaj, da si ob tej drži moderne znanosti ne bi mislili, da njena prva naloga ni toliko ublažitev groze, ki jo človeku zbuja nepredvidljiva narava in da ščiti človeštvo pred zlo naravo, ali narobe, da ščiti neomadeževano naravo pred človeškim zlom, ampak da se izogne medosebnosti in vzdržuje izoliranost [8]. V tem smislu je njena drža enaka drži narcisizma, ki vztrajno reže medosebne vezi okoli sebe, da bi lažje nadziral svoj notranji nemir in praznino, ki ju projecira na druge. O tem radikalnem spodrezanju se lahko prepričamo tudi v kratki zgodovini psihologije kot moderne znanosti, kjer sta se v preteklem stoletju izoblikovala dva pristopa, globinski psihoanalitični, ter zunanji bevioristični, kot reakcija na prvi pristop. Kljub navideznemu nasprotju oba druži podobna togost in zaprtost glede odnosnega jedra človeka, podoben način kontrole in izolacije posameznika: v psihoanalizi se kontrola nad posameznikovim čutenjem in čustvovanjem odvija od znotraj, s spodrezanjem od znotraj, zaradi česar posameznik ne more v svet in do drugih ljudi, medtem ko se v behaviorizmu kontrola izvaja od zunaj, z redukcijo drugih oziroma okolja na obvladljivi feedback, zaradi česar posameznik ne more do sebe, ker se mora stalno prilagajati reakcijam okolja, ki naj bi govorile o njem in ki naj jih ponotranji, kar vodi v popolno prilagajanje, lažne stike in žrtvovanje sebe na račun pripadnosti. Obe paradigmi slonita na projekcijah čutenj in pripisovanjih, ki prihajajo od vira, ki naj bi mu posameznik zaupal, in ki naj jih prav zato vzame za svoje, pri čemer ostaja brez možnosti, da poišče stik s tem virom in s samim sabo, kar je tipično narcisistična regulacija afektov [9].

Klinični raziskovalci narcisističnih motenj poudarjajo, da narcisizem vzbuja v posamezniku in ljudeh, s katerimi je intimno povezan, občutja zavrženosti, zapuščenosti, nepripadnosti in nevrednosti [10]. Še več, in to je najbolj žalosten del narcisistične drame, narcisistično ranjeni posameznik s tem, ko se bori zoper narcisistično prevaro in izdajstvo pri soljudeh, začne tudi sam ravnati prevarantsko in manipulativno, s čimer sproži pri drugih prav tisti tip vedenja, proti kateremu se bori. Ta vzajemno spodbujeni krog izdajstev in prevar v njem še bolj utrdi prepričanje, da se vse medčloveške vezi končajo z izdajo, prevaro, ponižanjem in zavrženjem. Prav ta krog je teorija navezanosti poimenovala ne-varna (*insecure*) navezanost [11].

4 ZAKLJUČEK

Od tod izhajata dve opciji, s katerimi se človeštvo spopada z ne-varno navezanostjo, ki je prežeta s strahom pred spodrezanjem, izdajstvi in narcisistično ogroženostjo: ljudje lahko na eni strani razvijejo individualne simptome in postanejo tesnobni, fobični, izogibavajoči, prežeti s krivdo in pretirano občutljivi na sramoto, ali pa na drugi strani izkusijo lastne simptome kot znake globoke vzajemne povezanosti in odzivnosti [12], ko se izza simptomov odkrije njihova medgeneracijska in sistemska dinamika, izza fobije medosebna dinamika sramu v izvorni družini [13]. Pred to dilemo stoji tudi moderna znanost: revolucije in izzive lahko doživlja kot napad, spodrezanje in skrajno ogroženost, ki jo pehajo v prikrivanje, izolacijo, neiskrenost in lažno povezanost z drugimi, ali pa poskuša razcepe in razkole vključiti v sistem povezanosti ter vedno znova poiskati drzne metode za verbalizacijo izključitve in spodrezanosti. Tega se lahko uči pri starih modrostih in religijah, ki vztrajno ponavljajo, da lahko samo človekov medosebni svet premaga grozo empiričnega oziroma grozo človekovih notranjih in zunanjih travm, kolikor model povezanosti poišče v varnem odnosu in zavezi med Bogom in človekom in prek tega odnosa gradi odnose med ljudmi.

Reference

[1] Neurath, O. (1921). Anti-Spengler. Reprinted in *Empiricism and sociology* (Ed. Neurath, M. & Cohen, R.). Dordrecht: Reidl, 1973, 75-76.

[2] Neurath, O. (1928). Personal life and class struggle. Reprinted in *Empiricism and sociology* (Ed. Neurath, M. & Cohen, R.). Dordrecht: Reidl, 1973, 252.

[3] Barlow, D. H. & Durand, V. M. (2005). *Abnormal psychology: An integrative approach. 4th edition*. Belmont, CA: Wadsworth.

[4] Cozolino, L. (2002). The Neuroscience of Psychotherapy: Building and Rebuilding the Human Brain. New York: W.W. Norton.

[5] Kuhn, T. (1977). *The Essential Tension*. Chicago: University of Chicago Press.

[6] Milner, J-Cl. (1989) *Introduction à une science du language*. Paris: Seuil.

[7] Mishkin, L. (1988). Fraud is a symptom of a deeper flaw. *Scientist*, 9,12.

[8] Rupnik, M. (2001). Reči človek: Oseba, kultura Velike noči. Koper: Ognjišče.

[9] Martens, W.H.J. (2005). Shame and narcissism: Therapeutic relevance of conflicting dimensions of excessive self-esteem, pride, and pathological vulnerable self. *Annals of the American Psychotherapy Association*, 8(2), 10-17.

[10] Millon, T. & Davis, R.D. (1996). *Disorders of personality DSM-IV and beyond*. New York: Wiley and Sons.

[11] Bowlby, J. (1969*). Attachment and loss: Vol. 1. Attachment*. London: Hogarth.

[12] Erzar, T. & Erzar K.K. (2006). The Idea of Mutual Affect. *International Journal of Applied Psychoanalytic Studies*, 3 (3), 242-254.

[13] Tangney, J.P. & Dearing, R.L. (2002). *Shame and Guilt*. New York: The Guilford Press.

ZNANOST O VEROVANJU – LETO KASNEJE

Matjaž Gams
Odsek za inteligentne sisteme
Institut Jožef Stefan, Jamova 39, 1000 Ljubljana, Slovenia
Tel: +386 1 477 3644; matjaz.gams@ijs.si

POVZETEK

V tem prispevku so podane izkušnje glede na lanskoletno konferenco "Znanstveno o verovanju" in odzive nanjo. Predvsem je zanimiv slovenski odziv glede na nove koncepte – ali je možno podati znanstveni pogled na verovanje kot na enega najbolj pogostih kognitivnih dogajanj, kaj je z razhajanji med cerkvijo in znanostjo, npr. evolucijo, obsmrtnimi doživetji, kognitivnim pogledom na verovanje, na Jezusa Kristusa in krščanstvo, o evolucijski (ne)koristnosti verovanja in sistemov vrednot slovenske družbe. Po avtorjevem mnenju gre pri razhajanjih predvsem za ideološke razlike podobno kot med političnimi strankami, medtem ko znanost lahko in mora ostati znanstvena tudi pri raziskovanjih verovanj Ni principielnih vsebinskih konfliktov med korektno znanostjo in osnovnim verovanjem kot kognitivnim pojavom. Zdi se celo, da znanost in verovanje obe opozarjata na določene probleme modernega časa.

1 UVOD

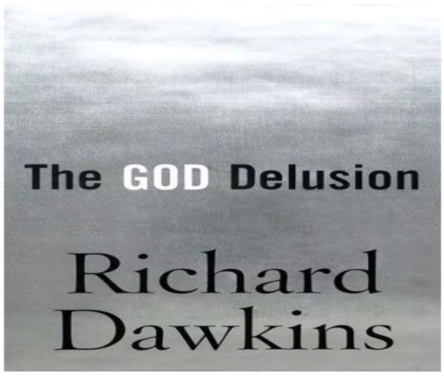
V tem prispevku bodo pregledani odzivi na konferenco Znanstveno o verovanju v 2005 (Gams 2005). Ti odzivi so zbrani v medsebojnih pogovorih in komunikacijah, del komentarjev je narejen na osnovi najnovejše literature, medtem ko za kakšne obširnejše ankete ni bilo možnosti.

Teza 1: Verovanje je eden najpogostejših kognitivih pojavov, po pogostosti primerljiv recimo s sanjami (Hameroff idr. 1997).

Na to tezo v Sloveniji ni bilo bistvenih negativnih odzivov, saj je konec koncev empirično podprta. Po drugi strani pa je res, da so nekateri strokovnjaki nad tem vprašanjem "vihali nos", češ da to ni primerno znanstveno področje. Medtem ko se je možno strinjati, da je področje zelo zahtevno za znanstveno obravnavo predvsem zaradi vseh spremljajočih ideoloških komponent in dogm, pa je težje sprejeti, da bi se morala znanost ograditi od teh vprašanj.
Morda je zanimivo omeniti, da nihče ni uradno javno protestiral, niti strokovna sfera, niti cerkvena, niti politična, v določenih krogih pa so z zadovoljstvom sprejeli konstruktiven odnos med področjema.

Teza 2: Znanost in vera sta si bila v zgodovini pogosto antipoda. Cerkve v Evropi in Ameriki so čedalje bolj prazne in kljub bolj strpnemu odnosu ljudi do vere se res aktivno religiozno udejstvuje čedalji manjši odstotek ljudi. Ali bo torej znanost spodrinila vero, kot je napovedal Marx?

Ko je Nitzche v "Tako je govoril Zaratustra" pisal o zatonu znanosti, je mislil predvsem na zaton moralnosti.
Zadnja leta se pojavlja nov val agresivnih kritikov verovanja. Sam Harris je v knjigi "Letter to a Christian Nation" kot odgovor na napade 9.11. napisal, da je za terorizem in marsikatero nasilje kriva vera, predvsem ekstremisti tako muslimanske kot kriščanske in drugih ver.
Tudi priznani Oxfordski biolog Dawkins (2006) (Sebični gen) je napisal izrazito negativno kritiko verovanja. Verovanja naj bi bila ostanek zgodovine in znak primitivnosti. Ljudi naj bi brez potrebe poneumljala in jih postavljala v nehuman, podrejen položaj.



Slika 1: Po Dawkinsu je verovanje ostanek zgodovine, ateisti pa so danes pametnejši.

Po splošnem mnenju pa tako pomen verovanja kot nasploh duševnega življenja narašča. V ZDA je le 6% anketiranih mnenja, da boga ni, 2% jih je "ne vem", kar 92% pa jih verjame (verniki in agnostiki). Pač pa bi več glasov za predsednika ZDA dobil homoseksualec kot ateist.
Znanstveno ta hip ne moremo kaj dosti napovedati o daljši bodočnosti verovanja, pogostosti in intenzivnosti. V zmerni bodočnosti nekaj deset let, kolikor je možno znanstveno napovedovati, pa najbrž prav radikalnih sprememb ne bo. V bistvu je komunizem že gradil na podobnik izhodiščih kot Dawkins, pa se zgodovinsko ni izšlo uspešno.
Verovanje kot kognitivni proces je sestavni del človeštva in bistveno dolgotrajnejše kot druge družbene oblike, npr. komunizem, kapitalizem ali globalizem. Podobno velja za znanost, kjer lahko mirno napovemo, da ni videti njenega zatona, kvečjemu nihanja glede pomena in njenega mesta v družbi.

Teza 3: Spopadu religij se ni moč izogniti.

Določen del mislecev vztraja, da je spopad krščanstva (in Židovstva?) z islamom neizogiben, kot je bil menda neizogiben spopad med Hitlerjevo Nemčijo in Anglijo … Podobno trdijo drugi avtorji, da je neizogiben spopad med ZDA in Kitajsko.
Po Harrisu (The End of Faith) je v prvi meri razlog za ekstremizem v verovanju samem – kdor verjame, da bo prišel v nebesa, če bo s terorističnim dejanjem pobijal civiliste, je na najboljši poti, da taka dejanja podpira in v islamstvu naj bi bilo po njegovem vse napeljano v smeri spodbujanja konflikta.
Avtor tega prispevka težko znanstveno oceni veljavnost zgornjih misli. Prav neizogibnih stvari je v bodočnosti bolj malo, posebej kar se spopadov tiče, po drugi strani pa kar nekaj indicev kaže v tej smeri. Nesporno pa je možno reči, da vojne prinašajo obilno gorja.

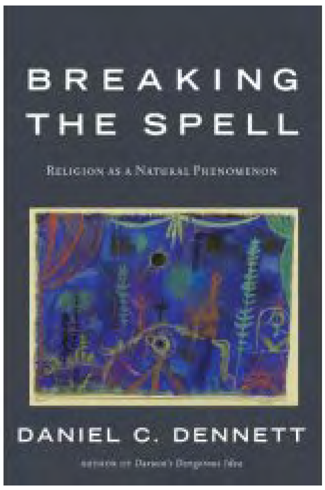
2 ZNANOST ODKRIVA KORISTNOST VERE

Teza 4: Ljudje (tudi ateisti) imajo del možganov vnaprej specizializiranih za verovanje/vero; postopki verovanja imajo celo svojo kemijo, svoje kemično-biološke procese.

Teza je bila objavljena v tuji znanstveni literaturi in jo povzema del kognitivnih znanstvenikov v Sloveniji. Najpomembnejši npr. nevrološki slovenski strokovnjaki pa tega spoznanja ne poznajo in ne priznavajo, vsaj take so njihove izjave npr. po televiziji. To se zdi nenavadno, ampak po drugi strani v Sloveniji glede na svetovno znanje zaostajamo kar na nekaj področjih in naloga takih srečanj, kot je naša konferenca, je med drugim tudi širjenje novejših svetovnih spoznanj.

Teza 5: Verovanje je ena ključnih lastnosti za evolucijski uspeh ljudi. Če si hipotetično predstavljamo dve ljudstvi v preteklosti, eno verno in eno neverno, je evolucija za zmagovalca izbrala verno ljudstvo (oz. drugačno genetsko podvrsto človeka).

Ta teza ni bila objavljena kot samostojni članek, vsaj po avtorjem vedenju ne, bila pa je mimogrede omenjene v tuji strokovni literaturi. Se pa zdi logičen in empiričen zaključek prejšnjih tez. Zakaj bi drugače imeli ljudje še danes en del sicer tako dragocenih možgan rezerviran za ta opravila?
V odzivih pravzaprav ni bilo videti nasprotovanja niti pretiranega odobravanja omenjenega spoznanja, pa čeprav je relativno novo, staro kvečjemu nekaj let. Po drugi strani pa je zanimivo, da za empirično ugotovljeno stanje v možganih in posledično evolucijsko empirično dejstvo nimamo splošno sprejete strokovne razlage. Čemu je ta lastnost evolucijsko koristna? Ali so morda ljudje brez pripadajočih moralnih lastnosti postali množica razkrojevalnih egoistov, ki so od znotraj razjedli skupnosti, npr. države in civilizacije in so propadli v tekmi z bolj homogenimi skupnostmi? Računalniški modeli nakazujejo take scenarije, čeprav je potrebno navesti, da so ti modeli socialnih odnosov precej "akademski". Čeprav se danes morala včasih zdi celo negativna za uspešno poslovanje v kapitalističnem sistemu, bi na osnovni gornjih hipotez lahko posumili v dolgoročno zdržnost "nemoralne" ureditve, vsaj na osnovi dolgotrajnih zgodovinskih in evolucijskih dejstev.
Morala (in ideologija) ima velik vpliv na delovanje združbe in je uresničena kot del obnašanja pri večini razvitih živalskih vrst. Primer so npr. levi, kjer samci po prevzemu krdela pobijejo mlajše mladiče, da se bodo levinje čimprej parile z njimi. To je individualna korist. Ne pobijejo pa nekaj starejših mladičev, čeprav s tem vseeno izgubijo nekaj "svojih bodočih mladičev". Torej je njihova "morala" v tem, da ne pobijajo srednje starih samičk kot del genetsko zakodirane varovalke vrste (nasproti individualnemu interesu), da prepogoste menjave samcev ne bi praktično uničile vsega naraščaja. Na primeru levov vemo, da bi samo individualni interes izrazito škodil celotni vrsti.
Nekateri svetovni avtorji v precejšnji meri pišejo podobno (Joan Roughgarden: Evolution and Christian Faith; Francis Collins: The Language of God).
Toda avtorji novega vala ateistov, ki so neverjetno medijsko uspešni, npr. (Dawkins 2006) trdijo, da so bili dogmatski moralni nazori koristni v zgodovini, dokler se ni razvila znanost do te mere, da lahko sama določi, kaj je moralno pravilno. Opomba avtorja: dalo bi se strinjati, da znanost nakazuje, da je moralnost koristna, vendar vsaj v računalništvu niso znano modeli, ki bi to nesporno pokazali tako principielno kot operativno.
Po Dawkinsu (2006) je znanost napredovala do mere, da lahko sama napiše boljšo moralnost, kot pa jo nudi vera. Kot primer navaja, da je kooperativnost in strpnost koristna v zgodovini, ko so ljudje živeli v povezanih skupnostih. Ko pa je svet postal globalen, je strpnost ali dajanje pomoči oddaljenim ali drugače mislečim po njegovem nekoristno.
Podobno kot E.O. Wilson (In Search of Nature), Robert Wright (The Moral Animal) in Richard Dawkins (The Selfish Gene), Dennett (2006) analizira verovanje kot kulturni/kognitivni pojav, podvržen evoluciji in naravni selekciji.



Slika 2: Čeprav Dennett razvije precej zanimivih misli, ostaja kritičen do "zastarelosti" naukov verovanja.

Po Dennettu je religija evolucijsko koristna, čeprav ima tudi negativne stranske pojave. Pravzaprav je mnenja, da so ti stranski pojavi brez smisla, ostanek pradavnega praznoverja, v splošnem pa je nenaklonjen verovanju.
Bolj zanimiva je njegova razlaga glede drugih ljudi, npr. umrlih sorodnikov in znancev. Vsi ljudje naj bi imeli v glavah del možganov rezerviranih za posebne ljudi in ti deli možganov se samostojno obnašajo, kot Minskyjevi agenti. Če se nam torej zdi, da govorijo ali nam projecirajo kakšne misli v naše, potem se oglaša ta del možganov kot samostojni program, inteligentni agent v računalništvu ali samostojni programi v filmu Matrica.

Teza 6: Verujoči ljudje so v splošnem bolj zdravi kot ljudje, ki v nič ne verjamejo. Statistično sicer niso ugotovili kakšne posebne razlike med verovanjem (vnetim ali blagim), jogami, avtogenimi treningi ali celo tehnikami dihanja (Newsweek, internet).

Tudi na to trditev ni bilo nasprotovanj z nobene strani, morda tudi zato, ker je podobno trditev neodvisno objavil tudi dr. Musek, oba pa sva se zgledovala po tuji študiji.
Občinstvu pa je morda ušla najpomembnejša nota te teze: Danes je splošno mnenje med strokovnjaki v svetu, da podobno kot potrebujemo fizično telovadbo za zdravo telo, potrebujemo tudi psihično telovadbo za zdrav um. Pri tem ni toliko pomembno, kaj ta telovadba je, važno pa je, da jo izvajamo. Znani so recimo primeri otrok, ki so živeli med volkovi in če je to trajalo npr. dobro desetletje, potem niso nikoli več znali govoriti v obliki stavkov. Torej – fizična telovadba za telo in umska za um sta nujnost za zdravo življenje.

Teza 7: Sistem vrednot modernega sveta (ki je praktično povsod kapitalističen) ni skladen z določenimi moralnimi vrednotami, ki jih zagovarjajo tako religije kot znanost.

Avtor je oster kritik "nemoralnosti" sodobnega kapitalističnega globalnega poslovanja. Čeprav bi mi lahko očitali pristranskost ali ideološkost, pa je dobršen del te kritike tudi strokovno utemeljen. Najprej pa je potrebno navesti, da je "moralnost" pojem, ki se je z desetletji in stoletji močno spreminjal. Če beremo npr. biblijo ali druge verske osnove, so v duhu tedanjega časa pravzaprav zelo nasilne in krute. Zahtevati od očeta, da žrtvuje svojega sina ali uničiti mesto, pa čeprav je grešno, danes ne bi sodilo v civilizirano obnašanje.
Kaj je torej civilizirano in moralno? S stališča inženirskih sistemskih znanstvenikov bi štelo predvsem tisto, kar prinaša dober razvoj neke skupnosti, recimo države, za družboslovne znanstvnike pa bi v poštev prišli tudi precej drugačni pristopi.
Če torej verovanje in znanost zagovarjata tradicionalne vrednote kot družino, sodobni kapitalizem pa jih razkraja, je torej prvi sistem vrednot moralen in koristen, drugi pa nemoralen in škodljiv.
Kot en primer primernosti klasičnih razmer ponovno navedimo, da je statistično ugotovljeno, da v polni družini rojeni otroci živijo bolj zdravo življenje. Torej moralnost nikakor ni samo ideološka kategorija.

Teza 8: Sloveniji grozi demografska katastrofa, saj je rodnost le 1.25 otroka na žensko, Slovencev pa bo čez sto let le še 500.000.

Veliki napredek je bil dosežen v tem, da zadnja leta lahko to pišemo in objavljamo v medijih in da se določen delež ljudi s tem strinja. Desetletje ali dva nazaj o nihče v javnih medijih ni bil pripravljen objaviti karkoli o tem.
Dobršen del ljudi pa še vedno le zmigne z rameni in pove, da jih kaj več kot leto vnaprej ne zanima. Če mi je dovoljena sakrastična pripomba: To je vseeno bolje kot pri zlati ribici, ki ima dve sekundi spomina.
Problem pa ostaja, ker zgornja teza, utemeljena z znanstvenimi podatki in projekcijo, pušča večinsko mnenje, javnost in politiko hladno. Kaj pa potem, če bi slovenski narod shiral, koga to sploh zanima? Za podvrsto slovenskih medvedov smo se pripravljeni boriti do zadnje kaplje krvi, glede projeciranega izumrtja slovenskega naroda pa praktično še ni nobene reakcije. Pri tem imamo v mislih najprej civilna gibanja, saj od politikov ali vodij v demokraciji ni pričakovati ukrepov brez pritiska javnosti in stroke. Pravzaprav je strokovno gledano vodstvena demograska politika zadnjih nekaj desetletij sistematično porazna, kljub temu da obstaja veliko pomembnih in uspešnih potencialnih ukrepov, ki bi nesporno prinesli bistvena izboljšanja brez dodatne obremenitve proračuna. Potrebno je le doseči prerazporeditev od tistih, ki prostovoljno nočejo imeti otrok, na tiste, ki so pripravljeni prevzeti naravne dolžnosti starševstva. Danes pa je ideja o davku na samske ali manjša pokojnina za tiste brez otrok še vedno sprejeta z velikimi odpori javnosti, sedanja situacija, ko starši z otroki delajo tudi za tiste brez otrok oz. se v resnici sredstva pretakajo v tej smeri, pa čeprav nevidno, pa kot nekaj normalnega. Avtor ocenjuje, da gre predvsem za ostanek miselnosti nepoštene uravnilovke preteklosti, ki žal danes pri nas še marsikje prevladuje.
Vseeno je lanskoletna konferenca opozorila na omenjene probleme, zavedanje o problemu pa se je nekoliko povečalo. Korak za korakom se tovrstna spoznanja vseeno širijo med ljudi.

Teza 9: V Sloveniji je npr. med maturanti in diplomanti le približno tretjina fantov, torej je slovenska šola spolno pristrana.

Tudi tej tezi nihče odkrito ne ugovarja, saj je empirično podprta. Zanimivo pa je, da precej predvsem profesorjev in študentov s FDV odgovarja, da je v današnji družbi zatirana predvsem ženska populacija, npr. pri populaciji univerzitetnih profesorjev, in da zgornji podatki niso pomembni. To se zdi vsekakor nenavadno, saj gornji podatki zajemajo reda velikosti 100.000 državljanov, tolikokrat navajani univerzitetni profesorji pa velikostnega reda 1000 posameznikov.
Z leti smo pravzaprav uspeli čedalje bolje analizirati razloge za tovrstno stanje – ker so praktično vse informacije na

internetu, ker dijakinje in študentke hitreje dozorijo, so pridnejše in so njihovi možgani primernejši za pomnenje in uporabo informacij, je v informacijski družbi sedanji šolski sistem pisan njim na kožo. Npr. pri testih IQ pa pri odraslih vodijo moški, nad 120 jih je 2x, nad 150 pa 5x več kot žensk (Gams 2006). Ta ustvarjalnost pa v šolskem sistemu, ki zahteva predvsem sprejemanje in reprodukcijo znanja, ne pride do izraza. Je pa prednost moških izrazita v najbolj kreativnih poklicih, recimo pri univerzitetnih profesorjih ali znanstvenikih.
Torej znanost dokaj dobro pozna odvisnosti, zna tudi predlagati ukrepe za zmanjšanje razlik v primernosti določenih področij (npr. že preproste kvote za vsa področja od šolstva do politike zadoščajo), naredi pa se nič zaradi zaostale dogmatične miselnosti o odnosih med spoloma, temelječe na razmerjih iz industrijske revolucije in nepoznavanjem osnovnih lastnosti informacijske družbe.
Pri tem problemu se lahko ponovno pohvalimo, da razširjamo nova spoznanja in predlagamo nove ukrepe. Odporom se na tako občutljivim področjem ne da izogniti, kljub temu pa je bil dosedanji odziv presenetljivo miren glede na agresivnost določenih feminističnih gibanj. Verjetno so k temu doprinesle svetovne študije in objave v medijih.

3 PRED- IN OBSMRTNA DOŽIVETJA

Teza 10: Pred- in obmrtni dogodki niso ideološka izmišljotina, ampak empirično dejstvo.

Kljub desettisočem pojavom (Moody 2001; Kubler-Ross 1991) so bile prve objave bolj ideološko obarvane in med strokovnjaki sprejete s skepso.
Danes sta predvsem po zaslugi nekaj deset objav o pojavih nekaj dni pred smrtjo in obsmrtnih pojavih, npr. v Newsweeku, Spieglu, … javnost in strokovno mnenje bolj ali manj seznanjena s tem. Ponovno pa se izkaže zaprtost slovenskega prostora, kjer precejšen del znanstvenikov temu odkrito nasprotuje, pomemben del kognitivnih znanstvenikov pa odločno zagovarja mnenje, skladno s svetovnim strokovnim (Gams 2002, 2003; Kononenko 2004; Musek 1995).
Pomembna ločnica ostaja med znanstvenim in ideološkimi pristopi. Verovanja obsmrtne pojave običajno povezujejo s posmrtnim življenjem, medtem ko znanost lahko empirično dokaže le pred- in obsmrtne pojave, nič dokončnega pa ne more reči o posmrtnem umskem življenju. Znanstveno je sicer materialno nesporno, da so edini dokazani primeri duševnega življenja vezani na fizično delujoče možgane, negacija sama – da po fizični smrti ni nobenega umskega življenja več, pa je izven fizičnega sveta samo delovna hipoteza. Zato pravimo, da znanost lahko empirično beleži, analizira in razlaga pred- in obsmrtne pojave, o posmrtnih dogodkih pa zna kaj povedati samo v materialnem svetu.

4 RELIGIJA O EVOLUCIJI

Teza 11: Ker v ZDA med 40 in 50% ljudi verjame, da je človek božja stvaritev, je to eden najpogostejših primerov ideoloških dogem, saj je znanstveno nesporno dokazana evolucija.
Predvsem v revijah kot (National Geographic) je na poljuden način predstavljena množica dokazov evolucije, tako da za znanost dileme ni. Zanimiv je odgovor predstavnikov udeležencev konference, da tu pravzaprav ni spora med evropskim krščanstvom in znanostjo. Morda je to posledica priznanja evolucije, ki ga je proglasil papež Janez Pavel.
Kot zanimivost velja morda omeniti, da celo nekatere oddaje v okviru strokovnih TV kanalov Discovery opisujejo NLP, pošasti iz Loch Ness itd. Pri tem mora biti jasno, da je za obstoj neke vrste, recimo prazgodovinskih pošasti iz Loch Nessa ali Big Foota iz ZDA potrebno primerno število osebkov, da se vrsta ohranja. Če ugibamo in napišemo številko 100, potem je jasno, da je po vseh pregledovanjih jezer in gozdov možnost, da bi se tolikšno število osebkov stalno skrivalo, praktično 0.

5 ZNANOST O ZGODOVINI KRŠČANSTVA

Teza 11: Kristus je imel neposredne biološke potomce.

Ta teza iz uspešnice Da Vinchijeva koda ni v ničemer zgodovinsko potrjena. Čeprav nimamo nasprotnega dokaza, da torej zagotovo ni znan noben Kristusov potomec, pa se tu ukvarjamo z materialnim svetom, kjer si želimo dejanskih potrditev za priznanje hipotez, drugače pač niso sprejete. Z drugimi besedami, če ni nobenega verodostojnega materialnega dokaza, da pošast iz Loch Nessa obstaja, potem je ni. Ker torej ni na voljo nobenega verodostojnega vira ob siceršnji množici zapisov, neposrednih potomcev torej najverjetneje ni bilo. V materialnem, mentalnem in elektronskem svetu pač veljajo druga/svoja pravila dokazovanja.

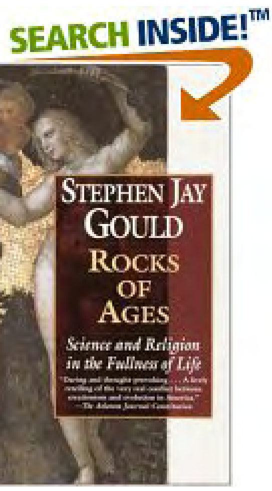
Teza 12: Kristus je imel biološko telo in ima posredne potomce.

Zgodovinski viri so tu nesporni. Ker je imel vsaj mater in je ta imela svoje sorodnike, bližnje in daljne, je zelo verjetno, da med današnjimi ljudmi živijo tudi neki potomci njegovih sorodnikov.
Ker kljub mnogim poskusom znanstveniki niso uspeli najti Kristusove DNA, tu nimamo primernih odgovorov. Drugače je npr. pri Džingiskanu, kjer imamo DNK potomcev in se da s preprosto analizo ugotoviti, kateri živeči človek je njegov potomec.
Po vsem sodeč pa ni bil poudarek na fizični komponenti Kristusa, ampak na nauku, ki je med najpomembnejšimi svetovnimi nauki.

6 ZAKLJUČEK - DISKUSIJA

S prvo konferenco smo pokazali, da je med strpnimi predstavniki znanosti in verovanj možno najti ne samo kompromis, ampak medsebojno spoštovanje in sodelovanje. Glede na zgodovinske probleme in ideološke spore je to velik korak naprej.

Po drugi strani pa so bila dosedaj naša srečanja relativno daleč od javnosti in morda je letos prilika, da poskusimo več energije nameniti popularizaciji omenjene strpnosti in sodelovanja.
V svetu se uveljavljajo podobni trendi. Tako lahko na internetu (med najpogostejši odovori na vprašanje “science religion” najdemo množico Einstenovih objav, Yahoo pa ima temu področju namenjeno svojo kategorijo) kupimo koledar s sliko Alberta Einsteina in njegovim znamenitim rekom: "If something is in me which can be called religious then it is the unbounded admiration for the structure of the world so far as our science can reveal it." (Albert Einstein, 1879 - 1955).
Žal se podobno kot leto prej ne da otresti občutka, da se večina odločitev sprejema na osnovi kriterijev kot dobiček ali osebni zaslužek, medtem ko se tradicionalni termini kot “boljše življenje vseh”, “skupnost”, “moralnost”, “družina”, “starševstvo in otroštvo” obravnavajo kot kapitalska kategorija. Celo ekonomisti priznavajo, da svetovna globalizacija vodi do množice čedalje revnejših delavcev po vsem svetu in tudi v bogatih državah. Vsakdo lahko opazi poneumljanje in izkrivljenost sveta, ki ga projecirajo najpogostejši medijski dogodki – reklame. V enem letu se reklame niso opazneje spremenile na boljše, prej bi lahko rekli, da se negativni pojavi nadaljujejo, narodna in posameznikova modrost, izražena preko globjih naukov in znanstvenih spoznanj, pa še v precejšnji meri tli in čaka na prebujenje.
Čeprav smo v odnosih med verovanjem in znanostjo uspeli najti neko sodelovanje, niti naše skupne misli o pomembnosti npr. družine, otrok ali demografske katastrofe niso našle odmevne poti v javnost. Boj z negativnimi trendi bo še težaven, vendar smo v določeni meri uspeli vsaj odpreti prostor za debato in pripraviti maneverski prostor za nadaljnja prizadevanja.



Slika 3: Gould meni, da večina pomembnejših mislecev med verniki in neverniki ne vidi razlogov za nesoglasja med področjema.

Znanost in verovanje imata obe svoje mesto v družbi, obe okolica ocenjuje in upošteva po dosežkih. Po mnenju Goulda (1990) ni razloga za spor med religijo in znanostjo in da tako trdi večina vodilnih mislecev na obeh področjih. Ljudje dobre volje delajo na tem, da bi znanost in vera sodelovali pri boljšem življenju za vse. Znanost in vera pa se ne moreta integrirati, ampak delujeta vsak na svojem, ločenem področju, podobno kot človek potrebuje spanje in hrano.

Literatura

Discovery TV programi
R. Dawkins (2006), The God Delusion (Hardcover), Houghton Mifflin.
D. Dennett (2006), Breaking the Spell: Religion as a Natural Phenomenon Viking Adult.
M. Gams (2001), Weak intelligence: Through the principle and paradox of multiple knowledge, Advances in computation: Theory and practice, Volume 6, Nova science publishers, inc., NY, ISBN 1-56072-898-1, pp. 245.
M. Gams (2002, 2003, 2005), Pregled opisov obsmrtnih doživetij na Amazon.com in internetu; Obsmrtno doživetje; Znanost o verovanju. Zborniki multikonference Informacijska družba, Ljubljana: Institut "Jožef Stefan".
M. Gams (2006), Razlika v inteligentnosti med moškimi in ženskami : znanstvena spoznanja. Delo (Ljubl.), let. 58, št. 124, str. 18, Znanost.
S. Gould (1990), Rocks of Ages: Science and Religion in the Fullness of Life, Ballantine Publishing
Internet sites related to science and religion (uporabi iskalnik in vpiši npr. science and religion):
http://www.aaas.org/spp/dser/
http://www.metanexus.net/metanexus_online/index.asp
http://www.uni-marburg.de/religionswissenschaft/journal/sor/
S. Hameroff, A.W Kaszniak, A.C. Scott (1997), Toward a Science of Consciousness II, The Second Tucson Discussions and Debates, A Bradford Book, The MIT Press.
I. Kononenko (2005), Znanost se približuje duhovnemu obravnavanju smrti kot prehodu. Dostop, letn. 1, št. 2, str. 38-40.
E. Kubler-Ross (1991), On Life After Death, Celestial Arts.
A.R. Moody, E. Kubler-RossLife (2001), Life After Life: The Investigation of a Phenomenon--Survival of Bodily Death, March 6, Harper San Francisco.
J. Musek (1995), Prispevek psihologije k razvoju kognitivne znanosti: vloga kognitivne psihologije.Čas. krit. znan., 23, št. 176, str. 73-87.
National Geographic, Newsweek, Spiegel

Nevropsihologija, strah in Sveto pismo

Ddr. Stanko Gerjolj
Univerza v Ljubljani
Teološka fakulteta
Poljanska 4, 1000 Ljubljana, Slovenija
Tel: +386 1 434 58 46; fax: +386 1 43458 54
stanko.gerjolj@guest.arnes.si

ZUSAMMENFASSUNG:
Neuropsychologie, Angst und die Bibel

Wenn auch die gegenwärtige Neuropsychologie hinsichtlich der religiösen Lebensdimension nach wie vor viele offene Fragen eingesteht, finden wir diesbezüglich manche Herausforderungen, die vor allem auf wissenschaftlicher Ebene keine Passivität zulassen. Logischerweise sind verschiedene Untersuchungsmethoden zu respektieren, da Religionen keine „wissenschaftliche“, sondern eine symbolische Sprache sprechen.

Es ist unheimlich interessant, wie z. B. in der Bibel manche Wurzeln des „Lernens“ zu entdecken sind. Genauso begegnen wir in biblischen Erzählungen manchen von Angst, Stress und anderen erschwerten psychischen Lebenssituationen, die auf Grund religiöser Kommunikation auch erfolgreich gelöst werden. Jesus begegnet oft Menschen, die allerseits geplagt sind. Seine befreiende Kommunikation kann Impulse geben, die heute genauso relevant sind wie zu seiner Zeit.

Povzetek:

Čeprav nevropsihologija v povezavi z religiozno dimenzijo življenja pušča odprtih veliko vprašanj, tudi na tem področju raziskovanja odkrivamo zanimivo prepletenost med profanimi in religioznimi odkritji. Pristopi so nedvomno različni in to dejstvo velja nenehno upoštevati. Govorica religij je simbolna in pogosto posredna.

Zanimivo, kako Sveto pismo posrečeno spregovori tako o začetkih »učenja« kot tudi o razreševanju in razpletanju življenjskih situacij, ki so prepojene s strahom, agresivnostjo in drugimi emocionalnimi težavami. V Jezusovih čudežih nedvomno najdemo nekaj zanimivih oblik komunikacije, ki odrešujejo in osvobajajo.

1. Uvod

Nevropsihologija že nekaj časa raziskuje tudi duhovno in religiozno razsežnost življenja ter skuša definirati (in celo meriti) tako imenovano duhovno in religiozno inteligentnost *(Musek 2005, 49)*. Nekatere hipoteze najavljajo, da so moralne dileme največ pripomogle k razvoju človeške misli in človeka najmočneje spodbujale k učenju. Čeprav je v širšem smislu o moralnem učenju možno govoriti tudi izven religioznega konteksta, nas zgodovina moralnih dilem uči, da je v praksi temeljna moralna vprašanja človek reševal v komunikaciji s »presežnim«.

Tudi strah je sestavni del življenja. Le-ta ni zgolj negativni pojav, marveč neredko ključna motivacija, ki nas spodbuja k učenju in osebnostnem odraščanju *(Rieman 2003, 9)*. Res pa je, da strah sproža tudi nepredvidljive in škodljive reakcije, zlasti takrat, ko na strah vzbujajoče situacije nismo pripravljeni.

2. Biblično-nevrološka hipoteza

Znani raziskovalec emocionalne inteligentnosti Daniel Goleman ugotavlja, da sta bila »na začetku človeštva« hippocampus in amygdala dva bistvena dela možganskega središča za vonj. Iz njiju sta se v teku evolucije razvila kortex in neokortex, ki sta v naših možganih odgovorna za učenje in spominjanje *(Goleman 1997, 33)*.

Ta vznemirljiva hipoteza me je peljala naravnost v svetopisemski rajski vrt, k Adamu in Evi pred drevesom spoznanja: »Gospod Bog je dal, da je iz zemlje pognalo vsakovrstno drevje, prijetno za pogled in dobro za jed, tudi drevo življenja sredi vrta in drevo spoznanja dobrega in hudega« *(1 Mz 2,9)*.

Glede na Golemanovo hipotezo, da so prve korenine kognitivnih sposobnosti v »vonju«, je zanimivo, da so rajska drevesa – vključno z drevesom spoznanja dobrega in hudega – opisana kot »prijetna za pogled in dobra za jed«. Upoštevana sta torej vid in okus, nič pa Sveto pismo ne omenja vonja. Tudi v povezavi z opisom izvirnega greha vonj ni omenjen: »Žena je videla, da je drevo dobro za jed, mikavno za oči in vredno poželenja, ker daje spoznanje« *(1Mz 3,6a)*. To pomeni, da Bog vodi evolucijo človekovega kognitivnega delovanja tako, da v proces učenja vključi razsežnosti izkušenj in modrosti.

Po mnenju nekaterih interpretov »dobro in hudo« v prvotni obliki ne vsebuje nujno moralne kvalifikacije in ne pomeni apriorne izbire med »dobrim in zlom« *(Friedman 2001, 17)*. Po njihovem prepričanju »drevo spoznanja« predstavlja poglobljen pogled v življenje, ki vključuje »obe strani«, dobro in slabo. Spoznanje ne vodi v »zla dejanja«, omogoča pa razlikovanje med dobrim in slabim, kar človeka »ipso facto« postavlja pred nove, tudi moralne in religiozne dileme. Večina eksegetov pa drevo spoznanja dobrega in hudega razlaga v moralnem pomenu *(Krašovec 1999, 69)*, iz česar moremo sklepati, da sta – vsaj v bibličnem kontekstu – moralna in emocionalna razsežnost življenja od vsega začetka sestavni dimenziji človekovega kognitivnega delovanja.

Človek je torej prej znal reagirati na podlagi okusa, vida, najbrž tudi sluha in prav gotovo dotika, kot na podlagi vonja. Naučenega in v tem smislu preventivnega spoznanja »dobrega in hudega« pa takrat še ni imel. V raju se prvi človek uči neposredno iz posledic storjenih dejanj. Z okusom in dotikom že sprejemamo tudi posledice dejanj, saj je z okusom hrana že v nas in v trenutku dotika nas že boli. V obeh primerih ni časa za preventivno učenje, zato ti dve čutili simbolizirata »nepremišljene reakcije«, pri katerih vsaj formalno ne moremo predvideti posledic. Tako z okusom kot dotikom sprejemamo posledice v trenutku zaznave. V komunikaciji z Bogom, ki jo simbolizira Stvarnikov »življenjski dih« *(1 Mz 2,7)*, na načelni ravni Bog sicer razloži in prvega človeka opozori na nevarnost in posledice uživanja sadov z drevesa spoznanja, toda zgolj teorija očitno ne prepriča. Je že tako, da človek postaja »moder« šele na podlagi »okusa« oz. učenja iz lastnih napak.

V primerjavi z okusom, sluh in vid nudita nekaj več časa za pripravo na pravilno reakcijo, toda z vidika učenja najbrž tudi ti dve čutili nista predstavljali dovolj velikega miselnega napora, da bi sprožili razvoj »kortexa«. Po Golemanovi teoriji je vsekakor vonj tisto čutilo, ki je na začetnih stopnjah Božje evolucije s človekom najbolj izzivalo po preventivnem odločanju za dobro in proti slabemu ter tako najbolj spodbujalo razvoj miselnih, s tem pa tudi moralnih in religioznih sposobnosti. Če namreč drži, da so se kortekalni centri človekove kognicije razvili iz možganskih centrov za vonj, potem je očitno prav ta oblika zaznavanja človeku dala največ »misliti« oz. največ spodbud in motivacije za učenje. S tega vidika je tudi logično, da vonja Sveto pismo v kontekstu z drevesom spoznanja ne omenja, saj ga Adam in Eva še nista upoštevala. Če bi ga, bi pravočasno »spoznala«, da v kačinem izzivanju nekaj »smrdi«. Toda, oči so bile preveč »lačne« in so ju zapeljale, da sta preskočila učni proces »vonja« ter takoj prešla k okušanju oz. uživanju (prepovedanih) sadov. Vera pa je bila prešibka, da bi premagala poželenje oči. Greh je bil – nepremišljeno – storjen prej, kot sta »spoznala« vonj zapletene situacije. Bog pa je imel bolj izostren »vonj« in je takoj po grehu začutil, da v človekovem raju nekaj »smrdi«. Zato je poiskal človeka, ga poučil in korigiral njegovo ne-religiozno in ne-moralno držo. Tako Bog postavi religiozno in moralno učenje za temelj vsakega učenja, ki se napaja v veri oz. zaupnem odnosu do Boga. Moralno in religiozno učenje potekata torej »z roko v roki«, se med seboj dopolnjujeta in podpirata, hkrati pa osmišljata celoten učni proces.

Z vidika učenja je zanimivo in hkrati razumljivo Adamovo in Evino izmikanje pred komunikacijo z Bogom po grehu *(1Mz 3,8)* in prelaganje odgovornosti z ramen na ramena (1 Mz 3,12-13). Po eni strani njune reakcije ponazarjajo, kako zahtevno je moralno in religiozno učenje, po drugi strani pa iz dejstva, da brez ugovora sprejmeta posledice svojih dejanj moremo prepoznati tudi moralno in religiozno učljivost prvih ljudi. S to Božjo »psihologijo učenja«, ki upošteva človekovo svobodo, hkrati pa predpostavlja, da bo sprejel posledice svojih dejanj – pri tem pa mu jih Bog usmiljeno in velikodušno pomaga prenašati – je prepleteno celotno Sveto pismo.

S tem, ko sta Adam in Eva pojedla prepovedan sad, sta morala »pojesti« tudi posledice nepremišljenega dejanja. Tudi Sveto pismo nas torej uči, da »ljubezen gre skozi želodec«. Kar smrdi in ni iz ljubezni, ni dobro in ni »modro«. Ta logika nas ne pripelje le do občutka, da sta moralno in religiozno učenje relevantni vprašanji celotne edukacije, marveč do »spoznanja«, da sta »učiteljici« vseh ostalih učnih postopkov. Človek se je namreč šele ob izzivih vonjav in odločanja za dobro in proti slabemu učil in postajal inteligentno bitje.

3. Strah in (emocionalno) učenje

Nevropsihologija uči, da emocionalno delovanje uporablja najmanj pet možganskih središč. Vizualna zaznava pristane najprej pri talamusu, ki jo »prevede« v jezik možganov in pošlje naprej proti vizualnemu korteksu, ta pa jo razprši po vseh nadaljnjih zainteresiranih centrih. Pri čustvenih zaznavah velik del informacij pristane v amygdali, središču in tudi nekakšnem skladišču emocionalnih doživetij. Če je vizualna zaznava prežeta s strahom in teži k hitri reakciji, pride del zaznavnih informacij po bližnjici od talamusa do amygdale *(Jensen 2005, 16)*, kar pomeni, da so te informacije ignorirale vizualni korteks. Potemtakem je amygdala prejela nepredelane informacije in ob tem začutila »izredno stanje« oz. izredno nevarnost. V takih primerih človek reagira prej, kot ve, »zakaj in kako« je najbolje ravnati. Informacije, ki jih amygdala prejme po bližnjici, povzročijo nekakšno obsedno stanje in te predkognitivne emocije človeka v trenutku prisilijo k reakciji. Ker informacije niso predelane, so reakcije hitre, a nepremišljene in pogosto netočne. Tako se lahko zvite vrvi podobno ustrašimo kot kače in ob pogledu nanjo tudi podobno »odskočimo« ali »napademo«. Včasih nas take »strašne« emocije preplavijo in pripeljejo do stanja, ko »ne vemo, kaj delamo«.

Amygdala je tudi mesto spominjanja emocij. Ko se učimo premišljenega emocionalnega ravnanja, pošilja amygdala emocionalne signale v prednji korteks, kjer se nahajata dva možganska centra oz. režnja, ki služita za dodatno predelavo emocionalnih doživetij. Na podlagi tako predelanih emocionalnih signalov se odločamo in si oblikujemo emocionalne izkušnje. V desnem sprednjem režnju se zbirajo signali negativnih emocij, levi prednji reženj pa je namenjen kontroli nad negativnimi čustvi in obvladovanju oz. preprečevanju njihovih »izbruhov« *(Goleman 1997, 47)*. Sodelovanje teh dveh središč tako prevzemata vlogo »koordinatorja« emocionalnih občutkov in ravnanja.[1]

[1] V skladu s tradicionalnimi in sodobnimi nevropsihološkimi spoznanji tendira desna možganska hemisfera k holističnemu, leva pa k analitičnemu načinu razmišljanja *(Jensen 2005, 14)*. Najbrž nas negativna čustva nagovorijo močneje in burneje

Kot nekakšno skladišče emocionalnih spominov amygdala večkrat uporabi tudi doživetja iz ranih otroških let. Ta so se med drugim tudi zato tako močno vtisnila v spomin, ker smo jih doživeli prej, kot smo znali govoriti. Tako so ostala v »surovem stanju«, saj jih nikoli nismo verbalizirali in kot »obrambni princip« delujejo močneje od predelanih in izraženih emocij *(Goleman 1997, 42)*. Lahko se zgodi, da v povprečno nevarnih situacijah reagiramo skrajno agresivno, ker nas te morda spominjajo na nepredelan in neartikuliran strah iz ranega otroštva. Razlog za pretirano agresivnost torej ni v neracionalni presoji trenutne situacije, pač pa v občutku, da zaradi morebitne podobnosti z negativnimi občutki iz ranega otroštva tudi sedanjih emocij nisem sposoben izraziti, »sedanje« situacije pa niti sprejeti, niti spremeniti. V takih situacijah torej reagiram podobno, kot sem reagiral v nevarnih okoliščinah takrat, ko sem bil dojenček in še nisem znal govoriti. Razlika je le v tem, da ima v odrasli dobi enaka čustvena napetost na razpolago neprimerno več moči in sredstev.

Če povežemo možnost nekontroliranih čustvenih izbruhov kot posledico skrajšanega potovanja informacij od talamusa do amygdale z vlogo nepredelanih in neizraženih čustvenih doživetij iz ranega otroštva, se nam bo marsikatero katastrofalno nasilje otroka, mladostnika ali odraslega človeka dokaj razjasnilo. Gre preprosto za trenutek, ko nepredelane negativne čustvene informacije preplavijo amygdalo in takrat – v nekakšni prepletenosti med strahom dojenčka, bestialno močjo ter kognitivnimi in tehničnimi sposobnostmi – »ne vem, kaj delam«.

Sodobna spoznanja hrabrijo, da emocionalna stabilnost le ni tako odvisna od ranega otroštva kot se je dolgo mislilo, čeprav drži, da zlasti nekatere posledice zlorab potrebujejo zahtevno predelavo *(Jensen 2005, 23)*. Toda, »z vsebinskim pristopom in intenzivnim delom na sebi je človek celo v obdobjih odraslega življenja sposoben popraviti odnos do sebe in preurediti emocionalno življenje« *(Showers 2000, 284)*. Prav v vsebinski navezi na socialno učenje skrbita moralna in religiozna inteligentnost vse življenje za izzive, ki jih človek potrebuje za oblikovanje in razvoj emocionalne inteligentnosti. Religiozna in moralna inteligentnost namreč reflektirata življenje skozi očala zadnjega smisla ter tako osmišljata tudi emocionalna čutenja in delovanja *(Coles 2001, 148-149)*.

Ko razmišljamo o oblikovanju pozitivne samopodobe, ki bistveno vpliva na razvoj emocionalne, pa tudi moralne inteligentnosti, že v prenatalni dobi življenja odkrivamo vlogo in pomen religiozne komunikacije. Materina (in družinska) molitev za še nerojenega otroka krepi njegovo življenje in preko matere tudi njega razbremenjuje in umirja. Prepričan sem, da npr. Mojzesa ni rešila le materina spretnost, temveč najprej njena molitev, ki ga je spremljala vse življenje. Preproste otroške molitve »Sveti angel« ne more nadomestiti nobena pravljica in nobena (zgolj) starševska tolažba. Tako je na poti oblikovanja pozitivne samopodobe, ki je sposobna presegati strah, agresivnost in nasilno ravnanje ter »pravilno« uporabljati emocionalno inteligentnost, skrb za religiozno inteligentnost tisto področje učenja, ki v mnogih stresnih situacijah omogoča »pametne« odločitve in dejanja. Tako celostno oblikovana spoznanja tudi na emocionalni ravni lahko postanejo polna in osrečujoča *(Childre & Rozman 2005, 114)*.

Zgoraj omenjeno sodelovanje med levim in desnim sprednjim režnjem oblikuje svojevrstno križišče, kjer se stikata čutenje in kognitivno mišljenje *(Goleman 1997, 48-49)*. Tu se potem oblikujejo z emocijami povezane odločitve. Domnevati moremo, da se prav v tem središču kot nekakšna simbioza kognicije in čutenja izraža tudi moralna (in religiozna izkušnja), ki najbrž odločilno vpliva na oblikovanje emocionalnih odločitev.[2] Kot vemo, emocionalna inteligentnost ne zagovarja nekontroliranega emocionalnega izražanja, pač pa podpira sicer močno in ustvarjalno, a hkrati tako oblikovano emocionalno življenje in delovanje, da služi življenju v skladu z njegovim »zadnjim« smislom.

Najbrž še tako intenzivno emocionalno, moralno in religiozno učenje ne more odpraviti strahu in tudi ne preprečiti agresivnih izbruhov, kar potrjuje tako v zgodovini kot v sodobni družbi veliko primerov. Za zdravo emocionalno ravnotežje sta odgovornost in kakovost pomembnejši od količine in intenzitete. Prav tako ni »potrebno«, da je zlasti religioznega učenja deležen vsak posameznik. Pomembno pa je, da sta v življenjskem prostoru posameznika navzoči moralna in religiozna kultura, ki nudita izzive in orientacijo tudi nereligioznim posameznikom.

4. Svetovalno-terapevtski in biblično-teološki izzivi

Fritz Riemann v knjigi »Grundformen der Angst« (Temeljne oblike strahu) navaja štiri tipe s strahom obremenjenih osebnosti. Vsaka lahko po svoji poti pripelje do nekontroliranih čustvenih izbruhov, ki niso škodljivi le za osebnost samo, marveč tudi za njeno okolico.

V prvo skupino spadajo ljudje s pretežno shizoidnimi lastnostmi, ki težijo k samostojnosti in neodvisnosti *(Rieman 2003, 20)*. Za te je značilno, da v vsakdanjem življenju uspejo svoje osebno čustveno življenje zelo dobro prikriti in obvladati. Radi se pogovarjajo o splošnih zadevah, zmanjka pa jim besed v osebnih pogovorih. Pravimo, da »bežijo« pred dolgotrajnimi osebnimi odnosi, saj jih je strah, da bi izgubili svojo svobodo, enkratnost in neponovljivost *(Rieman 2003, 26)*.

Drugo skupino sestavljajo ljudje z depresivnimi potezami. Ti naravnost hrepenijo po bližini in želijo biti »popolnoma« sprejeti. V želji po totalni pripadnosti pozabljajo na svoj »jaz« in na »jaz« drugega *(Rieman 2003, 68)*, zato s svojim tarnanjem, ljubosumjem in obsojanjem znajo zelo dobro »nežno« ubijati.

od pozitivnih, zato je razumljivo, da mora v teh primerih za obvladovanje negativnih čustvenih doživetij aktivneje sodelovati tudi leva hemisfera.

[2] Zanimivo je vse bolj razširjeno mnenje, da se bo v učnih procesih povečevala sinteza med kognicijo in emocionalnostjo *(Forgas 2000, 388-389)*, kar nakazuje dobro perspektivo celostnemu učenju in poučevanju, ki vključujeta tudi moralno in religiozno razsežnost življenja.

Tretjo skupino sestavljajo »tradicionalisti«, ki se bojijo sprememb, če pa do njih pride, se največkrat obračajo po vetru. Hkrati je zanje značilno, da dobro izpolnjujejo red in so zelo disciplinirani. Strah pred negotovostjo in spremembo jih sili v ustvarjanje »absolutnega« reda in trajne discipline, kjer ustvarjalnost posameznika nima kaj iskati. Tudi v partnerskih odnosih ti ljudje bolj »funkcionirajo« kot ljubijo *(Rieman 2003, 120)*. V poznejših letih se zlasti pri religioznih ljudeh te značilnosti rade podaljšajo v skrupuloznost.

V četrti skupini so »umetniki«, ki ne prenesejo stalnosti ter ne upoštevajo vzročnih povezav. S svojimi histeričnimi značilnostmi neredko izgubijo orientacijo in stik z realnim življenjem ter radi tvegajo več kot dovoljujejo okoliščine *(Rieman 2003, 158)*.

Vse te značilnosti so prežete in v veliki meri celo usmerjane na podlagi čustvenega naboja, ki je v vsakem človeku. Vsaka od teh skupin hrepeni po odrešenju, ki jo najpogosteje išče v svojem nasprotju – če je seveda pripravljena izstopiti iz lastne ujetosti. Rešitev pa ni v nasprotju, marveč v presegajočem »balansiranju« strahov in medsebojnem dopolnjevanju različnih osebnostnih struktur, ki že v začetni fazi navadno niso tako »čiste«, kot jih izriše naš »ratio« *(Rieman 2003, 209)*.

Zanimivo, da veliko teh karakteristik najdemo tudi v Jezusovih odrešitvenih dejanjih. Tako npr. v Kani Galilejski *(Jn 2,1-11)* srečamo Marijo, ki je depresivno-čuteča in prva vidi, da na svatbi nekaj manjka in to potoži Jezusu. Jezus o tem najprej noče nič vedeti in reagira v skladu s shizoidno osebnostjo. Rešitev je v tem, da se Marija ne zapre v lastno užaljenost, marveč preseže depresivne občutke, Jezus pa ji neopazno prisluhne in se ji približa ter stori čudež. Gre za enkraten primer, kaj pomeni – »ne ignorirati, temveč presegati osebnostne značilnosti in jih medsebojno dopolnjevati« *(Rieman 2003, 205)*.

S »tradicionalisti« ter strahopetnimi in arogantnimi zagovorniki reda se Jezus pogosto sooča. Dober primer je pripoved o prešuštnici *(Jn 8,1-11)*, kjer jih odreši tako, da jih razžene in s tem prisili v refleksijo, ki je pogoj za odpiranje spremembam.[3] Tudi v znani skljućeni ženi *(Lk 13,10-17)* moremo prepoznati anankastično-depresivnega človeka, ki so ga – najbrž notranji in zunanji – pritiski skljućili in potisnili na obrobje ter onesposobili za človeka vredno življenje. Toda Jezusov dotik jo ozdravi in ji vrne pokončen pogled v prihodnost.

Nekakšno »mešanico« med shizoidnostjo in histeričnostjo srečamo v čolnu, ko Jezus pomiri vihar na morju *(Mt 8,23-27)*. Jezus, ki simbolizira svet odnosov, jim zaspi (shozoidnost), ob tem ignorirajo vse težjo realnost, ko pa jim teče voda v grlo, je vse narobe in »histerično zahrepenijo po odrešenjskem odnosu. Tako histerične kot depresivne značilnosti zasledimo tudi v obsedencu z verigami *(Mk 5,1-19)*, ki ga Jezus najprej s pogovorom umiri, nato pa osvobodi od emocionalnega negativizma in bestialne agresivnosti.

[3] Osvobojena prešuštnica je pravzaprav že sad izzvanih sprememb, saj farizeji svojih anankastičnih naklepov niso izpeljali.

Jezusovih čudežev ne želim reducirati na terapijo. Prepričan pa sem, da se njegova beseda lahko dotakne le človeka v konkretnih situacijah in le tako, da se človek počuti sprejetega – vključno s svojimi hibami in osebnostnimi značilnostmi. V prizadevanju za to – Jezusovo – komunikacijo vidim tudi terapevtsko razsežnost religioznega učenja in poučevanja. V njej se nedvomno stikata vera in znanost.

Zdravo oz. zdravilno religiozno učenje in poučevanje vzame človeka »zares«. To pomeni, da oblikujemo okoliščine, kjer se človek zmore »izpovedati«, kar je za marsikoga zahteven korak. Zato je potrebno iskati poti komunikacije, ki preprečujejo preveliko izmikanje. Risanje, kiparjenje, pantomima, delo s simboli ipd. so za to odlične metode. Tudi pri Jezusovih čudežih srečamo malo verbalnih izpovedi. Izpovedovali so se s »kruljavostjo, lakoto, jokom in agresivnostjo. Velikokrat pozneje ugotovimo, da je šlo pri neverbalnem izpovedovanju za resnejše učenje, kot smo pričakovali.

Tako religiozno učenje je nedvomno zahtevnejša od običajnega pripovednega, debatnega in »pridigarskega« poučevanja.

Čeprav nekateri raziskovalci skušajo dokazati škodljivost religioznosti, se trend empiričnih podatkov prepričljivo nagiba v smer pozitivnega ovrednotenja vernosti, saj kažejo, da vera pozitivno vpliva na psihično stabilnost in zadovoljstvo z življenjem *(Musek 2005, 50)*. Ti argumenti še pridobijo na veljavi, če upoštevamo vlogo religioznega življenja pri oblikovanju skupnosti *(Gams 2005, 44)*. Velja pa poudariti, da omenjeni argumenti držijo le, če oznanjevalec oz. oznanjevalka diha z obema stranema pljuč, »znanstveno« in »religiozno« ter misli in dela z obema možganskima hemisferama.

Literatura:

Childre, D. & Rozman, D. (2005). Transforming Stress. Oakland: New Harbinger Publications.

Coles, R. (2001). *The Secular Mind.* Princeton: University Press.

Forgas, P. J. (2000). Feeling and Thinking: Summary and Integration. V: J. P. Forgas, *Feeling and Thinking: The Role of Affect in Social Cognition*, Cambridge: University Press. 387-406.

Friedman, R. E. (2001). *Commentary on the Torah: With a new English Translation*, San Francisco: Harper Collins Publishers.

Gams, M. (2005). Znanost o verovanju. V: O. Markič, M. Gams etc., *Informacijska družba IS 2005.* Ljubljana: Jožef Stefan. 43-47.

Goleman, D. (1997). *Emotionale Intelligenz.* München: Hanser.

Jensen, E. (2005). *Teaching with the Brain in Mind*. Alexandria: ASCD.

Musek, J. (2005). Psihološki, nevroznanstveni in evolucijski vidiki verskega doživljanja. V: O. Markič, M. Gams etc., *Informacijska družba IS 2005.* Ljubljana: Jožef Stefan. 48-51.

Krašovec, J. (1999). *Nagrada, kazen in odpuščanje: Mišljenje in verovanje starega Izraela v luči grških in sodobnih* *pogledov*. Ljubljana: Slovenska akademija znanosti in umetnosti.

Rieman, F. (2003). *Grundformen der Angst: Eine tiefenpsychologische Studie*. München: Ernst Reinhartd Verlag.

Showers, J. C. (2000). Self-Organisation in Emotional Contexts. V: Joseph P. Forges, *Feeling and Thinking: The Role of Affect in Social Cognition*, Cambridge: University Press.

Kako z vero v (post)moderni?

prof. dr. Janez Juhant
Univerza v Ljubljani
Teološka fakulteta
Poljanska 4, 1000 Ljubljana, Slovenija
Tel: +386 1 434 58 32; fax: +386 1 434 58 54

POVZETEK

Članek analizira razmere med verovanjem in umom v moderni dobi.

1 UVOD

Novi vek je pripravil izhodišča, ki so problematizirala odnos celotne krščanske kulturo v odnosu do moderne. Po prepričanju Tomaža Akvinskega in še bolj njegovih naslednikov in tudi po uradnem učenju katoliške Cerkve, si vera in um ne nasprotujeta, ampak se dopolnjujeta in filozofija zato lahko služi utrditvi vere.[1] Po cerkvenem izročilu sta si vera (tako vsebina kot dej vere) in um medsebojno soglasna oziroma se dopolnjujeta, ker je izvor obeh Bog.[2] Sholastična miselna enotnost sveta še ni poznala dilem, s katerimi se morajo ukvarjati krščanski misleci moderne pod vplivom razvoja, ki ga je sprožilo razsvetljenstvo in ga Ernst Cassirer imenuje "sekularizacija".[3] V narekovaju ima pojem širši okvir in predstavlja prelom: Misleci moderne ne priznavajo več Boga kot povezovalca vsega, zato pa jim je tudi svet razpadal in morajo ponovno iskati njegovo enotnost.

Zanimivo je stališče Jeana Guittona, ki ne priznava te ločitve med Bogom na eni ter svetom in človekom na drugi strani in je naklonjen Henriju Bergsonu, - zato ga ta pred smrtjo tudi 'obišče', kakor opisuje v prvem delu *Moje filozofske oporoke* - ki je po njegovem znal združiti nasprotja narave, kulture in človekovih najglobljih iskanj v mistično sintezo.[4] Oba se namreč zavedata, da je vse človekovo delovanje simbolno kot pravi Cassirer. Um prežema vse tvarno in ga poenoti ter mu da ustvarjalni zagon (Bergson: *L'Evolution créatrice*).[5] Iz tega po njem izhaja tudi pri različnih sodobnih mislecih kot Kierkegaard in Heidegger "nepremagljivo upanje".[6]

Proces ločitve Boga od sveta pa ima tudi dalekosežne posledice za življenje človeka in družbe. Ta proces se namreč v zadnjih stoletjih iz razsvetljenskega bolj ali manj umskega oziroma akademskega nivoja vedno bolj seli na vsa področja življenja: na religiozno, družbeno-politično in gospodarsko-socialno.

Teologi in tudi neteologi npr. F. Fukuyama so prepričani, da je "verska delitev med ljudmi sama po sebi nesreča," posebno, ker je vera sestavni del človeškega izročila.[7] Kulturnih delitev srednji vek (kljub različnosti religij in kultur, ki so tkale srednjeveško kulturo: judovstvo, krščanstvo, islam) ni občutil tako kakor moderna, saj je bila enotnost sveta značilnost evropske srednjeveške in tudi drugih tradicionalnih družb. Srednjeveška družba je lahko zaradi te enotnosti sprejemala, da sta (krščanska) vera in um izvorno od Boga. Tomaž Akvinski je združil različne govorice, Wittgenstein bi dejal jezikovne igre in kulturno povezal dejavnosti kot so politika, gospodarstvo, znanost, filozofija in religija. Iz tega je nastal enoten srednjeveški kulturni prostor, se je začel razčlenjevati z novoveškimi subjektivnimi postavkami. Srednjeveški filozofi so tako tudi spretno krmarili med skrajnostmi fideizma in racionalizma. Prvi ne dopušča razuma in zahteva le vero, drugi skuša vse razložiti le z umom in ne potrebuje vere. Naloga filozofa in torej mislečega človeka sploh pa je, da vse misli in da misli torej tudi o religiji. To je znana srednjeveška formula *fides, quaerens intellectum* – vera, ki išče umske razloge.

Novoveški misleci so postavili nove zahteve za to iskanje. Teologom tudi zdaj ni šlo predvsem za razčlenitev filozofskih problemov, temveč kako postaviti temelje

[1] Prim. Leon XIII. *Aeterni Patris* 1879, v: DS (Denzinger-Schönmetzer, Barcelona ect (Herder) 1965, št. 3135-3140.
[2] Prim. Akvinski, T., *Summa Theologiae* I/I, q.1, a.1; q. 2; Akvinski T., *Izbrani spisi*, Ljubljana (Družina) 1999, 333-341.
[3] E. Cassirer, *Filozofija razsvetljenstva*, Ljubljana (Claritas) 1998, 149
[4] Prim. J. Guitton, *Mon testament philosophique*, Paris (Galilée) 1997, 52 sl.
[5] Prim. Guitton, *Histoire et destinée*, Paris (Galilée) 1970, 35.
[6] Guitton, *Što verujem*, Zagreb (KS)1972, 92.
[7] Prim. Fukuyama F:, *Der große Aufbruch*, (angl. *The Great Disruption*, New York Free Press 1999*)*, Wien (Zsolnay) 1999, 26,366.

krščanske vere v razumne okvire tudi v kontekstu problemov moderne. Zato je treba vprašanje krščanstva in Jezusa postavljati dovolj kritično v duhu modernih kritične znanosti. Potrebno je versko oziroma mistično stališče prevesti v govorico, ki bo compatibilna z ostalimi govoricami oziroma jezikovnimi igrami. Upoštevati je treba stališča Kanta, Spinoze, Voltaira, Comta in drugih. Že omenjeni Guitton izpostavlja tudi širšo kritiko katolištva in Cerkve s strani prostestantov, marksistov in tudi znotraj katoliške kritike. Ugotavlja, da se marksizem in protestantizem stikata v kritiki Rimsko-katoliške Cerkve. Čeprav se Guitton zaveda pomena filozofije za vero[8], vendar je vez krščanstva ljubezen, ki se razodeva v Križanem.[9] Ker je torej temelj krščanstva ljubezen,[10] je krščanstvo celostna vera, ki povezuje vse: um in vero, izkušnjo in zgodovino. Krščanstvo kot celostna vera združuje nasprotja v celoto. Danes sicer še bolj kot za časa Guittona čutimo pomanjkanje čuta za splošno in tako za celostno in univerzalno misel, kajti zdaj je odločilen dejavnik subjektivnost, vendar mnogi to razumejo čisto liberalistično oz. individualistično, se pravi, vsak naj bi mislil in delal po lastni volji. Vsak posameznik naj bi bil po tem le sam svoj gospodar in naj bi odločal po svoje in delal le zase ne pa za skupno dobro. Zato ne samo na področju vere, pač pa tudi na vseh področjih prihaja do težav, kako najti skupen jezik, če vsak govori svoj jezik. Na področju vere je problem toliko bolj pereč, ker vsaj krščanstvo pozna govorico skupnosti.

Zdaj nova liberalistična sila - gospodarstvo - prek medijev ustvarja nov 'splošni čut', ki ne posega le na področje javnega življenja, pač pa vedno bolj določa področje človekove intime, njegovega zasebnega življenja, mišljenja in odločanja. Ta odtlej določa vse, kar je nekoč urejal verski skupnostni čut oziroma kar je določalo - krščanstvo. Danes je to v rokah finančnih in gospodarskih lobijev, ki jim služijo mediji. Tudi osebno versko življenje je danes pod medijskim udarom. Brevir in večerno molitev je zamenjala televizijska ali elektronska novica. Versko predstavo o svetu je nadomestil medijski spektakel.

Žal nam okvir ne dovoljuje, da bi temu vprašanju - ki je posebno v današnjem družbeno-političnem odločanju - odločilnega pomena, posvetili več pozornosti. Sodobni medijski teoretiki npr. Marschall McLuhan[11] s svojo tezo o globalni vasi - namreč poudarjajo, da je človekova predstava sveta, njegovo spoznanje in odločanje, bistveno povezano s medijskim posredovanjem. Sicer je človek od svojega izvora dalje simbolno bitje:[12] Svoj svet si ustvarja prek medija - govorice. Danes je prek medijske tehnike to dobilo razsežnosti novega univerzalizma oziroma totalitarizma nad osebo, ki ga krojijo predvsem gospodarsko-finančni interesi, ki se jim podreja tudi politika, to pa je v nasprotju z načeli subsidiarne družbe, po katerih naj vse stvari urejajo ljudje sami in sicer "od spodaj"[13]. Sodobna družba postaja tako znova totalitarna, se pravi oblikovana oziroma dirigirana po medijskih načrtovalcih. Ljudje imamo táko podobo sveta, kakršno nam krojijo mediji. Kot pravi francoski post-moderni arhitekt in filozof P. Virillo[14], je danes zaradi hitrosti medijsko-tehničnega sveta, v katerega je postavljen človek, možnost kritičnega odločanja zaradi tako hitrega spreminjanja vedno manjša. Človek kot oseba postaja vedno bolj neznatno bitje in vedno težje je zagotavljati v političnem delovanju interese osebe. Jacques Maritain govori o človeku kot stroju.[15]

Kot zahteva G. Vattimo, je treba v teh procesih zagotavljati po eni strani celostnost človeka in zato je prepričan, da ima odločilno vlogo v teh procesih tudi krščanstvo, ki je sooblikovala postmoderno družbo.[16] Na drugi strani pa se moramo ljudje zavedati tudi omejenosti svojega mišljenja, kar pomeni, da ne moremo vzpostavljati absolutnih sistemov, s čemer bi ravno sebe delali za Boga. G. Vattimo zato govori o 'šibkem mišljenju', ki je sestavni del zahodnoevropskega izročila. Upoštevati omejenost pa pomeni vgraditi v sistem presežnost in za J. Guittona je to mogoča le, če ljudje priznavamo Boga, ki preprečuje vsako absolutnost človeških sistemov: "iti v neskončno iskanje".[17] Guiton poudarja ne samo celotnost ampak tudi univerzalnost krščanstva, ki je namenjeno vsem ljudem. Zato pa so pomembne odprtost, presežnost in analognost človeka kot osebe po Jezusu Kristusu, ta je bil namreč odprt za vse ljudi. Jezusova predanost Bogu je temelj vsakega pojmovanja osebe, njene svobode in odgovornosti in spodbuda za preseganje vsakega poskusa, da bi kdorkoli osebo podrejal svojim oziroma kakršnim koli zemeljskim ideološkim ciljem ali interesom.

Seveda pa moramo kljub temu upoštevati Kantovo filozofsko izkušnjo in izkušnje drugih modernih mislecev, ki uvajajo razliko med vero in vedenjem in med njima vidijo prepad, katerega Guiton premaguje z dejanjem svobodne odločitve za Boga. Sicer pa nekateri novoveški

[8] Guitton, J., *Što verujem,* Zagreb 1992, 101.
[9] Prim. Guitton, J. *Mon testament philosophique,* n.d., 73.
[10] Prim. Guitton *Što verujem,* n.d. 106
[11] Prim. M- McLuhan, *The Medium is the Message. An Inventory of Effects*. New York 1967; P. Virillo, *La machine de vision,* Paris (Galilée) 1988.

[12] Prim. Juhant, J., *Zgodovina grške in srednjeveške filozofije,* Ljubljana 1999, 9-10.
[13] Prim. Okrožnica Janeza XXIII. *Mati in učiteljica* 1961, št. 53, v: *Družbeni nauk Cerkve,* Celje (MD) 1994, 236.
[14] Prim. P. Virillo, *Die Sehmaschine,* Berlin (Merve) 1989, 161.
[15] Prim. Maritain, J., *Zukunft der Christentheit,* Einsiedeln (Benziger) 1938, 247.
[16] Prim. G. Vattimo, *Glauben-Philosophieren,* Stuttgart (Reclam) 1997, 51.
[17] Guiton, J, *Što vjerujem,* n.d. 63.

misleci, še zmorejo premagati ta prepad ravno z ver oziroma z Bogom, kar jasno potrjuje Kant s praktičnim umom, ki svoje večno moralno hrepenenje lahko izpolni le v Bogu. Pri mnogih drugih modernih mislecih taka premostitev sploh ni več mogoča, kar pa pomeni konec metafizike in človek ostaja pred prepadom biti sam (Sartre). Kakor poudarjata Nietzsche in Heidegger, pa je ravno njegova življenjska naloga, da človek to prepadnost svoje biti vzdrži, kar je zopet sorodno z Guittonovo svobodno odločitvijo (seveda za Boga).
Guitton je na podlagi vere prepričan, da lahko povežemo in premagamo vse prepade bivajočega. Ključna prvina take sinteze pa je vera, ki se krepi v njenem ustanovitelju, Jezusu Kristusu. [18] Kljub takratnim zapletenim razmeram v Franciji in splošnemu dokaj negativnemu razpoloženju do vere v francoski družbi je Guitton prepričan, da se bo vera kot resnica, ki osvobaja človeka, še vedno lahko uresničila. Sodobne sociološke raziskave sicer potrjujejo odpiranje neki nedoločeni (pogosto neobvezni ezoterični) mistiki, ne kažejo pa ravno odpiranja institucionalnemu krščanstvu. Prej obratno: Zdi se, da se je v moderni (in postmoderni) dobi zgodil nek prelom.

2 Prelom

Kot prepričljivo dokazuje A. Giddens, ki navaja R. D.Lainga[19], se človekova samo-identiteta oblikuje na podlagi neprestane življenjske samorefleksije, ki jo v glavnem določa človekova prirojena in pridobljena sposobnost za čustveno obvladovanje življenjskih dogajanj in je plod človekovega zavestnega in nezavednega življenjepisa. Nanj zelo odločilno vplivajo diskontinutitete, ki jih doživlja posameznik na svoji življenjski poti. Če imamo po besedah F. Fukuyame[20] v moderni opravka dobesedno s prelomom (torej s popolno diskontinutiteto), potem tudi verna oseba težko najde kontinuiteto z ustaljenimi verskimi vzorci. Problem vernika moderne dobe je torej nasprotje med osebno vero in sistemskimi kulturnimi okviri, ker moderna človeka sili, da svoja osebna prepričanja univerzalizira - usklajuje s sekulariziranimi kulturnimi vzorci in torej od-pade od religije ali ohrani le zgolj osebno vero, na zunaj pa se prepusti kulturnim vzorcem moderne. Maritain pri presoji razlike med Descartesovo (moderno) filozofijo in filozofijo sholastike govori o prelomu (fr. *rupture*), tega, kar je (še) združevala sholastika. Descartes je najznačilnejši glasnik razdvojitve in ločitve srednjeveške enotnosti sveta, ki tlači dobo moderne. Osnove Descartesove filozofije so podlaga za "človekovo absolutno neodvisnost", čeprav je on sam še priznaval Boga kot temelj vsega.[21]

Prelom moderne je treba premagati z odpiranjem notranjim razsežnostim človeka, kjer se človekova svoboda razpre Bogu, ki edini zmore združiti nasprotja kot bi dejal Kuzanski. Psiholog Winnicott[22] izpostavlja pomen zgodnje človekove izkušnje v iskanju in utemeljevanju tega temelja, ki se odpira že otroku v njegovi izkušnji zavarovanosti pri materi in odpiranju drugemu in tako neznanemu svetu ter mu omogoča pot k nadosebni resničnosti. Če človek izkusi to razsežnost kot dar, potem jo je sposoben posredovati tudi drugim. Postmoderna s svojo zahtevo po individualni zgodbi omogoča tudi kristjani, da svoje osebno izkustvo posreduje drugemu in krščanska skupnost je tako skupnost verujočih, tistih, ki so zaradi odprtosti Bogu pripravljeni iskati skupni jezik tudi z drugimi.

[18] Prav tam, 114.
[19] A. Giddens, Modernity and Self-Identity, Cambridge (Polity) 1991, 53; R. D. Laing, *The Divided Self*, Harmondsworth (Penguin) 1965.
[20] Prim. F. Fukuyama, n.d. ,154 sl.
[21] Prim. J. Maritain, *Le Songe de Descartes*, v: *Oevres V.*, Paris 1982, 156 (citat str. 220).
[22] Prim. Winnicott, D. W. *Transitional Objects and Transitional Phenomena*, London 1951, Hogarth Press

Učitelji modrosti vseh kultur sporočajo isto

Igor Kononenko
Univerza v Ljubljani
Fakulteta za računalništvo in informatiko
Tržaška 25, 1000 Ljubljana, Slovenija
Tel: +386 1 4768390; fax: +386 1 4264647
Igor.Kononenko@fri.uni-lj.si

ABSTRACT: Teachers of wisdom from all traditions are telling us the same message

Both, science and spirituality are looking for the truth, but with completely different basic principles and methodologies. Spirituality, stemming from various eastern and western traditions, is necessarily subjective and relies on personal and intuitive sense. Its aim is the direct experience of reality in order to widen one's consciousness. The paper aims to find the common intersection of teachings from various traditions. For that purpose we provide a list of (currently) 54 teachers of wisdom and describe 18 most important common points that can be found in all teachings.

1 Uvod

Znanost in duhovnost raziskujeta in iščeta resnico, vendar s popolnoma drugačnimi temeljnimi principi in zastavljenimi vmesnimi cilji. Hkrati seveda uporabljata tudi popolnoma drugačne pristope in metodologije (Kononenko, 2005).

Duhovni pogled na svet je temelj vseh učenj velikih modrecev, pomembnih filozofskih in religioznih šol ter svetih tekstov vzhoda in zahoda (npr. Milčinski, 1992; Krishnamurti et al., 1993; Shah, 2000; Meera 2002; Jogananda, 2003; Aurobindo, 1991; Ravi Shankar, 1997-2003; Tolle, 2002; Osho, 1998; Pilgrim, 1999; Po, 1977; de Mello, 1989).

Vse različne duhovne šole temeljijo na enakih osnovnih principih: smisel življenja presega samo njegov materialni vidik; vse kar obstaja je eno - izhaja iz istega izvora in služi istemu namenu; resnica je neopisljiva in zato razumu nedosegljiva, vsak jo mora nujno začutiti sam, s subjektivno izkušnjo; namen življenja je učenje, cilj je preseganje omejenosti ega, subjektivno spoznanje resnice in doseganje modrosti; duhovno življenje temelji na gojenju duhovnih vrednot, kot so ljubezen in sočutje, ponižnost in strpnost, preprostost in skromnost, sprejemanje in odpuščanje, iskrenost, zaupanje in pogum.

Duhovnost nujno temelji na subjektivnem čutenju in zaupanju in z razumom je ni mogoče niti potrditi niti ovreči. Zaradi nujnosti subjektivne izkušnje duhovnosti ni mogoče objektivizirati - je nemerljiva in neponovljiva v objektivnem smislu. Da pa bi se prepričali, da je ta subjektivnost realna, čeprav je neopisljiva, so v tem članku opisane stične točke učiteljev modrosti iz mnogih dokumentiranih in nam dosegljivih kultur.

V 2. razdelku je na kratko predstavljen pojem učitelja modrosti. V 3. razdelku je seznam izbranih učiteljev, v 4. razdelku pa so opisane stične točke vseh modrecev.

2 Učitelji modrosti - predani občudovalci Resnice

Če lahko sprejmemo dejstvo, da smo duhovna bitja in da hodimo po poti duhovne evolucije, je samoumevno, da bomo nekoč, po številnih napakah, izkušnjah in preizkušnjah povsem izrazili svojo duhovno naravo. Za takšne ljudi pravijo, da so spoznali, da so prebujeni, samouresničeni, realizirani, razsvetljeni, odrešeni, blaženi, zveličani, Mojstri ljubezni in modrosti, ker popolnoma izražajo ti dve in druge kvalitete duhovne narave. To so bitja, ki so presegla vsakršen privlak želja in strasti, razblinila vse strahove in spregledala igre egocentričnega jaza, z lučjo svojega razumevanja so povsem predrla meglo slepil in iluzij. Mojstri so spoznali svojo povezanost s stvarstvom, zlitost z božanskim in to v takšni meri, da ločenosti od celote ne poznajo več. Imajo individualnost, vendar živijo kot celota, sestavljena iz neskončne pestrosti izrazov.

V zbirki v naslednjem razdelku so navedene osebnosti, za katere obstajajo zgodovinski dokumenti o njihovem življenju in delu ter o njihovih naukih. Delno so izjema osebnosti iz razdelka 3.1, v katerem so navedeni nekateri legendarni učitelji modrosti, za katere nimamo trdnih zgodovinskih podatkov, zato pa živi toliko močnejše ustno in intuitivno izročilo ter ljudske legende, kar je močno vplivalo in še danes vpliva na iskreno duhovno usmerjenost mnogih. Ker je duhovnost pogosto zlorabljena v uradnih religijskih krogih, velja, da so tudi mnoga zgodovinska »dejstva« vprašljiva in prilagojena političnim namenom državnikov in religijskih vrhovnih inštitucij. Zato so tudi učenja velikih mojstrov v mnogih religijskih spisih in dokumentih spremenjena in potvorjena in s tem zavajajo ne samo vernike, ampak tudi javno mnenje nasploh. Kot vsi mojstri zatrjujejo, je resnica neopisljiva, zato je treba nauke mojstrov brati ne samo z razumom ampak hkrati preverjati in čutiti intuitivno, s srcem. V teh naukih ni prostora za dokončna pravila in dogme.

Poleg vidnejših realiziranih mojstrov so navedeni tudi nekateri predani zagovorniki resnice, ki so jo globoko čutili, tako globoko, da je niso mogli izdati niti za ceno svojega življenja. Čutili so notranjo potrebo, da o njej spregovorijo ljudem, čeprav prav vsi hkrati trdijo, da je neopisljiva, nerazložljiva in da jo mora vsak najti sam, v sebi. Navedeni so tudi nekateri preroki, ljudje, ki so z globoko intuicijo imeli dostop do resnice in so jo kot kanali prenašali ljudem v poduk, pomoč in spodbudo.

Izbor modrecev je vedno nujno subjektiven, kot je subjektivno doživljanje njihove modrosti. Zbirka učiteljev ni in ne more biti popolna. Skušal sem izbrati najvidnejše učitelje, gotovo pa nisem opisal mnogih modrecev, ki so lahko bralcu najbolj pri srcu.

3 Seznam učiteljev modrosti

3.1 Legendarni mojstri

- Zaratustra (grško Zoroaster) (? 2. tisočletje pr. n. št.), legendarni perzijski razsvetljeni mojster in duhovni učitelj, utemeljitelj Zoroastrijske religije.
- Sri Rama (pribl. 45. st. pr.n.št.), legendarni indijski razsvetljeni mojster, kralj in modrec.
- Sri Krishna (pribl. 32. st. pr.n.št.), legendarni indijski razsvetljeni mojster, princ in modrec.

3.2 Antični bližnji in daljni vzhod

- Bodhidharma (Sanskrit: Pu Tai Ta Mo; Japonsko: Daruma Daishi) (470?-539?), razsvetljeni mojster in duhovni učitelj.
- Siddhartha Gautama Buddha (560?-480? pr.n.št.), razsvetljeni mojster in duhovni učitelj.
- Lao Ce (Lao-Tzu, Lao Zi) (570?-490? BC), kitajski modrec in filozof, utemeljitelj Taoizma.
- Zhuang Zi (Chuang Tzu, Chuang Tse, Chuang Chou) (369?-275? pr.n.št.), kitajski modrec, filozof in zapisovalec modrosti Taoizma.
- Jezus Kristus, Nazarečan (?6 pr.n. št- ?29 n.št.), razsvetljeni mojster in duhovni učitelj.

3.3 Grška in rimska antika

- Heraklit (pribl. 535 -475 pr. n. št.), grški filozof in modrec.
- Pitagora (pribl. 569-475 pr. n. št.), grški filozof, matematik, modrec in duhovni učitelj.
- Sokrat (470?-399? pr.n.št.), grški filozof in modrec.
- Apolonij Tijanski (pribl. 2-98), grški filozof in modrec.
- Seneka (4? BC-AD 65), rimski filozof in dramatik.
- Plotin (pribl. 205-270), grški filozof, modrec in duhovni učitelj, osnovatelj neoplatonizma.

3.4 Evropski srednji vek

- Sv. Frančišek Asiški (?1182-1226), blaženi, mojster ponižnosti, utemeljitelj frančiškanskega reda menihov.
- Meister Eckhart (1260-1327?), krščanski teolog, filozof in mistik.
- Sv. Terezija Avilska (Teresa Sanchez Cepeda Davila y Ahumada, angl. St. Teresa of Avila) (1515 - 1582), krščanska nuna, svetnica, mistik, reformatorka karmeličanskega reda.
- Sv. Janez od Križa (John de Yepes, angl. St. John of the Cross) (1542 - 1591), mistični teolog, svetnik, osnovatelj bosonogih karmeličanov.

3.5 Sufizem

- Omar Khayyam (polno ime: Ghiyath al-Din Abu'l-Fath Umar ibn Ibrahim Al-Nisaburi al-Khayyami) (pribl. 1048-1131), perzijski matematik, astronom, pesnik in učitelj sufizma.
- El-Ghazali (polno ime: Abu Hamid Muhammad Ibn Muhammad At-Tusi Al Ghazali) (1058-1128?), islamski filozof, teolog in sufi.
- Rumi, Jalal ad-Din (Jelaluddin ali Jellaludin) Muhammad Din ar- (1207-1273), perzijski pesnik in sufi, osnovatelj plesočih dervišev.
- Hafiz, Mohammed Shams od-Din (1325?-1389?), perzijski pesnik, sufi.

3.6 Indija in daljni vzhod

- Kanachi Sosan (kitajsko: Chien-chih Seng-ts'an; ali Jianzhi Sengcan) (cca.510 – 606?), razsvetljeni mojter in duhovni učitelj, tretji zenovski patriarh na Kitajskem.
- Huang Po (ime za časa življenja: Hsi Yün) (prva polovica 9. st. n.št.), mojster zena in duhovni učitelj.
- Rinzai (kitajsko: Lin Chi) (?-866), razsvetljeni mojster zena in duhovni učitelj.
- Naropa (1016-1100), razsvetljeni mojster in duhovni učitelj.
- Jetsun Milarepa (1052-1135), tibetanski jogi, pesnik, mag, razsvetljeni mojster in duhovni učitelj.
- Guru Nanak (1469-1539), razsvetljeni mojster in duhovni učitelj, utemeljitelj sikhizma.

3.7 19.stoletje

- Lahiri Mahasaya (polno ime: Sri Sri Shyama Charan Lahiri Mahasaya) (1828-1895), razsvetljeni mojster in duhovni učitelj.
- Helena Petrovna Blavatsky (1831-1891), parapsihološki medij in ustanoviteljica teozofskega društva.
- Sri Ramakrishna Paramahamsa (1833-1886) Razsvetljeni mojster in duhovni učitelj.
- Shri Sai Baba iz Shirdija (Sayin Saheb, Maharaj) (1840?-1918) Razsvetljeni mojster in duhovni učitelj.
- Rudolf Steiner (1861-1925), avstrijski filozof in znanstvenik, ustanovitelj antropozofskega gibanja.
- Sri Yukteswar (polno ime: Swami Sri Yukteswar Giri Maharadža) (1855-1936), razsvetljeni mojster in duhovni učitelj.

3.8 20.stoletje

- Rabindranath Tagore (1861-1941), indijski pesnik, filozof, Nobelov nagrajenec.
- Mahatma Gandhi – Mohandas Karamchand (1869-1948), mojster nenasilnega boja za resnico in človekove pravice.
- George Gurdjieff (1877-1949), grško-armenski duhovni učitelj in mistik.
- Carl Gustav Jung (1875-1961), švicarski psihiater, psiholog in filozof.
- Bhagavan Sri Ramana Maharshi – modrec iz Arunachale (1879-1950), razsvetljeni mojster in duhovni učitelj.
- Sri Aurobindo (1872-1950), razsvetljeni mojster in duhovni učitelj.
- Paramahansa Yogananda (1893-1952), mojster joge in duhovni učitelj.
- Meher Baba (1894-1969), razsvetljeni mojster in duhovni učitelj.
- Alan Watts (1915-1973), teolog, mistični filozof in duhovni učitelj.
- Mati Tereza (Agnes Gonxhe Bojaxhiu) (1910 - 1977), albanska katoliška nuna, blažena, poosebljena ljubezen, osnovateljica Misijonark usmiljenja, dobitnica Nobelove nagrade za mir.

- Sri Nisargadatta Maharaj (1897-1981), razsvetljeni mojster in duhovni učitelj.
- Peace Pilgrim – Romarka za mir (1908 - 1981), razsvetljena mojstrica, romarka in modrec.
- Jiddu Krishnamurti (1895-1986), razsvetljeni mojster in duhovni učitelj.
- Osho - Bhagwan Shree Rajneesh (1931-1990), razsvetljeni mojster in duhovni učitelj.
- Anthony de Mello (1931-1987), indijski jezuit, mistik in duhovni pisatelj.

3.9 Danes

- 14. Dalaj Lama, Tenin Gyatso (roj.1935), duhovni vodja tibetanskega naroda in dobitnik Nobelove nagrade za mir.
- Bhagavan Sathya Sai Baba (roj. 1926), razsvetljeni mojster in duhovni učitelj.
- Sri Sri Ravi Shankar (roj. 1956), razsvetljeni mojster in duhovni učitelj, ustanovitelj gibanja Art of living (Umetnost življenja).
- Mati Meera (roj. 1960), razsvetljena mojstrica in duhovna učiteljica.
- Eckhart Tolle (roj. ?1955), razsvetljeni mojster in duhovni učitelj.

Zgornji seznam 54 učiteljev modrosti je seveda nepopoln in se bo sčasoma dopolnjeval. Nastal je s prebiranjem obsežne literature, ki tukaj zaradi pomanjaknja prostora ne more biti v celoti navedena. Največ navedenih učiteljev je iz Indije (22) in večina je moških (samo 5 žensk), kar je posledica patriarhalnosti praktično vseh kultur v (znani) zgodovini človeštva - kljub temu nikakor ne smemo podcenjevati vpliva žensk, ki so bolj intuitivne in, čeprav manj razumske in bolj tihe, pogosto modrejše od razumskih in glasnejših moških.

4. Stične točke vseh učiteljev modrosti

Tu so zbrane in na kratko opisane najpomembnejše stične točke vseh zgoraj navedenih učiteljev modrosti. Seveda pa učitelji modrosti iz različnih kultur uporabljajo različno terminologijo, prilagojeno takratnim razmeram (in potrebam). Izbrana terminologija skuša povzeti rdečo nit učenj vseh učiteljev modrosti:

1. NI ZLA: V absolutnem smislu ne more obstajati Zlo, ker je v vseh stvareh Bog in so Bog; vsi strašni obrazi vesolja so le Njegove maske. Zlo je samo navidezno, je proizvod nevednosti, nevednost je človeška bolezen, ko je ozdravljen, je razsvetljen.

2. NI VEČNEGA PREKLETSTVA: Niti onostranski svetovi niti zemlja niso večni, temveč nastajajo in izginjajo in spet nastajajo v brezkončnem procesu kozmičnega pojavljanja. Večen je samo Bog v smislu neskončne absolutne Biti, Pravira oziroma neizrekljive neskončne božanske Osebnosti. Zato bivanje v kakšnih nižjih nebesih ali v kakšnem peklenskem svetu vsekakor ne more biti večno.

3. VSE POTI VODIJO K BOGU: Duša je izšla iz Boga in se bo prej ali slej zagotovo vrnila k Bogu. Ljudje po vseh poteh, kjerkoli hodijo, hodijo po Njegovi poti, saj vse poti vodijo k Njemu. Različne vere so samo različne poti, ki vse lahko peljejo k istemu končnemu cilju, čeprav seveda ne vse po enaki poti ali enako naravnost ali enako hitro. Ne obstaja kakšna edino zveličavna vera, saj nas vsaka lahko pelje k zveličanju, če ji zares iskreno sledimo, če res hrepenimo po Bogu.

4. ENOST vsega, kar obstaja: VSE JE BOG, VSI SMO BOG, le nivo zavedanja je različen. Ko spoznaš Resnico, spoznaš, da si eno z vsem – v vsakem bitju vidiš Boga, vidiš Sebe, vidiš, da je bila ločenost samo navidezna, v tvojem umu.

5. NIČESAR NI POTREBNO SPREMINJATI, RAZEN SEBE; Vse stvari so idealne takšne, kakršne so, le sprejeti se jih moramo naučiti. Edina prava sprememba je sprememba znotraj tebe, vse ostalo je le igra, namenjena temu, da spoznaš.

6. VENDAR POT NI LAHKA: je dolga in polna pasti in le redki pridejo relativno hitro do konca; večina se dolgo časa vrti v krogu, preizkušajo razne mikavne bližnjice, zahajajo v slepe ulice in se le počasi vračajo na Pot in iščejo naprej.

7. RESNICA JE NEOPISLJIVA: Kot vsi mojstri zatrjujejo, je resnica neopisljiva, zato je treba nauke mojstrov brati ne samo z razumom ampak hkrati preverjati in čutiti intuitivno, s srcem. V teh naukih ni prostora za dokončna pravila in dogme. Vsi predpisi in dogme so povsem nezadostni, da bi lahko izražali pravo, najvišjo resnico, saj Bog presega vse človeške predstave in vse umske obrazce, ki si jih more o Njem narediti človeška pamet.

8. RAZUM JE OMEJEN, ustvarja ločevanje in neresnico, je sicer lahko koristno orodje, ne sme pa biti gospodar; nujna je HARMONIJA SRCA IN RAZUMA, na koncu pa se mora razum utišati, sicer dojetje (spoznanje, uvid) resnice ni možno.

9. DOGME SO POSLEDICA NEZNANJA: V teh naukih ni prostora za dokončna pravila in dogme. Vendar vsaka predstava, verska smer, religija je lahko koristna in tudi potrebna, dokler ustreza razvojni stopnji nekega ljudstva ali skupine ali človeka in jim pomaga živeti in napredovati in tudi ustrezno spreminjati svojo predstavo, religijo – to velja tudi oziroma še toliko bolj za najbolj civilizirane in kultivirane narode.

10. RESNICO LAHKO SPOZNA SAMO VSAK SAM NEPOSREDNO: Pravo spoznanje Boga pa je itak možno le potlej, ko se povzpnemo onkraj vseh predstav in vseh pojmovanj k živemu neposrednemu mističnem doživetju v tihem očiščenem umu in čistem srcu. Nravne dolžnosti in nravna pravila ali postava imajo samo relativno veljavo in vrednost; duhovno osvobojeni človek pa se povzpne nad vsa nravna pravila ali zakone in ni več podvržen nikakršni nravni postavi.

11. SEDANJI TRENUTEK: Edina realnost je sedanji trenutek in samo v njem lahko spoznaš Resnico. Preteklost in prihodnost ne obstajata, sta samo spomin ali proizvod uma. Vsak strah, vsaka navezanost, vsak predsodek je v preteklosti ali v prihodnosti. V sedanjem trenutku ni strahu, ni sodb, je čista spontanost.

12. DA POSTANEŠ ENO, MORAŠ SEBE IZNIČITI; ego (osebnost, persona) je ovira na Poti, vendar brez ega ne moreš stopiti na Pot. Ko si pripravljen, žrtvuješ ego zato, da dobiš VSE.

13. KONČNI CILJ JE RAZSVETLJENJE; SPOZNANJE; ZVELIČANJE; SAMOURESNIČITEV; ZDRUŽITEV Z ABSOLUTOM, Z BOGOM; ZLITJE V ENO.

14. PRAVA SVOBODNA VOLJA OBSTAJA SAMO V STANJU RAZSVETLJENJA, vsa druga stanja so pogojena in zato nesvobodna – navidezen paradoks: dokler si pogojen zlorabljaš svobodno voljo, ko si osvobojen, delaš vse v skladu z Božansko voljo.
15. UČITELJ JE (skoraj) NUJEN, nivoju učenca ustreza nivo učitelja. Znanje je koristno samo, če je prilagojeno nivoju učenca. Vendar Učitelj ne more narediti ničesar namesto učenca – učenec mora sam prehoditi svojo pot.
16. TRPLJENJE in PREIZKUŠNJE SO NUJNI ZA UČENJE; svet dvojnosti je svet trpljenja in preizkušenj – v njem ni možno, dolgoročno gledano, 'idealno' življenje ali idealna ureditev življenja, je pa nujen, da dosežeš Spoznanje.
17. NAVEZANOST IN ŽELJE NAS ZAVAJAJO in nas oddaljujejo od Resnice. Smisel življenja je življenje samo in nikakor ne, da bi kakrkoli dosegli v življenju. Namen pomivanja posode ni ćista posoda, ampak pomivanje posode. Pomembna je pot in ne cilj!
18. ŽIVLJENJE NERAZSVETLJENEGA JE SPANJE, NEZAVEDANJE; šele ob razsvetljenju (spoznanju) se človek prebudi iz dremeža, postane Zavesten.

5. Zaključek

Čeprav seznam modrecev iz 3. razdelka ni (in tudi ne more biti) popoln, predstavlja zajeten reprezentativni vzorec. Iz stičnih točk navedenih učiteljev modrosti lahko izpeljemo dokaj trden sklep, ki ga sporoča naslov tega članka. Ker so bili mnogi navedeni modreci relativno nepovezani in neodvisni, lahko sklepamo, da so do svojih spoznanj prišli skozi lastno izkušnjo in ne na osnovi razumskega sprejemanja naukov od učiteljev ali pa iz prebiranja zapisanih dokumentov. Ker so modreci enotni ne glede na časovno obdobje in ne glede na prostor (kontinent), v katerem so živeli, in ne glede na tradicijo, iz katere so izhajali, lahko sklepamo, da vsi črpajo iz iste Resnice, čeprav vsak uporablja nekoliko drugačno terminologijo in ima vsak svoj stil pri opisovanju te neopisljive Resnice.

Modreci so se pojavljali in se pojavljajo v vseh obdobjih in na vseh kontinentih, najpogosteje takrat, ko jih najbolj potrebujemo. Vsi po vrsti nam govorijo eno in isto, le način pripovedovanja, jezik, globina povedanega se razlikujejo in so prilagojeni kulturi in duhovni zrelosti okolja: V absolutnem smislu ne more obstajati Zlo, ker je v vseh stvareh Bog in so Bog; vsi strašni obrazi vesolja so le Njegove maske. Niti onostranski svetovi niti zemlja niso večni, temveč nastajajo in izginjajo in spet nastajajo v brezkončnem procesu kozmičnega pojavljanja. Večen je samo Bog (Absolut, Enost, Neimenovani, Neizrekljivi, Vir, Stvarnik, Vsemogočni, Prvobitna zavest, Univerzalna Zavest, Kozmos) v smislu neskončne absolutne Biti, Pravira oziroma neizrekljive neskončne božanske Osebnosti (namesto besede Bog srečamo v različnih kulturah različne besede kot npr. Alah, Brahma, Hari, Ahura Mazda, Tao, Buda itd.). Zato bivanje v kakšnih nižjih nebesih ali v kakšnem peklenskem svetu vsekakor ne more biti večno. Duša je izšla iz Boga in se bo prej ali slej zagotovo vrnila k Bogu. Ljudje po vseh poteh, kjerkoli hodijo, hodijo po Njegovi poti, saj vse poti vodijo k Njemu.

Različne vere so samo različne poti, ki vse lahko peljejo k istemu končnemu cilju, čeprav seveda ne vse po enaki poti ali enako naravnost ali enako hitro. Ne obstaja kakšna edino zveličavna vera, saj nas vsaka lahko pelje k zveličanju, če ji zares iskreno sledimo, če res hrepenimo po Bogu. Vsi predpisi in dogme so povsem nezadostni, da bi lahko izražali pravo, najvišjo resnico, saj Bog presega vse človeške predstave in vse umske obrazce, ki si jih more o Njem narediti človeška pamet. Vendar vsaka predstava, verska smer, religija je lahko koristna in tudi potrebna, dokler ustreza razvojni stopnji nekega ljudstva ali skupine ali človeka in jim pomaga živeti in napredovati in tudi ustrezno spreminjati svojo predstavo, religijo – to velja tudi oziroma še toliko bolj za najbolj civilizirane in kultivirane narode. Pravo spoznanje Boga pa je itak možno le potlej, ko se povzpnemo onkraj vseh predstav in vseh pojmovanj k živemu neposrednemu mističnem doživetju v tihem očiščenem umu in čistem srcu. Nravne dolžnosti in nravna pravila ali postava imajo samo relativno veljavo in vrednost; duhovno osvobojeni človek pa se povzpne nad vsa nravna pravila ali zakone in ni več podvržen nikakršni nravni postavi.

Zahvala

Pri izboru modrecev so mi pomagali mnogi prijatelji, ki se jim iz srca zahvaljujem. Za dokončni izbor pa sem sledil svojemu srcu, saj če nečesa ne začutiš, o tem ne moreš kompetentno pisati. Globoko sem hvaležen, da mi je bilo naklonjeno srečati štiri od naštetih modrecev. Pri izboru učiteljev so mi pomagali predvsem Viktor Gerkman, Robert Leskovar, Marko Robnik Šikonja, Irena Roglič Kononenko, Nikola Petrovič, Primož Škoberne in Vesna Peričem Krapež. Stjepan Palajsa me je s svojimi predavanji v okviru Nove Akropole navdihnil za iskanje in opisovanje učiteljev modrosti. Sam sem bil presenečen, da se je potrdila trditev Viktorja Gerkmana, da je polovico vidnejših modrecev podarila človeštvu prav Indija.

Literatura

Sri Aurobindo: *Slapovi luči,* Mohorjeva družba, 1991.
Paramahansa Jogananda: *Avtobiografija Jogija,* Gnostica, Ljubljana, 2003.
J.Krishnamurti, A.Watts, Trungpa, R. Maharshi, Dalaj Lama, R.Steiner: *Knjiga duhovnih zakladov;* Julija Pergar, Ljubljana, 1993.
I. Kononenko: Objektivna znanost in subjektivna duhovnost sta komplementarni. V: O. Markič in sod. (ur.) *Zbornik 8. mednarodne multikonference Informacijska družba,* Ljubljana: IJS 2005, str. 61-64.
Mother Meera: *Odgovori matere Meere, 1.del*; Samozaložba, Tolmin, 2002.
Antony de Mello: *Žabja molitev - Meditativne zgodbe;* Župnijski urad Ljubljana-Dravlje, 1989.
Maja Milčinski (ur. in prev.): *Klasiki daoizma: Dao de jing, Zhuang Zi, Lie Zi.* Slovenska matica, Ljubljana, 1992.
Osho: *Zvok ploskanja ene roke;* Satja, Ljubljana, 1998.
Peace Pilgrim: *Romarka za mir - O svojem življenju in delu;* Prijatelji Romarke za mir; Satja, Ljubljana 1999.
Huang Po: *Učenje o prenosu duha*. Horizonti, Beograd, 1977.
Sri Sri Ravi Shankar: *In Intimate note to the Sincere Seeker; Volumes 1-7,* Art of Living Foundation; 1997-2003.
Idries Shah: *Put Sufija*; Gnosis, Ljubljana, 2000.
Eckhart Tolle: *The Power of Now*; Ganeš, 2002.

SPIRITUAL DIRECTION
A Christian Practice of Personal Aid

dr. Vladimira Leskovec
Research Institute 2020
Zrinjskega cesta 9
1000 Ljubljana, Slovenia
Tel: +386 59020010; mobile +386 41201441
e-mail: vladimira.leskovec@guest.arnes.si

ABSTRACT

Spiritual Direction– The main purpose of this article is to show some very important issues on spiritual direction. Initially, the article explores the main principles and characteristics of spiritual direction in general, and seeks to clarify its scope by discussing a variety of concepts, aspects and forms of spiritual direction. The spiritual direction covers the topics of spiritual theology and other theological disciplines; human and pedagogical sciences. These disciplines are the lens through which the ideas of modern theology are viewed. Furthermore, the article focuses on the main characteristics and goals of spiritual direction and those expressions that illustrate it. Furthermore, it points toward ways of choosing a suitable spiritual director, the qualities s/he should have, how to select him or her, about individual and group direction, and finally who can become spiritual director.

1 ITRODUCTION

The last twenty years has been some of most significante writing and thinking on spiritual direction, particularly after the second Vatican Council, in USA and among new communities within the Catholic Church. The spiritual director assists in coordinating the personal faith experience of today's Christian with his/her prayer and daily living. Spiritual direction is not a ministry restricted to priests and pastors, and is often exercise by lay persons. In the Christian tradition, the practice began in 4th century desert monasticisem, and was associated with *diskrisis*, discernement or spiritual insight. The director, often called spiritual father or mother was seen primarily as a person of experience, insight and holiness of life, the ministry of direction begin a by-product. Spiritual direction sometimes became associated, especially in the West with sacramental confession. In recent years interest in spiritual direction has revived within many other Christian denominations. Spiritual direction helps people to build up inner resources in Christ and enable them to struggle against evil. The purpose of this ministry is the restoration of the person to wholness in which the spirit, mind and body are in perfect balance.

2 DIFFERENT NAMES OF SPIRITUAL DIRECTION

The ministry of spiritual direction through the many centuries of the Church has been called many things. Some of these names are: mentoring, spiritual companioning, spiritual friendship, spiritual guidance, discipleship, and spiritual counsel. All these various names seek to express a relationship of "soul-journers," who seek to appropriate spiritual healing, spiritual growth, and the spiritual empowerment that is theirs by God's design and Christ's love. From time to time, we all need the help of a caring other for spiritual growth to happen in our lives. That is why spiritual friendships and spiritual direction ministries have been a vital part of the Christian tradition since it's beginning.

3 TRINITARIAN RELATIONSHIP SPIRITUAL DIRECTION

Spiritual direction strives to reproduce devine relationships in the human, but Spirit-filled, dialogue that occures. Every Cristian spiritual direction always includes three participants, as illistraded below (see Figure 1). In the case of spiritual directiors, one hopes there exists an itimate relationship between the director and Holy Trinity (God). What remains to be established is a right relationship between the director and the directee and a right relationship between the directee and Holy Trinity (God). All three participants have an important role to play- a role that cannot be played by either of the other two without hindering the process. [7]

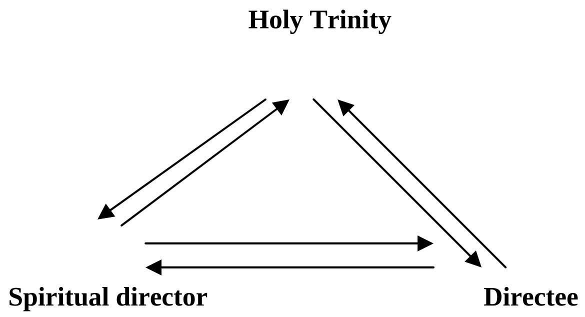


Figure 1: Trinitarian Relationships in spiritual direction.

The success of spiritual direction depends primarily on the Holy Spirit, who charts the journey for every directee or director and gives one the grace to strive for the perfection of charity. In the course of living there is a very precise line between divine sovereignty and human responsibility, as shown in Figure 2.

Figure 2: Devine sovereignty and human responsibility.

Chirtians may place the line in different places, depending on our theology (Catholic, Protestant traditions, etc.), but we all agree that there is a line. Everythinh on the left side of the line is God's souvereignity, and if we try to do what only God can do, we will invariable become frustrated and ultimately fail. Spiritual director is not the Creator, and he or she cannot save himself or herself; he or she should not trys to be someone else's consciences, and he or she can not change other person. Spiritual directors, as a members of the body of Chrits, the Church, have delegated uathority because of their position in Christ; they have power when they are filled with the Holy Spirit. We minister by virtue of Crist's authority and power. [10] We cannot use either one at our own discretion. Each spiritual director try to do God's will through speaking the truth in love (see Eph 4:15). The Holy Spirit, the Spirit of truth, is who will then gide directee in to all truth (see Jn 16:13), a truth that will set him free (see John 8:32). Director as directee have to learn to trust God for tomorrow and live responsible lives today by seeking the power of revealed truth in Jesus Christ.

A great dela of psychological literature discusses the role relationship between the terapist and client (see Figure 3):

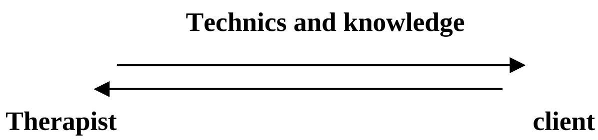


Figure 3 : Relationship between the therapist and client.

The therapist operate dipending on her or her knowledges and different technics he or she learnets. Therapeutic relationship has only two lines and don't include God as in spiritual direction. Therapeutic relationships mainly focus on ones dysfunction and its goal is to help one function better or have healthier relationships. Spiritual direction does not take the place of therapy if therapy is needed. Because Spiritual direction focus on the person as a spiritual being, it does has a more wholistic focus and approach. The spiritual direction relationship focus is on the whole person. Therefore, there is no aspect or dimension on ones' life that is not involved in spiritual direction. Spiritual direction relationships focus on living a more abundant life. (Jn 10:10) We see in collaboration with each other particularly in mutual respect and shering the experiences in the filed of working with people, for example in the practice of supervision. The collaboration is possible only in case of common anthropology of looking at human being as a whole: "May the God of peace himself sanctify you wholly; and may you spirit and soul and body be kept and blameless at the coming of our Lord Jesus Christ" (1 Thess 5:23).

4 GOALS OF SPIRITUAL DIRECTION

The main goal of spiritual direction is to lead a directee to the perfection and charity of the Christian life, and therefore the spiritual director in essentially a teacher, counsellor, and guide. It is the internal forum that a person discovers God's will for him or her, experiences the action of the Holy Spirit, and responds to inspirations received. The role of spiritual director is to help the directee, that is, to give a total and free response to God's call to holiness. The spiritual director is concerned with the whole person, for the spiritual life is not just for the life of the mind, or of the affections, or of the 'summit of the soul' - it is the life of the whole person. The collaboration of the director and directee should be aimed at the following goals.

Every stage of spiritual growth calls for renewed effort to overcome the difficulties involved, whether they be internal, such as self-love, egoism or aridity, or external, such as a secularized and materialistic environment, hedonism or greed. It is at these transition points that one needs the help of a spiritual director. In this need is to be met, however, competent guide and counsellors must be available.

4.1 Intimate Union with God

The Christina vocation is a “divine vocation” (*Gaudium et Spes, n.19*), hence, one who wants to reach that ideal must transcend purely human integration and perfection. As the directee is more and more moved by the Holy Spirit the intervention of the spiritual director becomes les frequent. His physical presence is eclipsed, but to one side and almost forgotten, because the purpose of spiritual direction is to foster a spiritual development.

4.2 Discernement of Vocation

One of the functions of the spiritual director is also to help directee to discern his or her vocation. To which state of life is one called: the priesthood, the religious life or the lay state? Once having clarified the options, iti is necessary to collaborate in analyzing the personal spirituality of the directee, the means best suited for growth in holiness, and hir or her particular apostolate in the Church and in the Society. Fidelity to one’s vocation and mission is very important in the present moment.

4.3 Consolations and Encouragement

Directee on the road to Christian perfection, which requires constant effort, also confront with the difficulties, sufferings and trails. Then the presence of a friend or spiritual director proves to be a great comfort. The directee at such times needs consolation and encouragement, and this calls for a great deal of compassion on the part of the director. When persistent trails and suffering tempt the directee to discouragement, the director will try to pacify and calm the soul. What matters most of all is one’s spiritual growth.

5 WHO CAN BECAME SPIRITUAL DIRECTOR

The Christian Ministry of spiritual direction includes lay and consecrated men and women. The charisma of spiritual direction is not restricted to ministerial priests. In the past most spiritual direction was still being done by ordained clergy and members of religious communities, most of them Roman Catholic, along with some Anglicans and Eastern Orthodox. Every year more and more people are discovering a gift of spiritual direction, which in turn has led a growing number of people to sense a call to offer it as a ministry. More and more lay people have sensed this call, especially laywomen. This trend (abroad) toward lay directors moves spiritual direction back to its roots in the desert, where most of the spiritual fathers and mothers were not ordained clergy or parts of organized and sanctioned religious communities. What increasingly counts is not one’s formal religious status but one’s personal charism for this ministry. [2] The variety of backgrounds (clergy, vowed religious, and laypeople) and spiritual sensitivities particularly lay people brings a great richness to this ministry where all are learning side by side as equals. Theologically, baptism, rather than ordination or commitment to a vowed religious community, is being seen more and more as the primary ground of spiritual calling for all Christians, opening the potential for spiritual direction to everyone.

6 QUALITIES OF THE SPIRITUAL DIRECTOR

The art of spiritual direction, which St. Gregory Nazianzen called “the art of arts and the science of sciences,” is not something spontaneously and automatically received. [11] There are different lists of the qualities of a good director as follows: knowledge, especially of Spiritual, pastoral, moral and dogmatic theology, The Scripture, Fathers of the Church, etc; prudence and good judgement; experience; insisting and holiness. Today there is an urgent need for thoroughly capable spiritual directors who will be able to listen and insist, who will be compassionable and full of peity; humility, and so on.

6.1 Mature Personality

Spiritual director can be given by any competent person regardless of state in life and it can contribute greatly to the renewal of contemporary Christian spirituality. A mature spiritual director is capable of establishing a free and genuine relationship with himself, with others – directee, and with God. Only a mature spiritual director can help a directee to achieve the freedom and courage necessary to be oneself and to have complete confidence in god. If spiritual director has a balanced personality rooted in Christ, he or she can easily avoid any extremes or abuse. It is a great help to the directee to be able to see that the spiritual father or mother is calm and balanced in the face of difficult situations.

6.2. Experience of the Spiritual Life and Humility

The mark of truly spiritual director is a deep experience of God. The example of one’s life not only inspires others, but it is the best assurance that one is a good guide of souls. A spiritual director who is advanced in the spiritual life will have sufficient experience for counselling others. He or she will understand the state of the directee by a kind of affinity or compassion and will offer practical directives.

The virtue of humility is closely connected with the role of the spiritual director particularly when dealing with mystical phenomena or extraordinary graces. The spiritual director needs a profound humility because in the first place God resist the proud and fives his grace to the humble. Second, the spiritual director needs humility so that he will distrust himself when necessary and not rush forward to solve difficulties without reflection and prayer. Third, humility in a director attracts directee, while pride repels him or her. In this respect also the director should imitate Christ, who said of himself that he is meek and humble of heart and he seeks only the glory of his Father.

6.3 Competence in the Spiritual Theology

St. Theresa of Avila believed that of the three requisites for a spiritual director: holiness, prudence and learning, and the most important is learning. [12] Thus the learning of spiritual director should be extensive and have good knowledge of ascetic and mystical theology, other theological disciplines, and of the human and pedagogical sciences.

6.4 Discernement of Spirits

Spiritual director needs to have also a chrism of discernement of Spirits, meaning that is a gift given for the good of directee. If the spiritual director is to give proper guidance and council, he or she must understand what is happening in the directee. He or she must trys to discern wether certain phenomena are caused by God, the individual, or the devil. If spiritual director has good common sense and possesses spiritual insight, it will protect directee from illusion or sin.

7 INDIVIDUAL AND GROUP SPIRITUAL DIRECTION

Spiritual direction basically takes two forms: one-on-one or individual direction and group direction. Individual direction is a private confidential relationship that may involve a long term or short-term commitment with a trained spiritual director. Group direction or direction-in-common is spiritual direction that takes place in a small group setting. Group direction tends to be short-term and issue or theme focused.

8 SELECTION OF A SPIRUTAL DIRECTOR

The choice of spiritual director should be made in a very prudent way. The person, or future directee need to ask God in prayer for the grace and light to find a right spiritual director. Then he or she can investigates who among the Christians possesses the prudence, experience, and learning for a good spiritual director. In some cases we can use also other aids to spiritual growth as spiritual reading or holy friendship.

9 CONCLUSION

The spiritual direction, as Christian practice of personal aid is an example of recent theological and, above all, pastoral possibilities. It is confirmed and supported by different methods which combine the statements from individual theological tracts. The article confirms the main statement that people suffering from distress, various diseases or addictions should be treated as a whole. Due to the fact that nowadays there is still no cooperation among the professions, which deal with a human body, soul and spirit, the spiritual direction as Christian ministry has become very important. Spiritual aid is obtained from the power of the gifts of God and the tradition of the Church. In the future we predict that the number of lay directors will continue to grow significantly, allowing this ministry to florish far more than it ever has in history. Their increasing presence as directors will democratized this ministry.

References

[1] J. Aumann. *Spiritual Theology,* Sheed&Ward, London 2001.
[2] T. Edwards. *Spiritual Directior, Spiritual Companion,* Guide to tending the soul, Paulist Press, New Jersey 2001.
[3] De C: Emetrio, *The Spiritual Direction,* Compendium of Spirituality, Volume One, Alba House, New York 2000.
[4] D. L. Fleming. *The Christian Ministry of spiritual direction,* St. Luis, Missouri 1996.
[5] J. Laplace. *Preparing for Spiritual Direction,* Franciscan Heralnd Press, Chicago 1988.
[6] K. Leech. *Soul Friend- Spiritual Direction in the Modern World,*D.L.T., London 2000.
[7] V. Leskovec. *Extended Spiritual Accompaniment,* PhD Dissertation, Faculty of Theology, Ljubljana 2003.
[8] F . R. Morneau. *Spiritual Direction a Path to Spiritual Maturity*, Crossroad, New York 1998.
[9] *The Holy Bible*. The Revised Standanrd Version, An Ecumenical Edition, Collins, 1973.
[10] T. E Zuehlke, et all.. *Christ Centered Therapy,* Zondrevan, Michigan 2000.
[11] St. Gregory Nazianzen, *Orationes*, PG 35, 435: *Compendium of Spirituality*, Volume One, Alba House, New York 2000.
[12] St. Teresa of Avila, The life, chap. 5,3.: *The Spiritual Direction,* Compendium of Spirituality, Volume One, Alba House, New York 2000.

DIMENZIJE DUHOVNOSTI

Janek Musek
Oddelek za psihologijo, Filozofska fakulteta
Univerza v Ljubljani
Aškerčeva 2 1000 Ljubljana
Tel: +386 3634170
janek.musek@guest.arnes.si; janek.musek@ff.uni-lj.si

POVZETEK

V zadnjem času so se v psihologiji pojavila nova pojmovanja duhovnosti, tako zlasti pojem duhovne inteligentnosti. Čeprav je bil sprejet v nekatere znane teorije in modele temeljnih človekovih sposobnosti, je bilo na tem področju le malo empiričnih raziskav. Eden od osnovnih problemov, ki terja empirično razrešitev, je vprašanje, katere so osnovne komponente duhovne inteligentnosti oziroma duhovnosti. V tej raziskavi sem opravil več multivariatnih analiz fonda izbranih vprašalniških postavk, ki merijo stopnjo duhovnosti. Analize so pokazale, da lahko celotno strukturo duhovnosti razčlenimo na več ravni, znotraj katerih se pojavljajo glavne dimenzije duhovnosti. Na najvišji, najbolj generalni ravni lahko govorimo o splošni dimenziji duhovnosti. Na naslednjih ravneh se ta dimenzija razdeli na več subdimenzij, med katerimi so najpomembnejše dimenzija smisla, dimenzija povezanosti, harmonije, notranjega miru in hvaležnosti, dimenzija vernosti in predanosti numinoznemu, dimenzija rasti in dimenzija odpuščanja.

1 UVOD

Religiozno in duhovno doživljanje sodi med temeljna določila človekove biti. Po Jamesu (1982/1902), so se mnogi, tudi nekateri najprominentnejši psihologi, npr. Adler (Adler in Jahn, 1933), Erikson (1958), Freud (1928a, 1928b, 1939), Fromm (1950) ukvarjali s psihološkimi vidiki verovanja, a razen izjem (kot npr. Bucke, 1923, in že omenjeni James) je psihologija do nedavnega le malo znanstveno raziskovala naravo duhovnega in religioznega dojemanja sveta. Do neke mere je to razumljivo, saj se ključni postavki duhovnosti, namreč smisel in transcendenca, izmikata operativnemu definiranju, s tem pa tudi znanstvenemu raziskovanju (Coles, 1999). Tematiki duhovnosti so se med psihologi še največ posvečali Jung (1921, 1931, 1933, 1958, 1964), Allport (1937, 1950, 1955, 1961), Frankl (1964), nato humanistični psihologi (Maslow, 1954, 1971; Rogers, 1961) in predstavniki transpersonalne psihologije (Grof, 1993; Tart, 1990; Wilber, 1995). V novejšem času se vprašanjem duhovnega in verskega doživljanja posvečajo tudi v krogih vplivne pozitivne psihologije (pregledno o tem Musek in Avsec, 2002).

Raziskovanje duhovnosti so spodbudila tudi nevropsihološka dognanja o odzivanju določenih možganskih predelov na duhovno dejavnost (Alper, 2001; Austin, 1998; Newberg, 2004; Newberg, d'Aquili in Rause, 2001; Persinger, 1987, 1993; Ramachandran in Blakeslee, 1998a, 1998b). Tako je duhovnost postala v novejšem času vse pogostejša referenca v psihološkem raziskovanju (Emmons, 1999). Duhovnost in vernost, povezani s predstavami o transcendentnem, božjem in absolutnem sta postali tudi predmet evolucijskih razlag (Montell, 2002).

Na vseh teh osnovah se je pred kratkim začel uveljavljati pojem duhovne inteligentnosti. Gardner (1999) ga je pod nazivom »eksistencialna inteligentnost« vključil v svoj razširjeni model multiple inteligentnosti, potem ko je že prej našel svoje mesto v modelu Buzana in Keena (1997). Zohar in Marshall (2000) sta nato popularizirala concept duhovne inteligentnosti. Avtorja opredeljujeta duhovno inteligentnost kot »dokončno inteligentnost, s katero rešujemo probleme smisla in vrednot, s katero svoja dejanja in življenja postavimo v širši, bogatejši okvir, ki daje vsemu smisel, s katero ocenimo, da je neka življenjska pot bolj smiselna in samoizpolnjujoča kot druga« (Zohar in Marshall, 2000). Komplementarne definicije najdemo tudi pri drugih avtorjih (Spiritual Intelligence. Definitions, 2004), pri čemer nekateri izrecno opozarjajo na neujemanja v pojmovanjih duhovnosti (Vaughan, 2004). Nekateri avtorji navajajo temeljne sestavine duhovne inteligentnost (glej npr. Stein, 2003), ki bi lahko olajšale razlikovanje duhovne inteligentnosti od drugih konstruktov, tudi od tistih, s katerimi se zdi najbolj povezana, recimo religioznosti (Idler in sod., 1999).

Šele v najnovejšem času se pojavljajo resnejši poskusi merjenja duhovne inteligentnosti (King in sod., 1995; King, Speck in Thomas, 2002; Underwood in Teresi, 2002), čeprav je za marsikoga sporen že sam pojem merjenja duhovnosti (Zohar in Marshall, 2000). Pri tem v bistvu prevladuje vprašalniški način merjenja, kar že po sebi postavlja koncept bolj v bližino konativnih vidikov osebnosti kot pa na področje kognitivnih sposobnosti. Med pomembnejšimi poskusi merjenja duhovnih zmožnosti velja omeniti multidimenzionalne lestvice, ki so jih razvijali na Fetzerjevem inštitutu (Fetzer Institute, etc., 1999). Rezultat teh prizadevanj je bila multidimenzionalna lestvica BMMRS (Brief Multidimensional Measure of Religiousness/Spiri-tuality, Idler in sod., 1999).

S tem so ustvarjene možnosti za empirično raziskovanje strukture duhovnosti. Postavlja se vprašanje, katere so glavne komponente oziroma dimenzije v prostoru našega duhovnega doživljanja. Namen te raziskave je prav ugotavljanje teh dimenzij.

2 METODA

Udeleženci

V raziskavo je bilo vključenih 509 oseb obeh spolov in vseh starostnih razredov. V vzorcu je bilo 185 moških in 324 žensk. Gre za osebe v razponu od 13 do 73 let, z aritmetično sredino 33 let in s standardno deviacijo 11,44.

Aparat

Za merjenje duhovne usmerjenosti smo uporabili posebno lestvico duhovnosti, ki smo jo oblikovali na podlagi izbora in modifikacije večjega števila postavk iz več virov (med njimi tudi s prilagajanjem nekaterih postavk lestvice BMMRS, Idler in sod., 1999). Končna modificirana lestvica vsebuje 54 postavk (Maravič, 2004; Musek in Maravič, 2004). Zanesljivost (notranja konsistentnost) lestvice je visoka, Cronbachov alfa koeficient znaša 0,94.

Oblikovanje raziskave

Raziskava je potekala v obliki multivariatnega raziskovanja.

Postopek

V analizah so bile uporabljene postavke kombinirane lestvice duhovnosti (duhovne inteligentnosti), ki so jo udeleženci izpolnili na spletni strani, zbiranje podatkov pa je potekalo v marcu in aprilu 2004. Izpolnjevanje je bilo anonimno. Dobljeni podatki so bili tabelirani in obdelani s pomočjo statističnih analiz po programskem paketu SPSS.13. Uporabljene so bili različne metode obdelave podatkov, predvsem pa dva tipa multivariatne analize: faktorska analiza in klastrska analiza.

3 REZULTATI IN DISKUSIJA

Strukturo celotnega prostora spremenljivk duhovnosti oziroma duhovne inteligentnosti sem skušal preveriti s pomočjo večjega števila multivariatnih analiz, vključujoč faktorske analize, klastrske analize in analize s pomočju multidimenzionalnega skaliranja. Omejil se bom na prikaz izsledkov faktorskih analiz in klastrskih analiz.

Faktorske dimenzije duhovnosti

Najprej sem s pomočjo faktorske analize preverjal strukturo prostora 54 postavk zgoraj omenjene lestvice duhovnosti. Te postavke so bile torej izbrane kot reprezentativni kazalci duhovnosti in to upravičeno, saj si je težko predstavljati, da obstaja kakšno področje našega duhovnega delovanja in doživljanja, ki ga postavke ne zajemajo. Najpomembnejši kazalci ustreznosti faktorizacije indicirajo primernost korelacijske matrike 54 postavk Lestvice duhovnosti za nadaljnje faktorske analize. Ustreznost vzorčenja po Kaiser-Meyer-Olkinovem testu je visoka in znaša 0,941; prav tako pa je visoko signifikanten tudi Bartlettov test sferičnosti ($p<0,001$). Faktorji so bili izločeni po metodi glavnih komponent in rotirani s pomočjo Promax metode rotacije.

Na podlagi kriterijev za izločanje faktorjev (zlasti Cattellovega testa drobirja – scree test) se zdijo najbolj pomembne faktorske solucije na treh ravneh: enofaktorska, trifaktorska in petfaktorska. Faktorji, ki so nižji od petega po vrsti so že dokaj specifični in ne prispevajo več bistveno k razumevanju temeljne strukture duhovnosti.

Na prvi ravni se torej zdi upravičena enofaktorska solucija, ki zajema en sam faktor, ta pa pojasnjuje 29,16 odstotkov celotne variance v izvorni korelacijski matriki 54 postavk. Praktično so vse postavke Lestvice duhovnosti signifikantno nasičene s prvim faktorjem pri enofaktoski soluciji, kar pomeni, da lahko ta faktor interpretiramo kot generalni (splošni) faktor duhovnosti. Ta faktor tudi korelira kar 0,998 s skupno točkovno vrednostjo lestvice, kar še bolj opravičuje njegovo interpretacijo v smislu generalnega faktorja duhovnosti.

Druga solucija zajema tri faktorje, ki pojasnjujejo skupaj 40,63 odstotka izvorne variance. Tretja solucija zajema pet faktorjev, ki pojasnjujejo 47,32 odstotkov izvorne variance. Prvi faktor pri trifaktorski soluciji najbolj nasiča postavke lestvice, ki pomenijo občutje višjega smisla, vernosti in predanosti (faktor višjega smisla). Z drugim faktorjem so najbolj nasičene postavke, ki se nanašajo na občutje harmonije, notranjega miru, povezanosti, hvaležnosti in odpuščanja (faktor harmonije). S tretjim faktorjem so nasičene predvsem postavke, ki predstavljajo občutje rasti, samoizpopolnjevanja in premagovanja lastnih napak (faktor rasti).

Pri petfaktorski soluciji (glej preglednico 1) dobimo po vrsti faktorske dimenzije, ki jih lahko interpretiramo kot

1. dimenzija smisla (značilne postavke: moja duhovnost daje smisel dogodkom v mojem življenju; moje duhovno prepričanje mojemu življenju občutek pomembnosti in smisla; brez občutka duhovnosti bi bilo moje vsakdanje življenje brez smisla; če na najtežje in najbolj vznemirjajoče dogodke pogledam z vidika duhovnosti, dajejo smisel mojemu življenju; kadar nisem povezan z duhovno platjo svojega življenja, izgubim svoj smisel);
2. dimenzija povezanosti, harmonije, notranjega miru in hvaležnosti (značilne postavke: čutim povezanost z izvirom vsega življenja; živim v harmoniji s svojimi najglobljimi vrednotami in s svojim smislom življenja; lepota stvarstva me notranje prevzame; čutim hvaležnost za življenje; v svojih odnosih z drugimi izražam in prejemam ljubezen in odpuščanje; občudujem stvarstvo in ga spoštujem; hvaležen sem za vse darove; čutim globok notranji mir oziroma harmonijo);
3. dimenzija verskega in numinoznega (značilne postavke: v kolikšni meri bi sami zase rekli, da ste verni...; meditiram ali molim; v svetu prepoznavam navzočnost božanskega; vera je zame izvir moči in tolažbe; verjamem v življenje po smrti);

4. dimenzija rasti in (samo)izpopolnjevanja (značilne postavke: pogosto se mi zdi, da ne bom mogel nikoli nadoknaditi napak, ki sem jih storil v preteklosti, ne glede na to, kako se zdaj trudim; pogosto se mi zdi, da mi ni upelo živeti tako, kot je prav; odpustil sem si stvari, ki sem jih naredil narobe; težko si odpustim nekatere stvari, ki sem jih storil);
5. dimenzija odpuščanja in sprejemanja (značilne postavke: odpuščam tistim, ki me prizadenejo; precej hitro se lahko spet spoprijateljim s prijatelji, ki so me na neki način ranili; nekatere zamere sem gojil mesece ali leta; druge sprejemam tudi takrat, ko naredijo kaj, kar se mi zdi napačno; verjamem, da kadar ljudje rečejo, da mi odpuščajo za nekaj, kar sem storil, to tudi v resnici mislijo).

Preglednica 1.
Nasičenja postavk kombinirane lestvice duhovnosti s petimi latentnimi dimenzijami.*

	Faktorske dimenzije				
	1	2	3	4	5
moja duhovnost daje smisel dogodkom v mojem življenju	**,855**	,476	,560	,102	,151
moje duhovno prepričanje mojemu življenju občutek pomembnosti in smisla	**,796**	,481	,554	,164	
brez občutka duhovnosti bi bilo moje vsakdanje življenje brez smisla	**,793**	,439	,549		
če na najtežje in najbolj vznemirjajoče dogodke pogledam z vidika duhovnosti, dajejo smisel mojemu življenju	**,784**	,482	,592		,239
kadar nisem povezan z duhovno platjo svojega življenja, izgubim svoj smisel	**,783**	,366	,451		
moja duhovnost mi omaga oblikovati cilje, ki si jih postavljam	**,765**	,521	,502	,149	,159
kar se trudim delati v vsakdanjem življenju, je zame pomembno z duhovnega vidika	**,730**	,466	,379	,104	
moje duhovno prepričanje daje smisel veselju in žalosti v mojem življenju	**,707**	,425	,484	,226	,136
vednost, da sem del nečesa večjega od mene samega, daje mojemu življenju smisel	**,688**	,460	,526		,113
doživljam povezanost z vsem živim	**,687**	,661	,675	,314	,183
v kolikšni meri bi sami zase rekli, da ste duhovna oseba...	**,651**	,491	,595	,248	,195
razmišljam o teem, da je moje življenje del večje duhovne sile	**,636**	,410	,634	,103	,174
smisel mojega življenja izhaja iz občutka povezanosti z drugimi živimi bitji	**,589**	,454	,164		,226
kljub temu, da gre toliko stvari narobe, ljubezen še vedno premika svet	**,405**	,324	,400	,107	,323
sreča je...	**,241**	,114			,203
ko pogledam svoje življenje...	**,192**			,137	,115
čutim povezanost z izvirom vsega življenja	,616	**,771**	,668	,278	,185
živim v harmoniji s svojimi najglobljimi vrednotami in s svojim smislom življenja	,369	**,768**	,432	,441	,101
lepota stvarstva me notranje prevzame	,467	**,748**	,361	,198	,238
čutim hvaležnost za življenje	,413	**,734**	,559	,318	,179
v svojih odnosih z drugimi izražam in prejemam ljubezen in odpuščanje	,438	**,734**	,457	,253	,425
občudujem stvarstvo in ga spoštujem	,535	**,720**	,603	,181	,212
hvaležen sem za vse darove	,470	**,718**	,558	,211	,286
čutim globok notranji mir oziroma harmonijo	,387	**,713**	,237	,254	,159
v svoji veri ali duhovnosti najdem moč	,397	**,645**	,431	,511	
svoje misli, besede in dejanja pregledam inb izprašam in sledim programu samoizpopolnjevanja	,560	**,641**	,508	,259	
čutim nesebično skrb za druge	,359	**,613**	,268		,359
živim v dostojanstvu in gorečnosti	,379	**,601**	,355	,282	,125
primerno nadzorujem svoja čustva in obnašanje	,162	**,482**		,246	,197
v kolikšni meri bi sami zase rekli, da ste verni...	,470	,386	**,813**	,127	,202
meditiram ali molim	,544	,524	**,804**	,118	,134
v svetu prepoznavam navzočnost božanskega	,615	,678	**,791**	,241	,177
vera je zame izvir moči in tolažbe	,629	,343	**,726**	,155	,250
verjamem v življenje po smrti	,445	,292	**,689**		,205
redno se pogovarjam s svojim duhovnim svetovalcem	,419	,466	**,610**	,196	
menim, da se vse zgodi z nekim namenom	,436	,246	**,485**		,295
pogosto se mi zdi, da ne bom mogel nikoli nadoknaditi napak, ki sem jih storil v preteklosti, ne glede na to, kako se zdaj trudim		,151	,236	**,711**	
pogosto se mi zdi, da mi ni upelo živeti tako, kot je prav		,245	,165	**,702**	,115
odpustil sem si stvari, ki sem jih naredil narobe		,212	,212	**,610**	,130
težko si odpustim nekatere stvari, ki sem jih storil			,157	**,584**	
kadar se počutim negotovo...		,198		**,509**	,103
kadar stvari ne gredo tako, kot si želim...	,147	,190		**,478**	,123
moja osebnost je...	,218	,273	,151	**,477**	,135
kadar si želim ljubezni...	,216	,282	,102	**,433**	,135
kadar sem soočen z izzivno situacijo...	,152	,206		**,417**	
spremembe vidim kot...	,193	,313		**,390**	,264
kadar čutim, da nimam nadzora...	,261	,286	,284	**,328**	,265
druge vidim kot...	,168	,280	,125	**,288**	,260
odpuščam tistim, ki me prizadenejo	,279	,376	,362	,266	**,737**
precej hitro se lahko spet spoprijateljim s prijatelji, ki so me na neki način ranili	,229	,242	,269		**,668**
nekatere zamere sem gojil mesece ali leta				,241	**,633**
druge sprejemam tudi takrat, ko naredijo kaj, kar se mi zdi napačno	,220	,542	,175		**,567**

verjamem, da kadar ljudje rečejo, da mi odpuščajo za nekaj, kar sem storil, to tudi v resnici mislijo	,327	,426	,220	,171	**,494**
lahko mi je priznati, da se motim	,179	,364		,193	**,404**

* Ničle pred decimalno vejico so opuščene.

Klastrske analize postavk duhovnosti

Izsledki klastrskih analiz se ujemajo z izsledki faktorske analize. Preglednica 2 prikazuje petklastrsko solucijo, ki se vsebinsko zelo ujema z izsledki petfaktorske solucije pri faktorski analizi. Klastrska analiza praktično replicira vseh pet dimenzij duhovnosti, ki sledijo iz interpretacije podatkov faktorske analize, s katero je bilo izločenih pet faktorskih dimenzij.

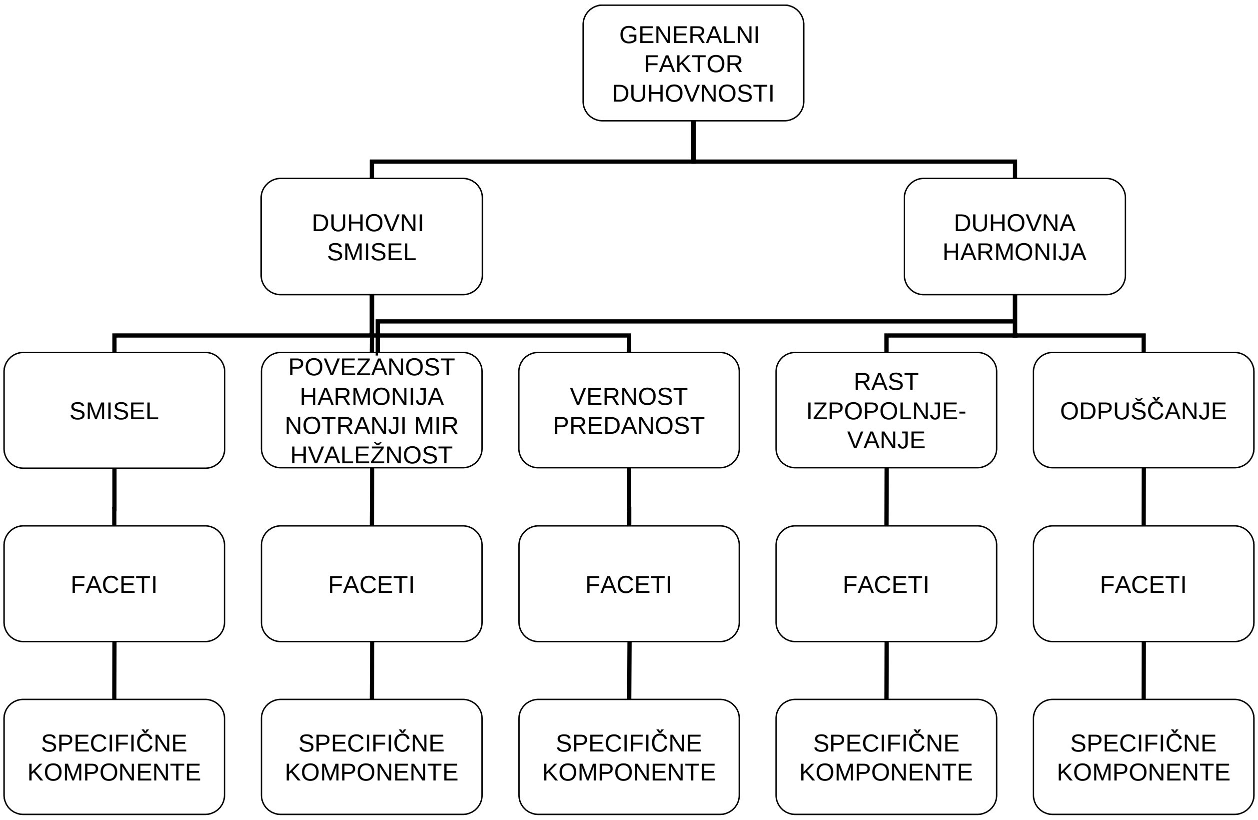
Preglednica 2.
Postavke, ki so klasificirane v skupine na ravni petih klastrov klastrske analize in njihova vsebinska interpretacija.

Postavke v petih klastrih	Interpretacija klastra
v svetu prepoznavam navzočnost božanskega	Povezanost, navzočnost, harmonija, notranji mir, hvaležnost
čutim povezanost z izvirom vsega življenja	
doživljam povezanost z vsem živim	
v kolikšni meri bi sami zase rekli, da ste duhovna oseba...	
lepota stvarstva me notranje prevzame	
občudujem stvarstvo in ga spoštujem	
hvaležen sem za vse darove	
čutim hvaležnost za življenje	
živim v harmoniji s svojimi najglobljimi vrednotami in s svojim smislom življenja	
v svojih odnosih z drugimi izražam in prejemam ljubezen in odpuščanje	
v svoji veri ali duhovnosti najdem moč	
čutim globok notranji mir oziroma harmonijo	
svoje misli, besede in dejanja pregledam inb izprašam in sledim programu samoizpopolnjevanja	
redno se pogovarjam s svojim duhovnim svetovalcem	
čutim nesebično skrb za druge	
druge sprejemam tudi takrat, ko naredijo kaj, kar se mi zdi napačno	
primerno nadzorujem svoja čustva in obnašanje	
živim v dostojanstvu in gorečnosti	
brez občutka duhovnosti bi bilo moje vsakdanje življenje brez smisla	Smisel, smoter
moje duhovno prepričanje mojemu življenju občutek pomembnosti in smisla	
kadar nisem povezan z duhovno platjo svojega življenja, izgubim svoj smisel	
moje duhovno prepričanje daje smisel veselju in žalosti v mojem življenju	
če na najtežje in najbolj vznemirjajoče dogodke pogledam z vidika duhovnosti, dajejo smisel mojemu življenju	
moja duhovnost daje smisel dogodkom v mojem življenju	
moja duhovnost mi pomaga oblikovati cilje, ki si jih postavljam	
kar se trudim delati v vsakdanjem življenju, je zame pomembno z duhovnega vidika	
vednost, da sem del nečesa večjega od mene samega, daje mojemu življenju smisel	
razmišljam o teem, da je moje življenje del večje duhovne sile	
smisel mojega življenja izhaja iz občutka povezanosti z drugimi živimi bitji	
v kolikšni meri bi sami zase rekli, da ste verni...	Vernost
meditiram ali molim	
vera je zame izvir moči in tolažbe	
verjamem v življenje po smrti	
kljub temu, da gre toliko stvari narobe, ljubezen še vedno premika svet	
menim, da se vse zgodi z nekim namenom	
pogosto se mi zdi, da ne bom mogel nikoli nadoknaditi napak, ki sem jih storil v preteklosti, ne glede na to, kako se zdaj trudim	Sprejemanje, odpuščanje
pogosto se mi zdi, da mi ni upelo živeti tako, kot je prav	
težko si odpustim nekatere stvari, ki sem jih storil	
odpustil sem si stvari, ki sem jih naredil narobe	
precej hitro se lahko spet spoprijateljim s prijatelji, ki so me na neki način ranili	
odpuščam tistim, ki me prizadenejo	
nekatere zamere sem gojil mesece ali leta	
ko pogledam svoje življenje...	
sreča je...	Rast, (samo)izpopolnjevanje
kadar sem soočen z izzivno situacijo...	
kadar stvari ne gredo tako, kot si želim...	
spremembe vidim kot...	
kadar se počutim negotovo...	
moja osebnost je...	
lahko mi je priznati, da se motim	
verjamem, da kadar ljudje rečejo, da mi odpuščajo za nekaj, kar sem storil, to tudi v resnici mislijo	
kadar čutim, da nimam nadzora...	
kadar si želim ljubezni...	
druge vidim kot...	

4 ZAKLJUČKI

Rezultati multivariatnih raziskav so pokazali, da lahko prostor duhovnosti strukturiramo na več ravneh (slika 1).

Na najvišji ravni lahko govorimo o generalnem (splošnem) faktorju duhovnosti, na nadaljnjih ravneh pa o posameznih, vedno bolj vsebinsko specifičnih dimenzijah duhovnosti. Najpomembnejše vsebinske vidike duhovnosti pokriva strukturna raven, ki zajema pet dimenzij: dimenzijo smisla, dimenzijo povezanosti, harmonije, notranjega miru in hvaležnosti, dimenzijo vernosti, dimenzijo rasti in dimenzijo odpuščanja.



Slika 1. Strukturna hierarhija dimenzij duhovnosti.

Literatura

Adler, A., & Jahn, E. (1933). *Religion and Psychology*. Frankfurt.

Allport, G. W. (1937). *Personality: A psychological interpretation.* New York: Holt, Rinehart and Winston.

Allport, G. W. (1950). *The individual and his religion.* New York: Macmillan.

Allport, G. W. (1955). *Becoming.* New Haven,CT: Yale University Press.

Allport, G. W. (1961). *Pattern and growth in personality.* New York: Holt, Rinehart and Winston.

Alper, M. 2001. *The "God" Part of the Brain: A Scientific Interpretation of Human Spirituality and God*. New York: Rogue.

Austin, j. (1998). *Zen and the brain: toward an understanding of meditation and consciousness.* Cambridge, Ma: Mit press.

Bucke, R. (1923). *Cosmic consciousness*. New York: Dutton.

Buzan, T. in Keene, A. *Head first*. Dobljeno na: http://www.happychild.org.uk/acc/tpr/bkr/o102head.htm

Coles, R. (1999). *The secular mind*. Princeton Univ. Press.

Erikson, E. (1958). *Young man Luther: A Study in Psychoanalysis and History*,. New York, W. W. Norton.

Fetzer Institute, National Institute on Aging Working Group: Multidimensional Measurement of Religiousness, Spirituality for Use in Health Research. (1999). *A Report of a National Working Group Supported by the Fetzer Institute in Collaboration With the National Institute on Aging.* Kalamazoo, MI: Fetzer Institute, 1999.

Frankl, V. E. (1962). *Man's search for meaning: An introduction to logotherapy*. Boston, Beacon Press.

Freud, S. (1928a). *The future of an illusion*. Translated by W.D. Robson-Scott. New York: Liveright.

Freud, S. (1928b). *Totem and taboo: Resemblances between the psychic lives of savages and neurotics*. New York: Dodd.

Freud, S. (1939). *Moses and monotheism*. London: The Hogarth Press and The Institute of Psychoanalysis.

Fromm, E. (1950). *Psychoanalysis and religion*. New Haven: Yale University.

Gardner, H. (1999). *Intelligence reframed.* New York: Basic Books.

Grof, S. (1993) *The holotropic mind.* New York: Harper SanFrancisco.

Idler, E. L., Musick, M. A., Ellison, C. G., George, L. K., Krause, N., Ory, M. G., Pergament, K. I., Powell, L. H., Underwood, L. G. in Williams, D. R. (2003). Multidimensional measurement of religiousness/spirituality for use in health research. Dobljeno na: http://www.fetzer.org/Resources/mm_doc/The%20Fetzer%20Books%20Update.pdf

James, W. (1982/1902). *The varieties of religious experience*. New York: Penguin Books.

Jung, C. G. (1921/1971). Psychological types. In *The collected works of C. G. Jung (Vol. 6).* Princeton, NJ: Princeton University Press.

Jung, C. G. (1931/1969). The structure of the psyche. In *The collected works of C. G. Jung (Vol. 8)*. Princeton, NJ: Princeton University Press.

Jung, C. G. (1933). *Modern man in search of a soul*. New York: Harcourt Brace.

Jung, C. G. (1958). *Psychology of religion: West and east*. London: Routledge and Kegan Paul.

Jung, C. G. (1964). *Man and his symbols*. New York: Doubleday.

King in sod. (1995) The Royal Free Interview for Religious and Spiritual Beliefs. *Psychological Medicine 25*: 1125-1134.

King, M., Speck, P. in Thomas, A. (2001) The Royal Free Interview for Spiritualand Religious Beliefs: development and validation of a self-report version. *Psychological Medicine 31*:1015–1023
Maravič, K. (2004). *Duhovna inteligentnost v povezavi z vrednotami in zadovoljstvom z življenjem.* Diplomsko delo. Ljubljana: Univerza v Ljubljani.
Maslow, A. H. (1971). Various meanings of »transcendence«. In H. J. Vetter and B. D. Smith (Eds.), *Personality theory. A source book*. (pp. 421-430). New York: Appleton-Century-Crofts.
Montell, C. (2002). On Evolution of God-Seeking Mind: An Inquiry Into Why Natural Selection Would Favor Imagination and Distortion of Sensory Experience. *Evolution and Cognition* 8(1):pp. 89-107.
Musek, J. in Avsec, A. (2002). Pozitivna psihologija. *Anthropos, 34, 1-3,* 41-68.
Musek, J. in Maravič, K. (2004). Vrednote in duhovna inteligentnost. *Anthropos, 2004, 1-4,* 271-289.
Myers, D. G. in Diener, E. (1995). Who is happy? *Psychological Science, 6,* 10-19.
Newberg, A. (2004). *Why won't God go away*? Dostopno na: http://www.andrew.newberg.com/qna.asp
Newberg, A. B. and d'Aquili, E. G. (1999). *The Mystical Mind: Probing theBiology of Religious Experience*. Minneapolis: Fortress.
Newberg, A., d'Aquili, E. in Rause, V. (2001). *Why God won't go away: Brain science and the biology of belief.* New York: Ballantine.
Persinger, M. A. (1987). *Neuropsychological bases of god beliefs.* New York: Praeger.
Persinger, M. A. (1993). Vectorial cerebral hemisphericity as differential sources for the sensed presence, mystical experiences and religious conversions. *Perceptual and Motor Skills, 76*, 915-930.
Persinger, M. A.. (2001). "The Neuropsychiatry of Paranormal Experiences". *Journal of Neuropsychiatry and Clinical Neuroscience*. Fall 13(4):515-524.
Ramachandran, V. S. in Blakeslee, S. (1998a). *Phantoms in the brain*. London: Fourth estate.
Ramachandran, V. S., and S. Blakeslee. (1998b). *Phantoms in the Brain: Probing the Mysteries of the Human Mind.* William Morrow, New York, NY.
Rogers, C. R. (1961). *On becoming a person: A therapist's view of pschotherapy*. Boston: Houghton Mifflin.
Spiritual intelligence. Definitions. (2004). © 2004 Mind*wise* Pty Ltd Dobljeno na: http://www.mindwise.com.au/spiritual_intelligence.shtm
Stein, J. (2003). Več miru, manj trpljenja. *Delo, 248*, 21-22.
Tart, C. (Ed.) (1990) *Transpersonal psychologies.* New York: Harper & Row
Underwood, L. G. in Teresi, J. A. (2002). The Daily Spiritual Experience Scale: Development, Theoretical Description, Reliability, Exploratory Factor Analysis, and Preliminary Construct Validity Using Health-Related Data. *Ann Behav Med, 2002, 24*(1):22–33.
Vaughan, F. (2004). *What is spiritual intelligence?* Dobljeno na: http://www.francesvaughan.com/work1.htm
Wilber, K. (1995) *Sex, ecology, spirituality* Boston: Shambala Wilber, K. (1995) *Sex, ecology, spirituality* Boston: Shambala
Zohar, D. in Marshall, I. (2000). *Duhovna inteligenca*. Tržič: Učila.

STOPNJA VERNOSTI KOT DEJAVNIK VREDNOTNE IN DUHOVNE USMERJENOSTI

Janek Musek
Oddelek za psihologijo, Filozofska fakulteta
Univerza v Ljubljani
Aškerčeva 2 1000 Ljubljana
Tel: +386 3634170
janek.musek@guest.arnes.si; janek.musek@ff.uni-lj.si

POVZETEK

Raziskava proučuje odnos med stopnjo vernosti ter dimenzijami vrednotne in duhovne usmerjenosti. 509 oseb obeh spolov in različne starosti smo razdelili v štiri skupine glede na robustno samoocenjeno stopnjo vernosti. Pri vseh skupinah smo z ustreznimi psihološkimi merskimi instrumenti izmerili vrednotno in duhovno usmerjenost. Analiza dobljenih podatkov je pokazala, da se stopnja vernosti pomembno povezuje z razlikami v vrednotni in duhovni usmerjenosti. Čim višja je stopnja vernosti, tem nižja je dionizična vrednotna usmerjnost (zlasti usmerjenost k hedonskim in čutnim vrednotam) in tem višja je stopnja usmerjenosti k verskim vrednotam. Čim višja je stopnja vernosti, tem višja je tudi izmerjena stopnja splošne duhovne usmerjenosti in tem višja je stopnja posameznih dimenzij duhovne usmerjenosti, zlasti dimenzije vernost – numinoznost - predanost. Verske vrednote in duhovna dimenzija vernosti med vsem spremenljivkami najbolj predicirajo stopnjo vernosti.

1 UVOD

Vera, vrednote in duhovnost so vsekakor povezane, čeprav ne istovetne pojmovne kategorije. Čeprav so se od Williama Jamesa (1982/1902) dalje ukvarjali z vprašanji religije in duhovnosti mnogi prominentni psihologi, pa je bilo do nedavnega sorazmerno malo empiričnega raziskovanja na tem področju. V sodobnem času se je odprlo tudi vprašanje ti. duhovne inteligentnosti (Zohar in Marshall, 2000) in morda si lahko obetamo, da bodo raziskave tukaj kmalu prispevale pomembne prispevke k boljšemu razumevanju človekovega verskega doživljanja in duhovnosti.

Drugo pomembno področje psihološkega raziskovanja, ki se je že v preteklosti dotaknilo tematike duhovnosti, je področje vrednot. Verski in duhovni odnos do sveta je povezan z vrednotami in vrednotnimi usmeritvami. Tako so vsaj nekatere verske in duhovne vrednote zastopane v večjih lestvicah vrednot (Musek, 1993a,b 2000; Rokeach, 1973; Schwartz in Bilsky, 1987, 1991). Več raziskav je pokazalo, da imajo vrednote pomembno in včasih tudi visoko prediktivno vrednost v odnosu do številnih področij človekovega delovanja (Musek, 2000). Med drugim je trdno ugotovljena signifikantna povezava vrednot, zlasti verskih, z verskimi, svetovno nazorskimi in političnimi prepričanji (Musek, 1998, 2000).

Versko doživljanje in stopnja vernosti sta torej po vsej verjetnosti močno povezana tako z vrednotami (vrednotnimi usmeritvami), kot tudi z dimenzijami duhovnosti. Pričakovati je, da se pri osebah z različno stopnjo vernosti pojavljajo razlike v vrednotni in duhovni usmerjenosti in da lahko na podlagi vrednotnih in duhovnih usmeritev posameznika učinkovito napovedujemo stopnjo njegove vernosti.

Na podlagi omenjenih premis lahko izpeljemo domnevo, da prihaja do razlik v vrednotnih in duhovnih usmeritvah v odvisnosti od stopnje vernosti posameznih oseb. To je hkrati temeljna hipoteza pričujočega empiričnega raziskovanja, ki je potemtakem zasnovano kot študija, ki naj osvetli, ali je stopnja vernosti dejavnik vrednotne in duhovne usmerjenosti in tudi obratno, ali in v kolikšni meri se dimenzije vrednotne in duhovne usmerjenosti pojavljajo kot dejavniki in prediktorji stopnje vernosti.

2 METODA

Udeleženci

V raziskavo je bilo vključenih 509 oseb obeh spolov in vseh starostnih razredov. V vzorcu je bilo 185 moških in 324 žensk. Gre za osebe v razponu od 13 do 73 let, z aritmetično sredino 33 let in s standardno deviacijo 11,44. Glede na samoocenjeno stopnjo vernosti so bili udeleženci razdeljeni tako, kot kaže spodaj:

popolnoma nič verni	80	15,7 odstotka
rahlo verni	128	25,1 odstotka
zmerno verni	211	41,5 odstotka
zelo verni	90	17,7 odstotka

Aparat

Kot je razvidno iz prejšnjega razdelka, smo stopnjo vernosti ugotavljali s pomočjo štiristopenjske samoocenjevalne lestvice.

Za merjenje vrednotne usmerjenosti smo uporabili Muskovo lestvico vrednot (MLV, natančnejši opis v Musek, 2000, str. 30-40). Lestvica je prirejena tako, da je mogoče poleg vrednosti posameznih vrednot oceniti tudi generalnejše kategorije vrednot. In sicer gre za 11 vrednotnih kategorij srednjega obsega (vrednotne usmeritve: čutna, varnostna, statusna, patriotska, societalna (demokratična), socialna, tradicionalna, kulturna, spoznavna, aktualizacijska, verska),

za 4 vrednotne kategorije večjega obsega ali vrednotne tipe (hedonski, potenčni, moralni in izpolnitveni tip vrednot) in za 2 vrednotni kategoriji največjega obsega (dionizična in apolonska velekategorija). S pomočjo MLV je mogoče med drugimi meriti tudi versko vrednotno usmeritev, kar je eden izmed možnih indikatorjev stopnje vernosti.
Za merjenje duhovne usmerjenosti smo uporabili posebno lestvico duhovnosti, ki smo jo oblikovali na podlagi izbora in modifikacije večjega števila postavk iz več virov (med njimi tudi s prilagajanjem nekaterih postavk lestvice BMMRS, Idler in sod., 1999). Končna modificirana lestvica vsebuje 54 postavk (Maravič, 2004; Musek in Maravič, 2004). Zanesljivost (notranja konsistentnost) lestvice je visoka, Cronbachov alfa koeficient znaša 0,94.

Oblikovanje raziskave
Raziskava je bila oblikovana kot kombinacija variančno analitičnega pristopa in korelacijskega ter multivariatnega raziskovanja.

Postopek
Udeleženci so izpolnili lestvico vrednot MLV in vprašalnik duhovne inteligentnosti na spletni strani, zbiranje podatkov pa je potekalo v marcu in aprilu 2004. Izpolnjevanje je bilo anonimno. Dobljeni podatki so bili tabelirani in obdelani s pomočjo statističnih analiz po programskem paketu SPSS.13. Uporabljene so bili različne metode obdelave podatkov, vključujoč analize variance, multivariatne postopke faktorske in diskriminantne analize.

3 REZULTATI IN DISKUSIJA

Glede na temeljno hipotezo raziskave lahko prikaz rezultatov razdelimo v nekaj zaporednih delov. Najprej sem s faktorsko analizo postavk lestvice duhovnosti določil glavne dimenzije duhovne usmerjenosti (glavne dimenzije vrednotnih usmeritev predvideva že uporabljena lestvica vrednot). Nato je bila s pomočjo analiz variance izmerjena statistična pomembnost razlik v vrednotnih in duhovnih usmeritvah glede na stopnjo vernosti. Končno sem s pomočjo diskriminantnih in regresijskih analiz ugotavljal, katere vrednotne in duhovne usmeritve v največji meri prispevajo k razlikovanju med skupinami oseb z različno stopnjo vernosti.

Dimenzije vrednotnih in duhovnih usmeritev v odnosu do stopnje vernosti
S pomočjo lestvice vrednot MLV smo izmerili 11 vrednotnih usmeritev srednjega obsega (čutne, varnostne, statusne, patriotske, demokratske, socialne, tradicionalne, kulturne, spoznavne, aktualizacijske in verske vrednote). Te se združujejo v usmeritve večjega obsega (hedonske, potenčne, moralne in izpolnitvene ali humanistične vrednote) in usmeritve največjega obsega (dionizične in apolonske vrednote). Preglednica 1 kaže ocene pomembnosti omenjenih vrednotnih kategorij glede na stopnjo vernosti in rezultate preverjanja razlik med skupinami s pomočjo analize variance. Očitno je, da na ravni vrednotnih kategorij srednjega obsega s stopnjo vernosti signifikantno narašča ocena pomembnosti verskih in patriotskih vrednot, medtem ko upada pomembnost čutnih, aktualizacijskih, varnostnih, kulturnih in statusnih vrednot (pri drugih kategorijah srednjega obsega ni pomembnih razlik med skupinami glede na vernost).
Na ravni vrednotnih kategorij večjega obsega je opaziti signifikantno upadanje pomembnosti hedonskih in na ravni kategorij največjega obsega signifikantno upadanje pomembnosti dionizičnih vrednot.

Preglednica 1. Ocene pomembnosti vrednotnih kategorij glede na stopnjo vernosti in rezultati analiz variance.*

Dimenzije vrednot	Stopnja vernosti				ANOVA	
	nič	rahlo	zmerno	zelo	F	Sig.
Srednji obseg						
čutne	7,937	7,661	7,173	6,678	6,464	,000
varnostne	8,652	8,647	8,313	7,807	3,849	,010
statusne	4,543	4,686	4,383	3,766	2,895	,035
patriotske	4,858	5,446	5,939	5,930	3,227	,023
demokratske	8,595	8,047	8,034	7,910	1,947	,121
socialne	8,623	8,716	8,945	8,613	1,160	,325
tradicionalne	7,836	8,159	8,213	8,109	,985	,400
kulturne vrednote	7,358	6,978	6,587	6,461	3,564	,014
spoznavne	8,709	8,436	8,325	8,555	,987	,399
aktualizacijske	8,020	7,837	7,460	7,078	4,773	,003
verske	2,015	4,000	7,675	8,922	157,366	,000
Večji obseg						
hedonske	7,000	6,805	6,408	5,931	4,452	,004
potenčne	4,706	4,982	4,987	4,625	,808	,490
moralne	8,459	8,534	8,644	8,404	,544	,652
izpolnitvene	7,924	7,641	7,399	7,328	2,454	,063
Največji obseg						
dionizične	6,232	6,135	5,735	5,192	4,604	,004
apolonske	8,273	8,225	8,257	8,124	,155	,926

* Ničle pred decimalno vejico so opuščene.

S pomočjo faktorske analize sem nato skušal določiti glavne dimenzije duhovne usmerjenosti. Najpomembnejši kazalci indicirajo ustreznost korelacijske matrike 54 postavk Lestvice duhovnosti kot primerne za nadaljnje faktorske analize. Ustreznost vzorčenja po Kaiser-Meyer-Olkinovem testu je visoka in znaša 0,941; prav tako pa je visoko signifikanten tudi Bartlettov test sferičnosti (p<0,001). Faktorji so bili izločeni po metodi glavnih komponent in rotirani s pomočjo Promax metode rotacije.

Na podlagi kriterijev za izločanje faktorjev (zlasti Cattellovega testa drobirja – scree test) se lahko odločimo za tri faktorske solucije. Prva zajema en sam faktor, ki ga lahko interpretiramo kot generalni faktor duhovnosti (pojasnjuje 29,16 odstotkov celotne variance v izvorni korelacijski matriki 54 postavk). Druga solucija zajema tri faktorje, ki pojasnjujejo skupaj 40,63 odstotka izvorne variance. Tretja solucija zajema pet faktorjev, ki pojasnjujejo 47,32 odstotkov izvorne variance.

Kot rečeno so praktično vse postavke Lestvice duhovnosti signifikantno nasičene s prvim faktorjem pri enofaktoski soluciji, kar pomeni, da lahko ta faktor interpretiramo kot generalni (splošni) faktor duhovnosti. Ta faktor korelira kar 0,998 s skupno točkovno vrednostjo lestvice.

Prvi faktor pri trifaktorski soluciji najbolj nasiča postavke lestvice, ki pomenijo občutje višjega smisla, vernosti in predanosti (faktor višjega smisla). Z drugim faktorjem so najbolj nasičene postavke, ki se nanašajo na občutje harmonije, notranjega miru, povezanosti, hvaležnosti in odpuščanja (faktor harmonije). S tretjim faktorjem so nasičene predvsem postavke, ki predstavljajo občutje rasti, samoizpopolnjevanja in premagovanja lastnih napak (faktor rasti).

Pri petfaktorski soluciji dobimo po vrsti faktorske dimenzije, ki jih lahko interpretiramo kot

1. dimenzija smisla (značilne postavke: moja duhovnost daje smisel dogodkom v mojem življenju; moje duhovno prepričanje mojemu življenju občutek pomembnosti in smisla; brez občutka duhovnosti bi bilo moje vsakdanje življenje brez smisla; če na najtežje in najbolj vznemirjajoče dogodke pogledam z vidika duhovnosti, dajejo smisel mojemu življenju; kadar nisem povezan z duhovno platjo svojega življenja, izgubim svoj smisel);
2. dimenzija povezanosti, harmonije, notranjega miru in hvaležnosti (značilne postavke: čutim povezanost z izvirom vsega življenja; živim v harmoniji s svojimi najglobljimi vrednotami in s svojim smislom življenja; lepota stvarstva me notranje prevzame; čutim hvaležnost za življenje; v svojih odnosih z drugimi izražam in prejemam ljubezen in odpuščanje; občudujem stvarstvo in ga spoštujem; hvaležen sem za vse darove; čutim globok notranji mir oziroma harmonijo);
3. dimenzija verskega in numinoznega (značilne postavke: v kolikšni meri bi sami zase rekli, da ste verni...; meditiram ali molim; v svetu prepoznavam navzočnost božanskega; vera je zame izvir moči in tolažbe; verjamem v življenje po smrti);
4. dimenzija rasti in (samo)izpopolnjevanja (značilne postavke: pogosto se mi zdi, da ne bom mogel nikoli nadoknaditi napak, ki sem jih storil v preteklosti, ne glede na to, kako se zdaj trudim; pogosto se mi zdi, da mi ni upelo živeti tako, kot je prav; odpustil sem si stvari, ki sem jih naredil narobe; težko si odpustim nekatere stvari, ki sem jih storil);
5. dimenzija odpuščanja in sprejemanja (značilne postavke: odpuščam tistim, ki me prizadenejo; precej hitro se lahko spet spoprijateljim s prijatelji, ki so me na neki način ranili; nekatere zamere sem gojil mesece ali leta; druge sprejemam tudi takrat, ko naredijo kaj, kar se mi zdi napačno; verjamem, da kadar ljudje rečejo, da mi odpuščajo za nekaj, kar sem storil, to tudi v resnici mislijo).

Preglednica 2 kaže faktorske točkovne vrednosti posameznih dimenzij duhovnosti glede na stopnjo vernosti. Zadnja dva stolpca preglednice pa kažeta tudi podatke analiz variance, s katerimi je bila preverjena statistična pomembnost razlik med skupinami vernosti za vsako dimenzijo duhovne usmerjenosti. Kot vidimo, s stopnjo vernosti skoraj monotono naraščajo faktorske vrednosti pri vseh dimenzijah duhovnosti, razen pri dimenziji rasti in izpopolnjevanja, a tudi tukaj so vrednosti daleč najvišje pri skupini najbolj vernih oseb. Pri vseh dimenzijah duhovnosti so razlike med skupinami oseb glede na stopnjo vernosti visoko signifikantne, pri čemer so F vrednosti daleč najvišje pri dimenziji vernosti (vernost numinoznost predanost), kot bi tudi pričakovali. Zaključimo torej lahko, da so dimenzije duhovne usmerjenosti tem močneje izražene, čim višja je stopnja vernosti posameznikov.

Preglednica 2. Faktorske vrednosti in rezultati analiz variance pri posameznih dimenzijah duhovnosti glede na stopnjo vernosti.*

Dimenzije duhovnosti	Stopnja vernosti				ANOVA	
	nič	rahlo	zmer no	zelo	F	Sig.
Petfaktorska solucija smisel	-,785	-,309	,190	,692	47,776	,000
povezanost harmonija notranji mir hvaležnost	-,511	-,314	,075	,724	32,295	,000
vernost numinoznost predanost	-1,384	-,573	,406	1,095	334,356	,000
rast izpopolnje-vanje	-,002	-,189	-,059	,411	7,071	,000
odpuščanje sprejemanje	-,423	-,064	,095	,244	7,663	,000

Trifaktorska solucija						
višji smisel	-1,103	-,464	,289	,964	135,046	,000
harmonija	-,603	-,290	,108	,696	34,272	,000
rast	-,050	-,223	-,054	,488	10,052	,000
Enofaktorska solucija						
g-faktor duhovnosti	-1,002	-,454	,240	,975	113,407	,000

* Ničle pred decimalno vejico so opuščene.

Diskriminativna in napovedna moč dimenzij vrednotne in duhovne usmerjenosti glede na stopnjo vernosti

Pa se vprašajmo še bolj natančno, katere dimenzije vrednotne in duhovne usmerjenosti največ prispevajo k razlikovanju med skupinami z različnimi stopnjami vernosti. Da bi to ugotovil, sem opravil skupno diskriminantno analizo za dimenzije vrednotnih in duhovnih usmerjenosti. Pri tem sem upošteval vrednotne kategorije srednjega obsega in petfaktorsko solucijo dimenzij duhovnosti, saj so predhodne analize pokazale, da se na teh ravneh najbolj izrazito pokažejo razlike med skupinami vernih oseb.

Diskriminantna analiza je izločila eno zelo pomembno diskriminantno funkcijo. Ta pojasnjuje v primeru vrednotnih dimenzij 95,6 odstotka diskriminativne varianc in ima zelo signifikantno vrednost Wilksovega koeficienta lambda. Skupinski centroidi funkcije kažejo, da enoznačno in linearno ločuje skupine glede na vernost: najnižje vrednosti so pri skupini nič vernih in najvišje pri skupini zelo vernih.

Preglednica 3 prikazuje nasičenja vrednotnih in duhovnih dimenzij z diskriminantno funkcijo. Daleč največ prispevata k razlikovanju stopenj vernosti dimenzija duhovnosti vernost – numinoznost – predanost in ocena pomembnosti verskih vrednot. V celoti gledano je očitno, da dimenzije duhovnosti močneje določajo stopnjo vernosti kot dimenzije vrednot.

Preglednica 3. Nasičenja vrednotnih in duhovnih dimenzij z izločeno diskriminantno funkcijo.

Dimenzije vrednot in duhovnosti	Nasičenje
vernost numinoznost predanost	,818
*verske vrednote**	,642
smisel	,308
povezanost hvaležnost harmonija notranji mir	,219
odpuščanje sprejemanje	,103
patriotske vrednote	,089
rast izpopolnjevanje	,042
tradicionalne vrednote	,037
socialne vrednote	,025
spoznavne vrednote	-,030
demokratske vrednote	-,060
statusne vrednote	-,065
varnostne vrednote	-,088
kulturne vrednote	-,097
aktualizacijske vrednote	-,109
čutne vrednote	-,127

* Vrednotne kategorije so napisane kurzivno, dimenzije duhovnosti pa z navadnim tiskom.

Tudi regresijske analize potrjujejo, da so med vrednotnimi kategorijami verske vrednote tiste, ki daleč najbolj napovedujejo stopnjo vernosti. Ocena pomena verskih vrednot je veliko boljši napovedovalec stopnje vernosti kot ocene vseh drugih vrednotnih kategorij skupaj. Verske vrednote korelirajo s stopnjo vernosti 0,721 (kar pomeni 0,520 odstotka skupne variance med verskimi vrednotami in vernostjo), medtem ko je multipla korelacija vseh ostalih vrednotnih kategorij s stopnjo vernosti le še 0,338 (0,114 skupne variance s stopnjo vernosti).

Pet dimenzij duhovnosti predstavlja še močnejši prediktorski niz stopnje vernosti kot so vrednotne dimenzije. Njihova multipla korelacija s stopnjo vernosti je 0,821 (0,670 skupne variance). Tudi tu je levji delež napovedne moči pri eni sami dimenziji duhovnosti, to je dimenzija vernost – numinoznost – predanost ($R=0{,}813$; $R^2=0{,}661$). Vse druge dimenzije le še minimalno dodatno prispevajo k napovedovanju stopnje vernosti.

4 ZAKLJUČKI

Izsledki naše raziskave so jasno pokazali, da je stopnja vernosti pomemben dejavnik vrednotne in duhovne usmerjenosti. Še bolj enoznačne so povezave med vernostjo in duhovno usmerjenostjo. Višja kot je stopnja vernosti, višje je tudi stopnja duhovne usmerjenosti in to tako pri generalni dimenziji duhovnosti kot pri posameznih vsebinskih dimenzijah duhovnosti. Razlike v stopnji vernosti lahko v daleč največji meri napovedujemo na podlagi verske vrednotne usmerjenosti v okvirju vrednotnih kategorij in na podlagi dimenzije vernosti, numinoznosti ter predanosti v okvirju dimenzij duhovnosti.

Literatura

Idler, E. L., in sod. (2003). Multidimensional measurement of religiousness/spirituality for use in health research. Dobljeno na: http://www.fetzer.org/Resources/mm_doc/The%20Fetzer%20Books%20Update.pdf

James, W. (1982/1902). *The varieties of religious experience*. New York: Penguin Books.

Maravič, K. (2004). *Duhovna inteligentnost v povezavi z vrednotami in zadovoljstvom z življenjem.* Diplomsko delo. Ljubljana: Univerza v Ljubljani.

Musek, J. in Maravič, K. (2004). Vrednote in duhovna inteligentnost. *Anthropos, 2004, 1-4,* 271-289.

Musek, J. (1993a). *Osebnost in vrednote.*. Ljubljana, Educy.

Musek, J. (1993b). The universe of human values: a structural and developmental hierarchy. *Studia Psychologica* (Bratislava), 35, 4-5, 321-326.
Musek, J. (1998). Political and religious adherence in relation to individual values. *Studia Psychologica* (Bratislava), 1998, 40, 1-2, 47-59.
Musek, J. (2000). *Nova psihološka teorija vrednot.* Ljubjana: Educy.
Rokeach, M. (1973). *The nature of human values*. New York, The Free Press.
Schwartz, S. H. in Bilsky, W. (1987). Toward a universal psychological structure of human values. *Journal of Personality and Social Psychology*, 53, 3, 550-562.
Schwartz, S. H. in Bilsky, W. (1990). Toward a theory of the universal content and structure of values: Extensions and cross-cultural replications. *Journal of Personality and Social Psychology*, 58, 878-891.
Zohar, D. in Marshall, I. (2000). *Duhovna inteligenca*. Tržič: Učila.

Bog v religijah

Novak Karlo Drago
Prem 73, SI–6255 Prem, Slovenia
Tel: 041 531 078
e-mail: ogard.i@gmail.com

POVZETEK

Poskus razumeti Boga (avtor izhaja predvsem iz boga kot ga pojmuje krščanska tradicija. Le ta pa je povzeta po pojmovanju judovskega boga, JHVHa, Jahveja). Ker pa je bog preko celotne Biblije ni enako predstavljen, se je avtor začel zanimati, zakaj je takšen pristop različnih avtorjev in redaktorjev Biblije.

1. UVOD

Poskus z nekaj enostavnimi izhodišči dokazati, kdo je tisti bog, bogovi, boginje ali božanstva v katere verujejo glavne religije in tudi druge manjše verske skupnosti ter združbe. Ali gre dejansko za nekaj božjega ali pa je le plod domišlije ali pa celo stvaritev samega boga, božanstva, bogov, boginj s pomočjo človeka. Začetno pomoč in izhodišče temu sestavku v grobem daje Biblija v obeh delih – judovskem kot Stari testament in krščanskem kot Novi testament.

Avtor namenoma v uporablja pri obeh delih Biblije naziv testament, kot sporočilo predhodnikov zanamcem in ne kot zavezo. Pri zavezi avtor meni, da naj bi šlo za zavezo ali pa celo za neko pogodbo med človekom in Bogom, še več med izbranim ljudstvom in Bogom. Krščanski teologi priznavajo, da Boga še ni nihče videl. Zaradi navedenega ni moglo priti do nobene zaveze ali pogodbe med njim in izbranim ljudstvom. Če bi bil ta izbor resnično izveden, potem bi bil krivičen in v velikem nasprotju s sedanjim poznavanjem človekovih pravic in temeljnih svoboščin. Božji izbor nekega ljudstva, je vsekakor diskriminatorno dejanje in ima vse elemente diskriminacije. Lahko pa verjamemo v teološko dogmo oziroma načelo, da je Bog pravičen sodnik, ki dobro plačuje in hudo kaznuje. Ta princip pa se uveljavlja preko njegovih zakonov vpisanih v naravo celotnega Stvarstva. Kršenje teh zakonov, pravil, načel s strani človeka, privede človeka v neko izredno stanje, ki je istočasno tudi opozorilo. Tipičen primer je nespoštovanja pravil prehrane v Raju in s tem izgon iz raja ter nastopajoče bolečine, ki nastajajo zaradi bolezni. Prenehanje teh kršitev, lahko privede človeka ponovno v stanje zdravja. Gre za človekovo izbiro.

Predhodno izhodiščno tezo, da je po njegovem mnenju bog v religijah ustvarjen in je v nadaljevanju razvita, je pisec tega sestavka pripovedoval raznim osebam. Vsi poslušalci so takoj stvari videli kot napad in rušitev neke religije. Rušitev ni avtorjev namen, niti ne deluje v tej smeri, niti ne želi, da bi zaradi tega kdo drugi počel z rušenjem. Tako kot vse stvari na tem svetu imajo svoj življenski ciklus, takisto velja za religije, ki so ustvarjene preko človeka in za človeka z različnimi nameni.

2. KDO JE TOREJ BOG

temeljno vprašanje, ki si ga marsikdo postavlja. Postavlja si ga tako vernik kot oni drugi. V Stari zavezi beremo, da je bil to Bog vsega živega in neživega. V začetku je bil samo Bog, nam pričuje Statri testament. Bog je začel stvaritev iz nič. Začel je torej stvaritev iz njega samega. Jezik Biblije nam pove, da je proces trajal nekaj dni. Te dneve se ne da pojmovati kot zemeljske dneve. Ti dnevi imajo bolj pomen faze razvoja in še druge pomene. Eden od teh pomenov je tudi prenos principa na teden, ki je razdeljen na čas dela in čas počitka.

Novi testament preko Janezovega evangeli pa pravi: “V začetku je bila Beseda in Beseda je bila pri Bogu in Beseda je bila Bog. Ta je bila v začetku pri Bogu. Vse je nastalo po njej in brez nje ni nastalo nič, kar je nastalo. V njej je bilo življenje in življenje je luč. In luč sveti v temi, a tema je ne sprejme.”

Iz obeh razlag v Bibliji gre za Boga predstavljenega kot nekakšno bitje, bolj točno naj bi šlo za neko duhovno bitje po Starem testamentu, kot po Novem testamentu, pa za nekaj bolj abstraktnega, kar Beseda prav gotovo je. Besede ima svoje atribute, ima svojo sporočilno moč, ima svojo magično moč in ne nazadnje ima tudi svojo energijo ter je lahko celo bitje. Z energijo Besede lahko svojemu bližnjemu pomagamo, ali pa škodujemo ali pa ga lahko celo uničimo.

Osebe, ki so doživljale obsmrtna doživetja znajo povedati, da se jim je približalo neko svetlobno bitje, ko so odšli iz svojega telesa, ki jih je osvetilo in jih postavilo v neko čudovito blaženo stanje, katero se ne da opisati z besedami in občutki, katere uporabljamo v normalnem življenju. Marsikdo od teh pripovedovalcev meni, da je to bitje sam bog. Martin Kojc za tega začetnika vsega Stvarstva, za ta praduh, to prabitje uporablja izraz prasila.

Mogoče pa bi bil izraz praenergija boljši za današnji čas. Dandanes se zavedamo, da je vse energija, tudi t.i. masa snovi je samo zgoščena energija. Da pa to kar merimo z maso ima maso in ima tudi veliko nemaso oz. praznega prostora, kot ta prazen prostor dandanes pojmujem. V kolikor bi maso zgostili in ne bi bilo nobenega praznega prostora, bi bil zgoščen človek le kot glavica bucike. Kaj je pa vse ostalo? Ali smo mi privid, ali pa maja kot se to imenuje v indijski filozofiji.

Če je že bilo nekoč stvarjenje Sveta, potem je šlo za takšno stvarjenje, da se je ta Stvarnik iz duha ali temu nekaj podobnega spremnil sam tudi v materijalni svet, v fizični svet z neke vrste postopki rekurzije. Skratka gre za magijo samega Stvarnika.

Pojavlja se torej vprašanje, na kakšen način so prišli pisci Biblije in verjetno tudi pisci drugih svetih knjih po celem svetu, do zaključka, da je v začetku le nekdo bil, ki je začel s stvarjenjem. Z začetkom sveta pa se vsi ne strinjajo. Predstavniki amazonskega ljudstva Indijanci Piraha pa trdijo “Vse se spreminja!” in nič ne slišijo o nekakšnem začetku, o nekakšnem svtarjenju. Mogoče le razmišljujoči človek ima fikcijo o nekem začetku, ki naj bi se zgodil, kot se to zgodi z njim. Ne more pa se nato sprijazniti s svojim koncem in zato je zanj vse nadalje postalo večno.

Splošno znano vedenje je, da je človek telesno in tudi duhovno bitje. Zakon Hermesa Merkuriusa Trismegista pravi, da kar je zgoraj je tudi spodaj in kar je spodaj je tudi zgoraj ter vse za poenotenje enega in istega. Kar lahko tudi pomeni, da to kar velja pri razmnoževanju telesa, velja lahko tudi, da se da tudi duh razmnoževati. Alkemija razmnoževanja telesa je znana, alkemija razmnoževanja duha pa ne, vsaj splošno ne. Po prepričanju avtorja ta možnost obstaja. Ni pa popolnoma prepričan ali pri duhu veljajo natančno taka pravila kot za telo. Duh namreč verjetno nima spola in ni potrebna spolna raznolikost za stvaritev novega duha, čeprav po mnenju avtorja je priporočljiva, da pri stvarjenju novega duha sodelujejo osebe različnih spolov.

Živorad Mihajlović Slavinski poroča o eksperimentu stvaritve duha. Prvo so mu dali pripadajoče lastnosti in čas v katerem je živel. Šlo je za stvaritev nekoga, ki je nekoč že živel in je bil poznan. To naj bi bilo predspočetje tega duha. Nato pa je skupina, tega duha kreirala z vizualizacijo in meditacijo ter molitvijo. To je bilo obdobje nosečništva tega duha in tudi neke vrste otroška doba. Ta duh se je razvijal in po nekem določenem času, nekaj mesecev in zaživel ter začel svoje samostojno življenje z značilnostmi, kot so mu bile dane ob spočetju. Te biološke faze razvoja, ki se tukaj uporabljajo, so bolj simbolične in niso popolnoma natančno takšne kot pri telesu. Služijo samo neki ponazoritvi.

Nadalje, avtorjevo sodobno zaznavanje. Šofer, ki sam vozi po cesti, se počuti svobodnega in od nikjer na svojem voznem pasu oviranega. Je relativno svoboden. Ko pa se približuje koloni, ga ta omeji s svojimi značilnimi lastnostmi. Ko pa se vključi, kar je priporočljivo s strani varnosti, postane del te kolone in začne “dihati” s to kolono. Kolona v bistvu ustvari nekega duha, ki jo vodi in udeleženci kolone mu sledijo. V bistvu pa oni ustvarijo duha kolone in ta jih šele nato vodi. Še več, tisti ki je prvi ima glavno besedo. Ta duh kolone je neke vrste začasen duh, in se takoj porazgubi, ko takšna kolona razpade. Razumevanje tega, še bolj pa občutje tega pojava, da razumevanje marsičesa duhovnega in povezana z duhom.

Ob pripovedovanju ribiča avtorju prispevka, glede ribičevih izkušenj, si je ustvaril avtor mnenje, da tudi živali imajo duha. Biblija trdi, da vse kar ima kri ima dušo. Ribič Mate pravi, da na mestu, kjer je bila ulovljena riba, naj si bo s košaro, trnkom ali harpuno, nekaj časa na tisto mesto ne pride nobena riba ali druga večja žival. Najdlje je takšno mesto prazno, po uporabi harpune in noža, ko teče tudi kri. Kaj je bilo to, kar je zaznamovalo to mesto, če ne duh ulovljene ribe, ki pa s časoma le oslabi. Po logiki sodeč, bi moral morski tok sledi sledi ulova moral zelo hitro sprati. Spere res hitro fizične sledi, drugih pa ne.

Indijanski poglavar je pripovedoval, da je njihovo ljudstvo šlo skozi deželo. Na nekem mestu so bili ustavljeni od njim neznane sile. Na mestu, kjer so čutili največjo jakost te sile, so začeli kopati in naleteli na človeške kosti. Od kje torej ta sila, ki je skupino Indijancev ustavila, čeprav v okolici ni bilo nobenega znaka o grobu. Ne gre mogoče za duha umrlega. Še več, Indijanci trdijo, da njihovi pokojni kot duhovi živijo na Zemlji in se ne preseljujejo po smrti nekam v vesolje.

Zanimivo je bilo tudi opazovanje opic, ki so živele na treh različnih lokacijah. Ena lokacija je bila tudi takšna, ki je eno skupino opic ločevalo morje od drugih dveh, ki sta bili samo krajevno ločeni, brez stikov. Prvo so opazili eno opico, ki si je umila v vodi umazano sadje. To znanje se je počasi širilo. Prevzele so ga počasi tudi druge opice, ampak brez učenja. Ko pa je umazano sadje umivalo nad sto opic, so nato zelo hitro, skoraj istočasno prevzele to znanje vse opice, ne glede na kraj, oddaljenost in ločitev. Zakaj?

Lep primer predhodnega je tudi izvedba revolucije na našem področju v prejšnjem stoletju. Poznavalci revolucije trdijo, da je bilo revolucionarjev nekaj nad sto, kvečjemu nekaj sto. Kar pomeni, da jih je bilo nekaj nad sto enotnih in to jih je privedlo do zastavljenega cilja.

Ali pa eksperiment treh košarkarskih skupin. Sestavi so tri košarkarske skupine. V vseh treh skupinah so bili sami neznalci igranja košarke. Eksperiment je bil kratkotrajen. Ena skupina je klasično trenirala, druga skupina je trenirala s pomočjo vizualizacije, tretja skupina sploh ni nič trenirala. Zadnja skupina se ni izkazala pri igri košarke, kot ostali dve skupini sta si bili v pridobljenem znanju košarke skoraj enakovredni.

Nadlje še eksperiment z otroci. Otroci so se morali naučiti dve pesmici iz tujega, njim popolnoma neznanega jezika – kitajskega. Pesmici sta bili enake težavnostne stopnje. Prva pesmica, ki je bila znana in so se jo učile generacije in generacije kitajskih otrok. To pesmico so otroci hitro osvojili. Druga pesmica, ki se jo kitajski otroci niso učili, ker je bila sveže napisana, pa je povzročala veliko težav pri učenju.

Živali v jatah ali krdelu se giblje v bistvu kot eno homogeno telo. Med njimi praktično ne pride do samouničevanj, poškodb zaradi trkov, če so živali zdrave, vitalne in z dovolj kondicije. Nekaj podobnega se dogaja tudi z ljudmi. Posameznikove lastnosti so popolnoma drugačne, kot lastnosti posameznika, ko je sam. V skupini se posameznik vede po zakonu skupine in zelo malo takrat lahko izraža sebe. Kdo torej takšne skupine, jate ali krdela združuje ali povezuje? Ne gre morda le za nekega skupinskega duha.

Nadaljno vprašanje je, zakaj so bili potrebni pregoni čarovnic pred stoletji in zakaj so nedolgo tega preganjali ljudi, ki so nekoliko drugače razmišljali in je bil njihova duhovnost drugačna. Sporočilo pregonov čarovnic je, da je duh človeka tisti oziroma sposobnost duha tista, ki daje moč, da ustvarja čudeže. Čudeži pa so vse tisto, kar človek ne razume, kar si ne zna na določeni stopnji razložiti ali pa si zaradi predsodkov noče. Brskanje po neznanem je le za ljudi, ki so sposobni odkritje tudi prenesti. Ostali se tega sploh ne lotijo. Zato nam srednjeveške čarovnice sporočajo, da so bile močne osebe in so bile zrtvovane, da so lahko šibki vladali. Le šibek lahko uničuje.. Torej, sporočilo žrtvovanih srednjeveških čarovnic je, da je duh tisti, ki daje moč. Materija ni nikoli tako močna, je pregroba, je pretoga.

Iz medicine pa je znano, da mišica lahko zlomi najmočnejšo, trdo, gostejšo kost. Mišici pa poveljujejo še redkejši možgani in njim podrejeni centri razporejeni po telesu. Kdo pa ukazuje možganom, če ne duh. Kako? Avtorju ni racionalno znano.

Moč duha se pokaše tudu v molitvi, meditaciji. Po Kononenku je znanstveno ugotovljeno, da se z molitvijo, meditacijo, da zdravit. Učinek je enak kot z zdravili, s to razliko, da molitev, meditacija nima stranskih učinkov. Kaj pa molitev za nekoga, da se v njegovem imenu zgodi čudež ozdravitve ali kakšno drugo čudežno dejanje, ali ni to podobno kot predhodna molitev, samo preko posredništva. In kdo tu tudi naredi čudež, če ne skupina molilcev, priprošnjikov s pomočjo njih ustvarjenega duha.

Da se vrnemo k glavni temu, kdo je ta Bog, ki je prisoten na tem področju krščanstva. Po mnenju avtorja ne gre za Stvarnika, ne gre za prasilo, za praenergijo, temveč za ustvarjenega Boga s pomočjo vernikov in predvsem svečenikov. Tega sinajskega Boga je imelo ljudstvo živeče ob Sinaju. K temu Bogu je šel Mojzes po Bibliji na Sinaj in tam se je srečal posredno z njim in od njega je dobil deset zapovedi. Ta Bog je bil prikazen v žarečem grmu, to je bil duh s svojimi omejitvami, duh, ki so ga v generacijah ustvarili. Ta Bog tudi priznava druge bogove, saj pravi: "Jaz sem Gospod, tvoj Bog, ki sem te izpeljal iz egiptovske dežele, iz hiše sužnosti. Ne imej drugih bogov poleg mene!".

3. ALI JE DANAŠNJI BOG, BOG MALIK

Predhodno nakazana teza, da je dandanašnji Bog duhovno ustvarjeni Bog po človeku, potem lahko nadalje utemeljimo, da je današnje obredje podobno obredju t.i. poganov s tem, da je morda na višji stopnji. Kakšna je lahko razlika med malikovanjem nekega drevesa ali pa nekega ustvarjenega duhovnega bitja? V bistvu nobena. Razlika je samo v temu, da v enem primeru se nabirajo anekdote okrog svetega drevesa, v drugem primeru pa okrog tega duhovnega bitja. Na stopnji razvoja t.i. primitivca, si primitivec drevesa ne zna razložiti in ga lahko časti. Na višji stopnji spoznanja, pa človek začne odklanjati drevo kot božanstvo, ki bi lahko vplivalo na njegovo žitje in bitje, pa mu šamani po neki razvojni poti evolucije ponudije nadomestila, dokler ne pridemo do te stopnje civilazacije, ko se ustvari eno in nenotno duhovno bitje in se ga časti. Istočasno pa se ga vzpostavi kot tvorca Sveta, tvorca vsega živega in neživega. Skratka tradicija čaščenja neznanega in nadmočnega se je ohranila vse do današnjega časa. Razlike med primitivcem in Zapadnjakom na tem področju ni.

Še bolj čudno pa je, da nikjer v Bibliji ni zaslediti, kako so nastali taki in drugačni duhovi, takšna ali drugačna duhovna bitja, s takšnimi in drugačnimi lastnostmi ter v katerem dnevu stvarjenja jih je Bog ustvaril.

4. BOG KOT ENO Z VSEM

Če povzamemo po sv. Pavlu: "Ko pa mu bo vse podvrženo, se bo tudi Sin sam podvrgel njemu, ki mu je vse podvrgel, da bo Bog vse v vsem." Bog je že sedaj vse v Vsem. Ali pa Paskal: "Mir ni v nas, a tudi izven nas ni; mir je v bogu, ki je v nas in izven nas." Skratka Paskal in sv. Pavel povesta o Bogu oz. kar naj ta Bog predstavlja, ki je v bistvi vse v vsem in smo tudi mi del njega. Čaščenje pa ima lastnost, da se vedno časti nekaj, kar je izven nas. Čaščenje nečesa izven, pa je čaščenje idola, malika, fantoma. Ko se bo človek zavedal, da ne more nič izven njega vplivati na njega, takrat se bo po Kristusu vrnil v očetovo hišo in bo postal sam sebi bog. To kar že je, pa se noče zavedati, ker bi tako moral sprejeti popolno odgovornost. Ko se bo zavedal, da je tudi on sam bog, kot to da so tudi druga bitja bogovi, tedaj lahko pričakujemo eksodus v Raj, ki bo zavladal med ljudmi. Zavedati se pa mora, da ni nič izven nas, kar je v nas. To trdi tudi naša psihološka znanost, ko pravi, da vsakdo izhaja vedno sam iz sebe.

5. MNENJE

Zakaj pa religije vidijo Boga izven sebe, izven sveta, kot nekega starca na tronu, vladarja, sodnika, modreca…, v nekem posebnem kraju imenovanem tudi Nebesa, kateri so v njegovi bližini, se mu klanjajo in ga častijo, ter jim je zelo lepo. Na drugi strani pa imamo nek drugi kraj, ki se imenuje Pekel, kjer vlada temu kraju zlo, zli duh(ovi) ali kar hudobec, hudič, peklenšček in gredo vsi po zaključki življenja tja, če niso spodobno, brezgrešno živeli. Ta slika odslikava družbo po smrti, ki je le odslikava družbe na Zemlji. Imamo oblast, ki je že po naravi dobra in vsi dobrotniki se drenajo okoli nje. Na drugi strani so tisti, ki niso dobri in ne počnejo, to kar se od njih zahteva. So neke vrste notranji družbeni sovražniki. Vsi ostali pa so prepuščeni vicanju ali kar navadnemu življenju. Ta sistem v onostranstvu je popolna slika tostranskega.

Ker pa je Bog tudi v nas, zato velja stavek teologov, da smo vsi božji otroci in nadalje ko "zrastemo", lahko postanemo Bogovi in stvarniki svojih Neba in svoje Zemlje kot tudi svojega Neba ali Pekla. Kajti On je pravičen sodnik, ki hudo kaznuje in dobro palčuje; ampak ta On smo mi.

Hipoteza, da je prebivališče boga v svetiščih in samo tam je zelo iluzorna, da se ga samo tam lahko časti. Tam zapeljani ljubijo roke njegovim posrednikom, se jim klanjajo in mislijo, da se lahko samo preko njih pride do Njega.

Ali nam res lahko študij bogologije prinese ključ do stika z Bogom ali Njim ali s prasilo, praenergijo in tako lahko postanemo njegovi tuzemeljski advokati, njegovi zagovorniki, njegovi pooblaščeni glasniki, lakaji, njegovi vazali? Verjetno ne, nikoli.

Ker pa je Bog (ali karkoli si pod tem pojmom predstavljamo tudi v nas), ga ne moremo popolnoma dojeti, ga ne moremo popolnoma razumeti in ga tudi ne moremo popolnoma videti, le zavedamo se ga lahko, ga lahko začutimo in ga lahko samo nekoliko spoznamo ter le toliko kolikor lahko spoznamo sebe in začutimo sebe. Kaže se nam kot nekakšen odsev. Da pa do tega pride, pa ne pomaga nikakršno glasno trkanje ali pa begajoče iskanje. Takšno prisiljevanje ne obrodi rezultatov. To se lahko dogodi le v tišini, molku, zbranosti. Le potrpežljivost nas privede do Njega v Nas samih. Zato je naše telo, tudi tempelj, svetišče, cerkev Njega. Stanje našega telesa, nam kaže na stanje odnosa do nas samih in tudi do njega. Kakršen je ta tempelj, tako vidimo Njega in njegovo Stvarstvo oz. taksen odsev tudi vidimo.

Sedanji religijski Bog, bogovi, božanstva, boginje so ustvarjeni maliki in je le višja stopnja malikovanja narejenih malikov v obliki podob. Zato ta Bog živi izven nas, zato se lahko prikaže v obliki žarečega grma ali peščenega vrtinca ali pa stebra ali pa odpre nebo in se nam tako pokaže. Zato so malikovalci lahko vzeti v Nebesa ali Pekel, ki pa je umetno ustvarjen nek Eshatološki svet, ki pa ni rečeno, da je fiktiven, navidezen, je lahko še kako resničen. Stvari so podobne kot v matematiki, ko imamo različne prostore.

Vsakemu je dana izbira in svobodna odločitve, kaj počne in kako počne na poti, ki se ji pravi Življenje. Po kakršni poti hodimo, k takšnemu cilju tudi pridemo. Bog hodi po božjih poteh.

Viri:

[1] Biblija – Stari Testament
[2] Biblija – Novi Testament
[3] Živorad Mihajlović Slavinski, njegova zgodnja dela, sedemdeseta in osemdeseta leta prejšnjega stoletja
[4] Carol Zaleski; Onstranska potovanja
[5] Mladina, 3. april 2006
[6] Don Miguel Ruiz, Štirje dogovori
[7] Lastni zapiski in premislek

Transpersonalno jedro človeka in njegova vloga z vidika psihosinteze

Barbara Novak Škarja
Zavod CDK
Akademija za psihosintezo
Ruska 13, 1000 Ljubljana, Slovenija
Tel: +386 1 4339303; fax: +386 1 4339303
Barbara.novak@akademija-psihosinteza.org

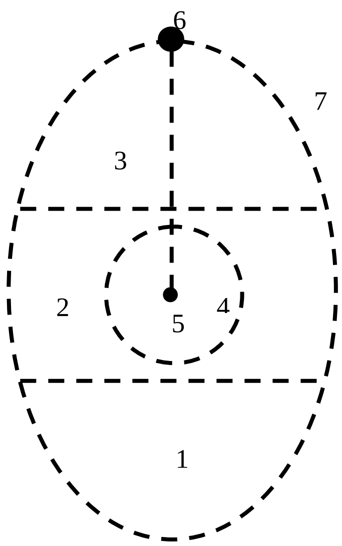
POVZETEK:
Namen prispevka je predstaviti psihosintezo, ki se od drugih psiholoških šol in praks loči po tem, da predpostavlja obstoj višjega ali transpersonalnega jaza. S tem se dotika področja filozofskega in religioznega, vendar ne z namenom, da bi posegala vanj, ampak zato, da bi ga integrirala v celovito in praktično uporabno vedenje o človeški naravi. Psihosinteza v svojem pristopu k raziskovanju človekove psihološke narave ostaja znanstvena. Prizadeva si za odprtost in živost zato se izogiba prezgodnjim teoretskim zaključkom in sistematizaciji. Spodbuja k raziskovanju tistih področij, ki so bila doslej zaradi redkosti, nenavadnosti ali izrazite subjektivnosti zanemarjena.

1. Kaj je psihosinteza in kako je nastala?

Ideja za psihosintezo se je porodila v glavi italijanskega psihiatra in psihoterapevta Roberta Assagiolija, kot posledica nezadovoljstva z obstoječimi pristopi in načini reševanja človekovih eksistenčnih problemov. Psihosinteza je sistem, ki je odprt za povezovanje vsega vedenja, ki ga imamo kot človeštvo o svoji naravi in tehnik, ki nam lahko pomaga pri našem razvoju. Vključuje spoznanja iz različnih področij, med katerimi so najpomembnejša (Assagioli, 1965):

- psihosomatska medicina, ki je osvetlila vpliv psiholoških dejavnikov na težave organskega značaja;
- psihologija religije, ki raziskuje različne manifestacije religiozne zavesti in mističnih stanj;
- raziskovanje nadzavednega (intuicije, iluminacije), izvora genialnosti in kreativnosti;
- parapsihološke raziskave, ki potrjujejo obstoj nadnaravnih psiholoških sposobnosti, kot so izvenčutna zaznava, telekineza (mehanska akcija z daljave), telepatija (komunikacija na daljavo) in prekognicija (slutnje o prihodnosti);
- vzhodna psihologija (predvsem indijska), ki temelji na neposrednem notranjem uvidu *ršijev* (vidcev);
- *Šola modrosti*, Hermana Keyserlinga, ki poudarja ustvarjalno moč duhovnega razumevanja;
- psihologija osebnosti in njen holistični pristop;
- socialna psihologija;
- psihiatrija;
- antropološke študije človeka;
- aktivne tehnike za zdravljenje in razvoj osebnosti (hipnoza, sugestija, avtosugestija, avtogeni trening, meditativne tehnike, psihodrama, skupinske terapije, trening mišljenja, spomina, imaginacije in volje).

Na osnovi proučevanja in študijskih raziskav z zgoraj omenjenih področij je Assagioli oblikoval večdimenzionalni koncept človekove osebnosti, ki ga je grafično ponazoril s spodaj prikazanim modelom.



1. Nižje nezavedno
2. Srednje nezavedno
3. Višje nezavedno ali nadzavedno
4. Polje zavednega
5. Zavestni ali osebni jaz (jaz)
6. Transpersonalni ali višji jaz (Jaz)
7. Kolektivno nezavedno

Slika 1: Model človeške psihe (Assagioli, 1965)

Tako imenovano '*Assagiolijevo jajce*' (slika 1) predstavlja celoto naše psihe. Tri vzporedne črte, ki razmejujejo oval, predstavljajo preteklost, sedanjost in prihodnost. Vse tri so dejavne v nas, čeprav na različne načine.
Nižje nezavedno (1) v glavnem predstavlja našo osebno psihološko preteklost v obliki potlačenih kompleksov in davno pozabljenih spominov. Tu je shranjena potlačena energija, ki nadzoruje naše delovanje in nam jemlje svobodo.
Srednje nezavedno (2) je tisto, kjer so doma naše veščine in stanja razuma, ki jih lahko po svoji volji prikličemo v *polje zavednega* (4), ki je – v tem trenutku za vas – ta prispevek in besede, ki jih berete.

Naša evolucijska prihodnost zaobjema stanja bivanja, vedenja in čutenja, ki jih imenujemo *nadzavedno* (3). V besedah Assagiolija je *nadzavedno* področje, iz katerega »sprejemamo višjo intuicijo in navdih – umetniški, filozofski ali znanstveni, etične 'imperative' in nujo za humanitarna in junaška dejanja. To je izvor višjih čustev, kot je na primer altruistična ljubezen; izvor genialnosti, kontemplacije, razsvetljenja in ekstaze.«[1]
Razlika med *nižjim* in *višjim* nezavednim je razvojna, ne moralistična. Nižje nezavedno predstavlja le najbolj preprosti del nas, naš začetek, bi lahko rekli. To ni *slabo*, je samo *zgodnejše*. Nasprotno pa *višje nezavedno* predstavlja vse tisto, kar lahko dosežemo v toku svojega razvoja. To ni samo abstraktna možnost, ampak je živa realnost z lastnim obstojem in močjo.
Naša duševnost ni izolirana. Koplje se v morju, ki ga je Carl Gustav Jung imenoval kolektivno nezavedno (7). Po Jungovih besedah je kolektivno nezavedno »predpogoj vsake individualne psihe, tako kot je morje nosilec posameznega vala.«[2] Vse črte so prekinjene, kar pomeni, da ni trdne ločnice, ki bi preprečevala medsebojni vpliv med vsemi ravnemi.

2. Odnos med osebnim in transpersonalnim jazom
Odnos med osebnim in transpersonalnim jazom je na prvi pogled paradoksalen. Videti je, kot bi imel človek dva jaza. Osebni jaz se običajno ne zaveda obstoja višjega jaza oziroma celo zavrača njegovo realnost. Višji jaz pa je latenten in se ne razkriva neposredno.
Jaz in transpersonalni jaz sta v resnici ena realnost, ki jo izkušamo na različnih ravneh, na različnih stopnjah zavedanja in samouresničitve (Assagioli, 1965). Na zgodnjih stopnjah človekovega razvoja zavest o sebi ne obstaja. Za večino nas zdaj že obstaja na bolj ali manj zastrt in nejasen način. Naša naloga je izkusiti zavest v njenem čistem stanju, ki je *jaz* (5). Taka zavest nam daje občutek osrediščenosti in identitete. Jaz živi na ravni individualnosti, kjer se uči regulirati in usmerjati različne elemente osebnosti. Zavedanje jaza je predpogoj za psihološko zdravje.
Jaz je odsev ali oporišče *višjega jaza* (6). Čeprav je videti kot da ta refleksija obstaja sama zase v resnici nima lastne avtonomne substance. Z drugimi besedami, to ni nova in drugačna luč, ampak je projekcija svojega lastnega svetlobnega izvora (Assagioli, 1965).
Identifikacija s transpersonalnim jazom je redek dogodek – za nekatere posameznike je to doživetje vrhunec večletne discipline; za druge je spontana nenavadna izkušnja. V indijski tradiciji je bila opisana s sanskrtskimi besedami *sat-čit-ananda*: bivanje-zavest-blaženost. Transpersonalni jaz ohranja občutek individualnosti, čeprav živi v svetu univerzalnosti na ravni, kjer so osebni načrti in skrbi presvetljeni s širšo vizijo celote. Izražanje transpersonalnega jaza je znak duhovne samouresničitve (Ferrucci, 1982).

3. Osebna in duhovna psihosinteza
Glede na različni vlogi osebnega in transpersonalnega jaza ločimo osebno in duhovno psihosintezo. Cilj osebne psihosinteze je doseči harmonično uglašenost posameznika s samim seboj, s skupnostjo, ki ji pripada in v kateri igra smiselno vlogo. To dosega z integracijo in povezovanjem vseh elemenotov osebnosti okrog središča – osebnega jaza.
Obstaja pa nekaj ljudi, ki niso in ne morejo biti zadovoljni s tem običajnim dosežkom, ne glede na to, kako pomemben in dragocen se zdi ostalim. Ti ljudje želijo uresničiti in sprejeti tisto področje zavesti, ki ga imenujemo duhovno. Za te ljudi obstaja višja oblika psihosinteze – duhovna psihosinteza. Njen cilj je izražanje višjih manifestacij človeške psihe, kot so ustvarjalna imaginacija, intuicija, aspiracija in genialnost (Assagioli, 1965).

4. Raziskovanje transpersonalnega
Temeljna hipoteza psihosinteze je, da poleg tistih delov nezavednega, ki jih imenujemo nižje, srednje in kolektivno nezavedno, obstaja še eno široko področje našega notranjega bitja – nadzavedno (Assagioli, 1965). Le to je bilo s strani znanosti in psihologije precej zanemarjeno, čeprav je njegova narava najdragocenejša in njegova človeška vrednost najvišja. To višje področje človeškega bivanja je bilo znano že stoletja a šele v zadnjih desetletjih se je nekaj pogumnih znanstvenikov lotilo njegovega raziskovanja na znanstveni način. Tako so položili temelje tistemu, kar je Frankl imenoval "višja psihologija".[3]
Tako imenovana višja ali duhovna stanja zavesti in parapsihološke izkušnje so povsem pragmatično gledano dejstva, saj vplivajo na resničnost - notranjo resničnost in zunanje obnašanje posameznika. Transpersonalni jaz v psihosintezi ni samo koncept, ampak je živa realnost. Energije nadzavesti so zanjo enako resnične in temeljne kot instinktivne energije, ki jih je opisal Freud. Oba dela človeka, materialni in duhovni, sta enako pomembna in si zaslužita enakovredno znanstveno obravnavo (Assagioli, 1965).

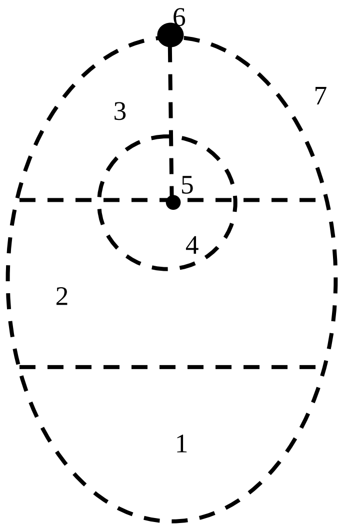
5. Psihosinteza kot znanost
Vizija psihosinteze je, da se postopoma razvije v znanost o Jazu (Assagioli, 1990). To je dolgoročna vizija v kateri se nakazujeta dve možni poti razvoja, ki pa sta odvisni tudi od razvoja drugih vej znanosti in tehnologije oziroma od razvoja človekovih kognitivnih sposobnosti. Prva smer razvoja je povezana z možnostjo objektivizacije psihičnih energij. Zahtevala bi genialnega fizika, nekakšnega novega Einsteina, ki bi odkril napravo za merjenje čustvenih, miselnih in duhovnih energij. To bi bil korak v smeri večje objektivizacije psihološke dinamike v človeku.
Druga možnost razvoja pa je povezana z razširitvijo človekovih kognitivnih sposobnosti. To bi pomenilo premik od dosedanjega ascendentnega logično-miselnega načina sklepanja, ki se pomika od neznanega k znanemu, od posamičnega k splošnemu, od poskusa ali izkušnje do teorije; k novemu descendetnemu intuitivno-logičnemu načinu sklepanja. Pri prvem je v ospredju funkcija mišljenja, s pomočjo katere skuša raziskovalec zaobjeti in razumeti celoto življenja. Pri drugem pa je v ospredju še dokaj nerazvita funkcija intuicije – neposrednega uvida v bistvo stvari. Pri intuitivnem uvidu, ki hipno in neposredno zaobjame celoto ima mišljenje le še funkcijo pravilne interpretacije, kritičnega preverjanja in logične umestitve uvidenega v dosedanji sistem znanja.
Ker je funkcija intuicije neposredno povezana z višjimi stanji zavesti, je prav raziskovanje teh stanj tisto, ki spodbuja njen

razvoj. Tako kot za vse psihološke funkcije (zaznava, čustvovanje, želje in potrebe, imaginacija, mišljenje) tudi za intuicijo velja, da pozornost in zanimanje zanjo pospešujeta njen razvoj. Pozornost ustvarja fokus, hrani in spodbuja intuicijo k njenemu izražanju (Assagioli, 1965).

Ne glede na možne poti razvoja te nove veje znanosti, ki bo poglobila razumevanje človeške narave in objektivizirala človekovo psihološko dinamiko, bo pomemben del znanstvenega razikovanja še vedno ostal povezan z učinki, obvladovanjem in usmerjanjem notranjih psiholoških energij v vsakodnevnem življenju. V življenju povprečnega človeka energije višjega jaza še niso prisotne. Obstajajo pa posamezniki (iz preteklosti in iz današnjega časa) pri katerih je izkušnja transpersonalnega jedra in njegov vpliv bolj ali manj prisoten v njihovem življenju. Ta prisotnost je lahko spontana ali pa zavestno izzvana.

6. Spontane izkušnje transpersonalne zavesti

Assagioli opiše dve kategoriji izkušenj stika z nadzavednim, čeprav med njima obstajajo številne vmesne faze. V prvo kategorijo sodijo osebe, ki so dosegle trajen in stabilen stik z višjim jazom. Te osebe imajo številne višje sposobnosti in lahko demonstrirajo svojo veličino in kreativnot na različnih področjih. To so bili na primer: Pitagora, Platon, Dante, Leonardo da Vinci, Einstein in številni drugi. Te osebe so izražale kvalitete višjega jaza na različne načine in so hkrati dosegle tudi relativno stabilno notranje in zunanje ravnovesje.

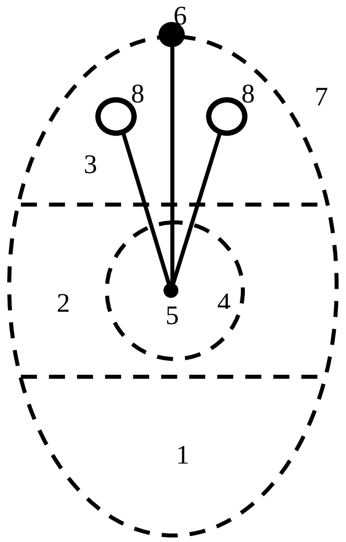


1. Nižje nezavedno
2. Srednje nezavedno
3. Višje nezavedno ali nadzavedno
4. Polje zavednega
5. Zavestni ali osebni jaz – jaz
6. Transpersonalni ali višji jaz – Jaz
7. Kolektivno nezavedno

Slika 2: Stanje stabilnega stika z nadzavednim (Assagioli, 1965)

Kot je razvidno iz diagrama (slika 2), se je pri the osebah zavestno središče osebnosti premaknilo višje, na mejo med zavednim in nadzavednim. Polje zavednega pa do neke mere sega v polje nadzavednega.

V drugo kategorijo sodijo osebe, ki imajo poseben dar, vendar le na enem področju. Skozi to nadarjenost ustvarjajo običajno umetniška dela, literaturo ali glasbo zelo visoke kvalitete, vendar njihove osebnosti niso nad povprečno ravnijo. Včasih so celo pod povprečjem, neprilagojene in v nekaterih vidikih nezrele. Izstopajoč primer je Mozart, ki je komponiral čudovito glasbo ko je imel komaj nekaj let. Znanstvno bolj eksaktno bi bilo pravzaprav reči, da se je skozi njegov živčni sistem prevajala odlična glasba. To se je nadaljevalo celo njegovo kratko življenje. Tudi sam je priznal, da ne ve od kod ta glasba prihaja in kako je kompinirana. Slišal in čutil jo je v sebi, moral jo je samo zapisati.



1. Nižje nezavedno
2. Srednje nezavedno
3. Višje nezavedno ali nadzavedno
4. Polje zavednega
5. Zavestni ali osebni jaz – jaz
6. Transpersonalni ali višji jaz – Jaz
7. Kolektivno nezavedno
8. Vsebine nadzavednega

Slika 3: Projekcija vsebin nadzavednega v polje zavedanja (Assagioli, 1965)

V tem primeru gre za prežemanje polja zavednega z rezultatom neke psihološke aktivnosti izven in nad običajno zavestjo osebnosti. Številka (8) na diagramu (slika 3) predstavlja ustvarjalno aktivnost (literarno, glasbeno, …), ki svoje rezultate projicira v polje zavesti običajne osebnosti, katera pa ostaja na isti ravni. Projekcija gre v osebni jaz, ki ostaja nespremenjen in predvsem sprejema – včasih presenečeno in vznemirjeno – novo, nepričakovano vsebino, oziroma rezultate nečesa, kar deluje v njem.

Podobno se dogaja pri intenzivni pozornosti na abstraktne vsebine pri matematikih ali fizikih. Tudi oni dobivajo iz nadzavednega resnične intuitivne uvide in razumevanje, ki ga nato prevedejo v razumljive matematične izraze.

Estetska izkušnja lahko človeka prav tako popelje v spontani stik z nadzavednim in v neke vrste ekstazo.

Takšen učinek imajo lahko tudi nevarne situacije, kot so vojne ali plezanje v gorah. Takrat je človek zmožen, namesto strahu, ki bi ga praraliziral, izraziti herojsko moč in pogum. Vendar ta izkušnja traja le dokler traja situacija.

Poleg spontanega stika z nadzavednimi vsebinami pa lahko oseba doživi tudi trenutke čiste samo-realizacije, ko pride do trenutnega ali začasnega popolnega zlitja med osebnim in višjim jazom. V tem stanju izginejo vse ostale vsebine zavesti. Ostane le čista intenzivna izkušnja samozavedanja.

Obstajajo tudi številna vmesna stanja, ki se lahko pojavijo v življenju posameznika. Znane so izkušnje ko človek neko obdobje brez očitnega zunanjega razloga preživi v neke vrste ekstazi. Kot bi se točka običajne vsakodnevne zavesti za nekaj časa premaknila v višje sfere, kjer je vse jasno in mirno. Človek čuti širino, globoko razumevanje in ve, da je življenje smiselno. Po nekem obdobju pa, kot bi čarovnija popustila, se znova znajde v svojem običajnem svetu, kjer so stvari nejasne in zastrte, občutek identitete pa negotov. Taka izkušnja pusti v zavesti človeka velik vrašaj in ga ponavadi usmeri k zanimanju za duhovno plat življenja.

7. Tehnike za zavestni stik s transpersonalnim jazom

V psihosintezi so duhovne potrebe človeka obravnavane z enako realnostjo, kot so spolne potrebe ali potrebe po izražanju agresivnosti (Assagioli, 1965). Čeprav pri običajnem človeku te potrebe še niso ozaveščene, so vendarle prisotne. Večina jih je v preteklosti zadovoljevala s pomočje religij. Danes, z naraščajočim ateizmom, ostaja ta še vedno v veliki meri neozaveščena potreba nepotešena. Bolj ozaveščeni posamezniki zato iščejo različne načine za neposredni stik s svojim duhovnim jedrom. Poglejmo nekaj tehnik, ki lahko pomagajo vzpostaviti zavesten stik s transpersonalnim:

- Molitev – njen temeljni element je predanost višjemu.
- Meditacija – je bolj razumski postopek, določeno zaporedje korakov, ki lahko vključuje tudi mantro ali simbol.
- Delo s simboli - simbol je neke vrste posrednik, ki omogoča stik z bolj abstraktnimi energijami oziroma kvalitetami nadzavednega. Simboli so lahko abstraktni (krog, trikotnik), naravni (sonce, cvet) ali personificirani (Kristus, notranji učitelj, angel, notranji vodkni, modrec).
- Notranji dialog – preko simbola (notranjega učitelja, modreca) skuša vzpostaviti komunikacijo med osebnim in višjim jazom.
- Tišina in lepota sta dve kvaliteti, ki nam prav tako pomagata, da se z zavestjo lažje dotaknemo, če govorimo v energijski terminologiji, vibracijsko višjega stanja, ki je značilno za nadzvedno. Ko utišamo druge funkcije osebnost, lahko prisluhnemu intuiciji, ki je mnogo subtilnejša od ostalih. Ko doživimo trenutek lepote, se celotna osebnost harmonizira in doživimo trenutek čistega psihološkega zdravja, trenutek, ko za hip postanemo več kot smo bili (Ferrucci, 1982).

8. Odnos psihosinteze do religije

Ko je govoro o transpersonalnem ne moremo mimo odnosa, ki ga ima psihosinteza do religije. Assagioli je razločeval dve fazi religije. V prvi fazi gre za neposredno izkušnjo duhovne resničnosti, ki so jo doživeli utemeljitelji religij, pa tudi mistiki, nekateri filozofi in številni ljudje. V drugi fazi pa gre za teološko ali metafizično formulacijo te izkušnje. Na njeni osnovi se je v določenem zgodovinskem času in kulturnem prostoru zgradila instituicija. Namen te institucije je bil posredovat bogastvo in vrednost tega spoznanja množicam. Znotraj institucij so se razvile metode, simboli in rituali preko katerih lahko tudi množice, ki te izkušnje nimajo, posredno sodelujejo pri razodetju.

Psihosinteza potrjuje resničnost notranje duhovne izkušnje in obstoj višjih vrednot, ki pripadajo področju nadzavednega. Ostaja pa nevtralna oziroma neopredeljena do različnih formulacij in institucij. Ceni, spoštuje in prepoznava njihovo potrebnost, vendar je njen osnovni namen pomagati do neposredne izkušnje.

Psihosinteza lahko ponudi pomoč tistim, ki ne verjamejo v religijo in nimajo jasnih filozofskih konceptov. Vsem tistim, ki zavračajo obstoječo zgodovinsko formulacijo religije, lahko psihosinteza pomaga, da se povežejo s svojim duhovnim jedrom in uresničijo svoje višje potenciale – dosežejo duhovno samorealizacijo.

Tudi tistim, ki imajo živo vero in pripadajo dolečeni cerkvi ali filozofski šoli lahko psihosinteza pomaga globlje razumeti njihovo vero. Še več, pomaga jim razumati, da se ista notranja izkušnja lahko izrazi skozi različne simbole in razlage. Tako postanejo bolj odprti in razumevajoči do drugačnosti. Ta odprtost lahko končno pripelje do možnosti za ‘psihosintezo religij’. Pri tem nima namena ustvariti novo religijo in izbrisati stare. Lahko pa pomaga razvijati razumevanje in spoštovanje med različnimi veroizpovedmi in vzpostaviti sodelovanje med njimi.

9. Zaključek

Cilj psihosinteze je *notranja religija*, ki v izvornem pomenu besede re-ligare (ponovno povezati) želi povezati človeka z njegovim transpersonalnim jedrom in univerzalno zavestjo, ki prinaša dobro za vse. Živa izkušnja transpersonalnega jedra je tista, ki lahko v resnici spreminja življenje človeka, prinaša v njegovo zavest višje vrednote altruizma, sočutja, sodelovanja in notranjo etiko. Le z živo izkušnjo lahko etične vrednote, ki so skupne vsem reliogioznim in filozofskim sistemom resnično zaživijo – ne le v umovih in srcih ljudi ampak tudi v njihovih dejanjih. S tem bo psihosinteza pripomogla k rojstvu novega civilizacijskega vzorca, ki bo presegal egoizem, separatizem in diskriminacijo, katere koli vrste (politični, religiozni, rasni, generacijski). Nov način življenja bo upošteval človeštvo in planet z vsemi kraljestvi narave kot celoto. Vse to je v polju naše zavesti kot ideal že prisotno, v žviljenje pa ga bomo prenesli edino z lastnim prizadevanjem in lastno voljo. K temu nas bodo bodisi prisilile stvetovne krize (lakota, onesnaženje, vojne, naravne ujme) ali pa nas bo tja popeljala dovolj široka zavest zadostnega števila posameznikov, ki bodo prepoznali to potrebo še preden bo postala preživetvena nuja.

Reference

[1] Roberto Assagioli, *Psychosyntehsis, a Manual of Principles and Technicques;* Mandala, An Imprint of HarperCollins*Publishers* London, 1965 (ponatis 1990), str. 17 – 19.
[2] C. G. Jung, *The Practice of Psychotherapy* (London: Routledge & Kegan Paul, 1966), str. 169
[3] V. E. Frankl, *Der unbewusste Gott*, Amandus, Wien, 1949

Literatura

Roberto Assagioli: *Psychosynthesis, a Manual of Principles and Techniques;* Mandala, An Imprint of HarperCollins*Publishers* London, 1965 (ponatis1990).

Piero Ferrucci: *What We May Be, Tecniques for Pychological and Spritual Growth through Psychosynthesis,* Jeremy P. Tarcher/Putnam, New York,1982

Izražanje vere in kultura

dr. Mari Jože Osredkar
Univerza v Ljubljani
Teološka fakulteta
Poljanska 4, 1000 Ljubljana, Slovenija
Tel: +386 1 434 58 46; fax: +386 1 43458 54
mari.osredkar.ofm@siol.net

ABSTRACT: Expressions of Faith and Culture

As it is the case in civil society, also the present situation in the European Catholic Church differs from the one in the past. Namely, many Church members are indifferent to her teachings, but remain Catholics nevertheless. This situation is the starting point for reflections on the meaning of religious practice and on its dependence on culture, which is understood in a broader sense of the word as the way of life and thinking that unites individuals in a certain environment and in a certain historical period. Since in different social orders culture changes, the image of God, the image of the believer and, consequently, the expressions of faith change as well. Faith does not disappear, only its expressions change and thereby slowly change the institution leading the faithful. Every relation consists of an ethical component and a theological one, therefore every search for the other comprises faith defined as search for the Other. On the basis of this axiom from the world of relations, it can be concluded that faith saves the community and thereby saves the individual: it gives him life. As long as man is in a relation, which is essential for his existence, he will believe (i.e. search for the o(O)ther) though the expressions of faith (i.e. religion) will constantly be changing.

Uvod

“Poklekni in moli, pa boš veroval!“
Blaise Pascal

16. avgusta 2006 ob 8. uri zjutraj je bilo na svetu 6.534.909.538 prebivalcev[1]. Velika večina danes živečih ljudi (prav tako pa tudi večina vseh tistih, ki so kdaj koli živeli na našem planetu) izpoveduje vero. Bolj natančno povedano, 84,8 % danes živečega svetovnega prebivalstva pripada neki religiji.[2] Podobno razmerje med vernimi in nevernimi velja tudi za Slovenijo.[3] Njihova vernost pa ni zabeležena le ob štetju prebivalstva in v registrih verskih skupnosti, temveč se kaže tudi v vsakdanjem življenju. Izražanje vere v vsakdanjem življenju imenujemo verska praksa, ki še zdaleč ne sestoji le iz obiskovanja obredov. Po veri živi, kdor sledi predpisom in nauku, ki ga postavlja verska institucija. Tu pa se v moderni zahodnoevropski kulturi pojavljajo različna vprašanja, ki jih bomo predstavili v tem predavanju in hkrati nakazali odgovor. V uvodnem delu si bomo pogledati položaj verske prakse v Katoliški cerkvi. Številke govorijo o podobnem položaju drugih verskih skupnosti v Evropi. Ta predstavitev je izhodišče za nadaljnje razmišljanje o povezavi med kulturo in izražanjem vere.

1. Položaj verske prakse v evropski Katoliški cerkvi

Danes se Katoliška Cerkev v Evropi srečuje z zanimivim položajem. Tako imenovani verniki so razdeljeni v dve skupini. V prvi so tisti, ki so v občestvu vidni, ki torej prihajajo k maši ob nedeljah in praznikih, sodelujejo pri skupnih dejavnostih v župnijah in skušajo živeti po nauku Cerkve. V drugo skupino vernikov pa prištevamo tiste, ki so sicer krščeni in se imajo za kristjane, njihovo verovanje oziroma verska praksa in moralno življenje pa niso v skladu z naukom Katoliške Cerkve. V cerkev pridejo le ob izrednih priložnostih ali pa prihajajo, toda za njena navodila se ne menijo. Zato jih pogosto imenujemo ne-praktikanti. Verjetno ni treba posebej poudarjati, da ta druga skupina predstavlja veliko večino v skupnosti Cerkve. Ko nekdo želi spoznati versko stanje v nekem kraju, je ponavadi njegovo prvo vprašanje: »Kakšen je pa odstotek praktikantov?« Torej, koliko je dejavnih kristjanov v Cerkvi? V Sloveniji je v povprečju od 15 do 20 odstotkov krščenih, ki se redno udejstvujejo v življenju Cerkve. Malo, toda več kot v marsikateri drugi evropski državi.

Morda bo kdo pripomnil, da je približno tako v zgodovini vedno bilo. Res je. Vedno so obstajali posamezniki ali pa skupine, ki so nasprotovale Cerkvi. Ampak ti so jo tudi zapustili. Zakaj pa mislite, da se je Kristusova Cerkev v dvatisočletni zgodovini tolikokrat razcepila? In zakaj je kljub vsemu prišlo tudi do nekih sprememb? Zato, ker so neka nasprotovanja in odstopanja v Cerkvi vedno obstajala. Kdor se ni držal vere in verske oziroma moralne prakse, je bil preprosto izobčen. Če ga ni cerkveno učiteljstvo uradno izobčilo, se je od občestva sam oddaljil. Protestantje, ki so nasprotovali najrazličnejšim določilom v Cerkvi so »šli na svoje«, ustanovili so svoje Cerkve, kjer se duhovniki

1 Spletna stran Statističnega urada Republike Slovenije http://www.stat.si

2 Spletna stran *Religions of the World* www.religioustolerance.org/worldrel.htm#wce

3 Po štetju leta 1991se je več kot 75 % prebivalcev Slovenije izreklo za verne, po zadnjem štetju leta 2002 se je ta odstotek znižal na nekaj več kot 60 % zaradi dane možnosti, da vprašancu ni potrebno odgovoriti.

poročajo, kjer so tudi ženske lahko mašniki, kjer ni več zakramenta spovedi, kjer ni obvezen obisk nedeljskega bogoslužja …

Če smo bolj natančni, moramo zapisati, da se Cerkev srečuje z dvema različnima problemoma. Prvi je star že dve tisočletji: mišljenje nekaterih vernikov se ne sklada z naukom institucije. Od prvih stoletij krščanstva dalje smo priče ločitvam iz Cerkve – shizmam. Verniki, ki niso mogli izražati vere v Cerkvi, so se od nje ločili. Nov pa je drug problem: verniki, ki ostajajo v Cerkvi in ignorirajo njen nauk, svojega mišljenja pa tudi nimajo.

Pravi problem današnje evropske Cerkve torej niso verniki, ki bi želeli spremeniti pravila ali nauk Cerkve (saj so tudi te težnje prisotne v Katoliški Cerkvi: za poročenost duhovnikov, za žensko duhovništvo, ponovna poročenost ločenih…, ampak so v manjšini), temveč dejstvo, da mnogi njeni člani sploh ne vidijo razloga, zakaj bi pravila morala obstajati. Ne vidijo razloga, zakaj bi se držali kakršnih koli pravil v Cerkvi. Zato se jih ne držijo in hkrati ostajajo njeni člani.

Eni in drugi verniki so nekaj posebnega. Če ponovim: lahko, da jih sploh ni videti v cerkvi, lahko so pa zelo prisotni in vendar se razlikujejo od drugih, ker je njihova verska praksa drugačna od tiste, ki jo uči institucionalna Cerkev. Verske resnice, verska in moralna praksa so postale stvar individualne izbire ali pa verskih resnic sploh ne poznajo in nimajo nobene potrebe, da bi sploh poznali, kaj Cerkev zahteva od svojih pripadnikov. Njihova posebnost je torej v tem, da želijo biti katoličani, vendar ne »na svojem« temveč »po svoje«; na nek način istočasno skupaj in ločeno od drugih vernikov. To je položaj današnje Cerkve, ki ji je bil do sedaj neznan in marsikateremu opazovalcu se zazdi, da vera izginja.

Reakcija duhovnikov je znana. Rešitev vidijo v taki vzgoji vernikov, da bi tako kot v preteklosti danes zopet sprejemali nauk in sledili navodilom institucije. Ali je to možno? Ne, ni možno. Toda raje se vprašajmo, zakaj tako.

Postavili bomo tezo, da je izražanje verske prakse pogojeno s kulturo, ki se spreminja. In s spremembami kulture se spreminjajo tudi izrazi vere. Ne vera, ampak izrazi vere. To, kar imenujemo verska praksa. Da bomo lahko opravičili svojo trditev, najprej opredelimo pojem kulture.

2. Kaj je kultura?

Kulturo bomo opredelili kot sklop vezi, ki v določenem okolju in v določenem zgodovinskem trenutku povezujejo posameznike v skupino. Te vezi so navade in običaji oziroma način, kako živimo in kako nekaj naredimo. Kdor je vsaj malo potoval po svetu, je lahko ugotovil, da so drugje ljudje drugačni kot doma. Ne le, da govorijo drug jezik ali narečje, temveč imajo tudi drugačne običaje, navade in drugače razmišljajo. Posameznike v nekem okolju povezujejo pogledi, vrednote in življenjski slogi, skratka način življenja. Prav to pa jih razlikuje od drugih. Vzemimo za primer pozdrav. V Sloveniji imamo navado, da ob srečanju prijatelju stisnemo desnico. Če se srečajo znanci v Franciji, se objamejo in poljubijo na lice. V Parizu enkrat, na jugu Francije pa trikrat. Na Daljnem vzhodu pa se drug drugemu poklonijo. Drugače torej izrazijo srečanje s prijatelji in znanci. In ker to storijo drugače, niso čudni, le drugačni oziroma v drugačni kulturi živijo. Podoben primer je priprava hrane. Opoldanski obrok pri nas začnemo s toplo juho. To je nekaj čisto samo po sebi umevnega – za nas. Ko smo nekemu Špancu v Ljubljani postavili na mizo juho, nas je čudno pogledal in nam pojasnil, da ni bolan in da ne bo jedel juhe. Pri njih je navada, da toplo juho postrežejo le bolniku. Kakor hitro ljudje prestopijo mejo doma in okvire svojega izročila, odkrijejo, da obstaja več kakor samo en način, kako kaj početi in kako se izražati. Prav zadnji glagol je pomemben: »izražati se«. Izražanje je pogojeno s kulturo, ki človeku privzgoji način, kako kaj sporočiti drugim. Človek se v nekem okolju rodi in nihče ga ne vpraša, ali bi želel, da ga naučijo govoriti slovensko ali francosko ali kitajsko. Jezik nam je bil podarjen. Prav tako način razmišljanja in vedenja.

Prav posebno poglavje kulture je besedno izražanje. Beseda namreč nima pomena sama v sebi. Nihče tudi besedi ne more določiti pomena. Pomen dobi v komunikaciji. O tej ideji razmišlja Ludwig Witttgenstein[4], omenjeno problematiko najdemo pri Emilu Benvenistu[5], to idejo razvija tudi Guy Lafon[6]. Da je to res, se lahko hitro prepričamo. Vzemimo npr. slovenski glagol »upati«. Slovar slovenskega knjižnega jezika to besedo opredeli tako: »biti v duševnem stanju, ko se vidi možnost za rešitev iz težkega položaja«[7]. V osrednji Sloveniji študent upa, da je uspešno opravil izpit, bolnik upa, da bo kmalu ozdravel, kmet pa upa, da se bo kmalu končalo sušno obdobje. Če pa se premaknemo nekaj desetin kilometrov proti zahodu, v Vipavsko dolino, bomo pa slišali, da tam otrok ne upa priti v šolo, ker je bolan, delavec ne upa dvigniti bremena, ker je pretežko, in vernik ne upa brati verske literature, ker nima časa. Tam se glagol »upati« uporablja v pomenu »moči«. Torej morem – ne morem. Zakaj tako? Zato, ker beseda nima pomena sama v sebi in tudi Slovar slovenskega knjižnega jezika ne more kar določiti pomena neki besedi, kakor ji tudi nihče drug ne more preprosto določiti pomena. Pomen »se rodi« v občevanju med ljudmi. Ista beseda med posamezniki v različnih okoljih izraža različen pomen. Kakor je lahko tudi ista gesta v različnih okoljih različno razumljena. To pa zato, ker je človek vedno pogojen z nekim kulturnim okoljem in zunaj njega ne more niti zaživeti. Človek se izraža vedno v neki kulturi, z izrazi, ki so tej kulturi lastni. Posameznikovo zavedanje in njegova pripadnost kulturi sta odvisna prav od izrazov, ki so lastni tej isti kulturi… Otroka so naučili govoriti starši in okolje. In sicer tako, kakor so starši in okolje govorili in se izražali. Človek torej vse dela tako, kot se je naučil… Od drugih. In to pomeni roditi se in živeti v neki kulturi. Vse, kar posameznika okolje nauči, ga zaznamuje in potem veže na to okolje. Če človek zamenja okolje, opazi različnost in tudi v drugem okolju ohrani »svoje navade«, ki ga identificirajo in vežejo na dom. Če pa je kulturna različnost prevelika, se človek ne more »vživeti« v drugo okolje oziroma ima težave s skupnim življenjem.

4 Prim Kerr Fergus, *La theologie apres Wittgenstein*, Paris Cerf, 1991, str.110.

5 Prim. Benveniste Emile, *Problemes de linguistique generale*, Gallimard, 1966.

6 Prim. Lafon Guy, *Esquisses pour un christianisme*, Paris, Cerf, 1979, str. 51-75.

7 *Slovar slovenskega knjižnega jezika*, DZS, Ljubljana 1998.

Tudi napisana besedila so vedno izraz in odraz kulture v kateri so nastala. In če ne poznamo kulture, tudi besedil, ki so v njej nastali, ne moremo razumeti. Čeprav poznamo vse besede, ki besedilo sestavljajo, ne razumemo pomena besedila. Izreki, primere in prispodobe so odraz življenja v čisto določenem okolju in času. Brez poznanja teh dveh nam primere nič ne povedo. Angleži imajo lahko še tako dobre slovarje in prevajajo besede slovenskega izraza »živeti na koruzi«, pa jim prevedene besede ne bodo razložile pomena tega stavka…

Človek tudi Boga časti takšnega in tako, kot so ga naučili drugi oziroma na način, ki ga je videl pri drugih v svoji okolici. Še več, tudi Božje razodetje lahko človek prepoznava in posreduje drugim le na način in z izrazi, ki se jih je naučil od njih samih. Pri študiju teologije je torej poznanje kulture pomembno, ker tudi za Sveto pismo veljajo enake zakonitosti. Njegov nastanek je pogojen z življenjem in izražanjem v določeni kulturi v preteklosti. Svetopisemsko besedilo je izraz vere in prepoznavanja Božjega razodetja nekega okolja iz nekega obdobja v zgodovini. Ker ni nujno, da je imela beseda, ki jo mi sicer poznamo in uporabljamo, v tisti kulturi enak pomen kot pri nas, moramo poznati kulturo – način življenja, da bi lahko razumeli tudi besedila, ki so v tisti kulturi nastala. Tudi Kristus se je rodil v neki čisto določeni kulturi, v njej živel in deloval in zato sta njegovo izražanje in jezik z njo pogojena. Če hočemo torej razumeti njegov nauk, moramo poznati čas in okoliščine v katerih je živel.

3. Kultura se spreminja

Zgodovina nam priča, da se kultura spreminja. Hkrati s spremembo načina življenja, mišljenja in izražanja se spreminjata tudi prepoznavanje Boga in posredovanje Božjega razodetja, skratka spreminjajo se izrazi vere.

Mary Douglas, ameriška antropologinja, je v svojih raziskavah zapisala, da v svetu obstajajo štirje modeli družbenih ureditev[8]: tradicionalna hierarhična družbena ureditev, tekmovalni individualizem, osamitveni individualizem in fundamentalizem.

Za tradicionalno hierarhično družbeno ureditev je značilno, da vzdržuje hierarhični red, ki se ga je treba držati. Ta red je stalen. V tej ureditvi velja načelo, da kraljev sin sede na prestol, čevljarjev sin bo popravljal čevlje. S samim rojstvom dobi človek v njej nek položaj, ki ga ne more spreminjati. Tudi odnosi so vnaprej določeni. Točno se ve, kdo ukazuje in kdo posluša. Za to družbo velja izreden čut pripadnosti. Izredno je tudi poudarjena avtoriteta, ki velja od zgoraj navzdol. V taki družbeni ureditvi so medsebojni odnosi določeni in posameznik (niti tisti, ki je na vrhu) se jih ne more osvoboditi, ker ga vežejo od zunaj. Obstaja imperativ: Tako je in tako bo! Zato tudi v odnosu do Boga sprejema neko postavo, ki ga veže od zunaj in jo bo spoštoval (Če so gospod župnik rekli, potem moramo tako narediti …). Človekova veličina je v tem, da se umesti v ta vnaprej določen red, kar pomeni, da mora sprejeti svoj položaj, ne da bi lahko izrazil svojo voljo. Sociologi take družbe imenujejo holistične družbe. Posameznik je kot žival na povodcu.

S prehodom v tekmovalni individualizem se pojavi odnos, ki prej ni bil mogoč, kajti v hierarhični družbi posameznik ne reče »nočem«, ker ve, da mu potem sledi kazen. Zdaj pa ima posameznik možnost izbire, da reče hočem ali nočem. Človek si sam prizadeva, da bi dosegel neki položaj in sam izbira, kakšne odnose bo imel z drugimi. V tej družbeni ureditvi so vezi šibke, vendar še povezujejo posameznike v neko skupnost. Zanjo je značilna tekmovalnost (kmet, ki je bolj iznajdljiv, postane bogat, drugi ga začnejo spoštovati in zato lahko spremeni svoj položaj v družbi – začne ukazovati, odločati). Zdaj ni več stalnosti (s kapitalom ali znanjem lahko posameznik napreduje po družbeni lestvici in s tem spreminja odnose), nastane nek pluralizem mnenj. Posameznik postavlja zakone. Pojavi se demokracija, oslabi čut pripadnosti (konkurenca), možno je odločati in se osvoboditi vpliva družbe. V tekmovalnem individualizmu želi posameznik uveljaviti svojo osebnost, zato si sam postavlja zakone in pravila za življenje. (demokracija, referendum). Institucija izgublja veljavo. Posameznika nihče ne more prisiliti. Človek je bil prej bolj sredstvo, zdaj pa je cilj.

S prehodom iz tekmovalnega v osamitveni individualizem nastopi pomanjkanje komunikacije, ki je bistvena za skupnost. Zdaj se vezi zreducirajo na minimum, na najmanjšo možno stopnjo, kajti posameznik se umika v svoj svet. Ljudje se ne poznajo med seboj ali pa so popolnoma brezbrižni drug do drugega, drug drugega se bojijo, ne čutijo ne pripadnosti ne avtoritete. Vsak gleda le nase, odnosi postanejo patološki (anarhija, ločenost, osamljenost). Ker prevlada ignoranca do drugih ljudi, izgine tudi spoštovanje. V političnem življenju se to stanje prepozna tudi po politični brezbrižnosti do skupnih zadev – čeprav so v demokratičnem sistemu, se državljani ne udeležijo volitev in se niti ne zanimajo za zakone. Tudi na verskem področju se posameznik ne zanima za mnenje institucije in predpostavljenih. Še več. Ne oblikuje si niti svojega mnenja. Tu človek opazi svojo nemoč, ko ostane sam. Pripadnost in odvisnost sta vzajemni, človek je človeku opora in breme hkrati. Če odložiš breme, si izpodmakneš tudi oporo.

Tekmovanje (odrivanje drugega) pripelje posameznika v osamljenost in ko se ta stopnjuje do bolestnosti, se začno isto misleči združevati v skupine, ki temeljijo na selekciji: izločanje drugače mislečih. Ustanavljajo se zaprte skupnosti, ki zavračajo dialog in drugače misleče. Fundamentalistične skupnosti so kot obramba pred anarhijo, so trdnjave pred kaosom. Mislijo, da so oni tisti, ki bodo rešili svet pred anarhijo s tem, da bodo odstranili vse, ki se jim ne podrejajo. Fundamentalizem je v bistvu osamitveni individualizem zaključenih skupin, ki ne sprejemajo drugačnosti

V bistvu so te štiri družbene ureditve stopnje razvoja družbe. Naša zahodnoevropska družba je bila najprej hierarhično urejena, kjer se je moral posameznik podrejati skupnim interesom, nato se je posameznik osvobodil izpod oblasti institucije. Njegovo osamosvajanje pa ga je pripeljalo v položaj, kjer ne pozna več soseda in se niti ne zanima več

8 Douglas M., *The Effects of Modernisation on Religion Change*, v: *Religion and America, Spiritual Life in a Secular Age*, Beacon Press, Boston 1983. V slovenščini so njene ideje predstavljene v: Michael Paul Gallagher, *Spopad simbolov*, Družina 2003, str. 43-52.

zanj ter na koncu ostane osamljen. Sledi ponovno povezovanje isto mislečih posameznikov.

Te štiri družbene ureditve se med seboj razlikujejo po odnosih, ki posameznike povezujejo v skupnost. Tisto pa, kar povezuje posameznike v skupnost na nekem kraju in v nekem trenutku, je kultura. Zato lahko iz omenjenih družbenih ureditev izpeljemo štiri različne kulture. Tam, kjer so odnosi med posamezniki vnaprej določeni in nespremenljivi, govorimo o »urejeni kulturi«. Tam, kjer se posameznik lahko odloča s kom se bo povezoval, in lahko svojo izbiro tudi spremeni, obstaja »kultura izbire«. V okolju, kjer so posamezniki brezbrižni drug do drugega in hkrati osamljeni, najdemo »minimalistično anarhično kulturo«. V zaključenih fundamentalističnih skupinah pa prepoznamo »kulturo selekcije«.

Štiri različne kulture pogojujejo tudi prepoznavanje Božjega razodetja in izraze vere pri posameznikih. Človek namreč Boga ne more »videti«, zato je njegovo »védenje« o Bogu izraženo s podobami, ki so pogojene s kulturo v kateri vernik živi.

Ker je v urejeni kulturi vse urejeno in red drži posameznika v življenju, je temu primerna tudi vernikova predstava Boga: Bog je avtoriteta, ki dobro plačuje in strogo kaznuje. Bog je torej strog sodnik, avtoriteta, postavodajalec. Podobno kot tisti, ki v tej družbeni ureditvi sedi na vrhu hierarhične ureditve. Vernik pa je ponižen izpolnjevalec vsega kar mu rečejo[9], tako kakor v civilni družbeni ureditvi.

V kulturi izbire je vernik iskalec. Začne se spraševati, ali je res tako, kakor ga uči institucija. Vzame v roke Sveto pismo in tam prebere, da Bog ni le strog sodnik, temveč tudi usmiljeni Oče, ki sprejema izgubljenega sina in mu odpušča. Ta podoba Boga mu je bolj všeč, zato se odloči zanjo. In podoba usmiljenega Boga je zanj tudi izgovor, da si institucionalno versko prakso, ki je lahko breme, prilagodi po svojih željah. Sam si postavlja pravila za verovanje, sam si kroji moralo in tudi svojo vero izraža po svojem okusu.

V minimalistični kulturi vernik sploh nima svojega mišljenja. Redko izraža vero, zato je njegova podoba Boga zamegljena, nejasna in tudi podoba vernika samega je nejasna. To je tisti, ki pravi, da veruje, pa se tega nikjer ne opazi.

V kulturi selekcije se ustvari podoba Boga, ki je temu ustrezna. Verniki hočejo uničiti oziroma izničiti nasprotnike, drugače misleče, zato Bog dobi podobo pokončevalca. Ni usmiljenja. Vernik pa je bojevnik, ki se bojuje v imenu Boga (npr. stari Izraelci so pobili nasprotnike po ukazu Boga, križarske vojne, pobijanje drugačnih v islamu …).

S spremembo kulture, torej načina življenja in mišljenja,[10] se torej spreminja podoba Boga in vernika, ker se spremenijo izrazi vere. Tu lahko na kratko opredelimo tudi razmerje med pojmoma religija in vera: »Religija je zakrament vere!«[11] Ta opredelitev pove, da je religija izraz vere. Religija je družben in institucionalen izraz vere, »je celota govorjenja, čustvovanja, ravnanja in znamenj, ki se nanašajo na Boga!«[12] S spremenjeno versko prakso se spreminja religija, ne pa vera. Vsi lahko izpovedujemo isto vero, ki pa se različno izraža. In prav zato, da se vsebina vere ne bi spremenila, se morajo spreminjati izrazi vere. Zato, ker se spreminjamo ljudje oziroma kultura. Ne le v različnih zgodovinskih obdobjih, danes lahko vidimo razlike pri različnih generacijah in različnih okoljih. Statistike kažejo, da približno dvajset odstotkov slovenskih kristjanov izraža svojo vero po nauku Cerkve. Vsako nedeljo so pri maši, otroci redno do konca šolanja pri verouku ... Velika večina pa svojo vero izraža po svoji presoji. Zadovoljijo se s krstom otroka, birmo, morda poroko in pogrebom. Znotraj cerkve jih zelo redko vidimo in po večini se v njej ne znajo obnašati. Da o povezavi z župnijskim občestvom sploh ne govorimo. Pa so še vedno kristjani. Še vedno verujejo in se čutijo del Cerkve. To je krščanska religija večine slovenskih katoličanov, ki pač vero izražajo na drugačen način, kot bi želela institucija. Ker vera se vedno izraža glede na kulturo, kjer živijo verniki. Izraža se kot zaveza med ljudmi in troedinim Bogom ter hkrati tudi kot zaveza med ljudmi. Vernik v zavezi z drugimi uresničuje svoj odnos z Bogom.[13] Posredovanje verskega izročila se prilagaja zgodovinskim spremembam in zahtevam kulture.[14] Vstop krščanstva v neko kulturo imenujemo inkulturacija[15].

Človek se z Bogom pogovarja v različnih časih in prostorih. Vsaka kultura mora odkriti novo obliko, da bi ostala skladna s prvotno resnico. Nikar ne bodimo presenečeni oziroma se ne pohujšujmo, če so različna obdobja oziroma različni misleci v zgodovini krščanstva, Božjo besedo razumeli različno in o njej tudi različno govorili. Zgodovinska obdobja se med seboj razlikujejo, vsako ima svoje težave in okoliščine, tako se tudi »Logos« – Božja beseda v vsakem obdobju »utelesi« na nekoliko drugačen način. Razodetje kot odnos med Bogom in človekom, ni nikoli zapečateno enkrat za vselej. Bog se danes razodeva na drugačen način kot se je pred tisočletjem. Obleka resnice se prilagaja »modi«. Zato se tudi teologi ne obotavljajo in vedno znova iščejo resnico oziroma jo predstavljajo kar se da najbolj razumljivo sodobnemu človeku. Ne le različnim kulturam, vsaki generaciji bi moralo

9 Vernik – ponižni izpolnjevalec zakonov – obiskuje nedeljsko mašo, prejema zakramente in se drži tega, kar reče župnik, preprosto zato, ker je tako prav, ker vsi tako delajo in ker se boji kazni, če bi ravnal svojevoljno.

10 To se lahko zgodi ob prevladi nekega naroda nad drugim narodom ali s preprosto preselitvijo »z vasi v mesto«.

11 Religiosità popolare, v: *Nuovo dizionario di teologia*, EP, Milano 1985, str. 2049. Prim. tudi D. Ocvirk, *Religija in vera*, v: Osnovno bogoslovje (skripta), Ljubljana 1988, 10-11.

12 Prim. A. Stres, *Moderni ateizem* (skripta), Ljubljana 1985, 3.

13 Prim. D. Ocvirk, *Človek in Bog v komunikaciji*, v: *Nedelja*, 10. december 1989, str. 8.

14 Npr. evangelist Matej v svojem evangeliju ni uporabljal izraza »Božje kraljestvo«, ker si naslovniki – judje niso drznili izgovoriti Božjega imena ali izpeljanke. To bi bilo zanje bogokletje. Zato je uporabil izraz »nebeško kraljestvo«. Apostol Pavel je prišel oznanjat v Grčijo in je govoril o njim znanem »neznanem Bogu« – ki ga je predstavil v luči evangelija. Stara zaveza je tudi bila prevedena v grščino, ki je bil takrat »svetovni« jezik. Ravno tako so bile novozavezne knjige napisane v grščini, čeprav je Kristus oznanjal v aramejščini. Med vero in kulturo obstaja torej močna vez. Evangelij je nastal v neki kulturi in zunaj kulture ne more obstajati. Pri inkulturaciji (ki je evangelizacija kulture) se vnaša evangelij »v samo srčiko kulture«.

15 Izraz »inkulturacija« kot teološki termin je začel uvajati papež Janez Pavel II. od 1979 dalje; v pomenu, da se evangelij lahko živi kjerkoli.

biti razodetje oznanjeno na novo, na njej razumljiv način, ker otroci živijo v drugačni kulturi od tiste, ki so jo poznali starši.[16] Zato se je tudi njihov način razmišljanja in izražanja spremenil. Če novim generacijam govorimo o veri s starimi miselnimi vzorci, je ne razumejo.

Vera torej ne izginja, le izrazi vere se spreminjajo. Res je, da se zmanjšuje izražanje vere po navodilih institucije, po drugi strani je tudi res, da danes ljudje hrepenijo in veliko bolj iščejo duhovnost kot v preteklosti in izražajo vero na sebi lasten način in s tem počasi, nehote spreminjajo institucijo, ki ji pripadajo.

4. Civilna družba

Civilna družba se danes srečuje s popolnoma enakim problemom kot verske skupnosti. Izogibanje avtoriteti Cerkve je samo izraz stanja, ki trenutno zadeva našo celotno zahodno evropsko kulturo. Kulturo v smislu človekovega načina vedenja in komuniciranja. In prav komuniciranje in vedenje sta se v civilni družbi v modernih časih močno spremenila. Tradicionalno ustaljen način življenja, pa naj gre za družino ali državo, se je bistveno spremenil. Danes se ljudje ne upajo več za stalno poročati – vezati na drugega. Strah jih je prevzeti dokončno odgovornost oziroma mladi, ki začnejo živeti skupaj hitro izgubijo smisel za skupno življenje. Udejstvovanje posameznika v civilni družbi je tudi v krizi. Za obstoj vsake skupnosti so namreč potrebna pravila – potreben je red. Živeti v neki skupnosti pomeni podrediti se točno določenemu redu. Skušnjava današnjih dni je izmakniti se podrejenosti, redu. Zato povsod kjer gre za aktivno vključitev posameznika v neko skupnost (in pri aktivnosti v skupnosti gre vedno za neko podrejanje tej isti skupnosti), pa naj bo to družina, Cerkev ali pa država, naletimo na krizo. Skratka, zdi se, da povsod, kjer gre za brezpogojno razpoložljivost neki skupnosti, posameznika spremljajo težave pri odločitvi. Sociologi to problematiko imenujejo »individualizem«. Mi pa se ne bomo zadovoljili s tem odgovorom, ampak bomo postavili tezo, da gre za izrazito religiozno-teološki problem v najbolj radikalnem pomenu besede[17]: spreminja se to, kar veže ljudi med seboj. Tako se poraja vprašanje: »Če posameznik noče biti del skupnosti, ali bo ta izginila? Ali ne bo hkrati preminil tudi posameznik?«

5. Skupnost lahko reši le vera

Da bomo lahko razložili trditev, da vera rešuje skupnost, bomo uporabili enega od aksiomov iz sveta odnosov, ki smo jih na konferenci predstavili lansko leto.[18]

Vsak odnos je sestavljen iz etične in teologalne komponente. Ti dve sta tako tesno povezani, da ena brez druge ne more obstajati, kot dve strani lista papirja. Lahko bi rekli, da je v vsakem srečanju nekaj človeškega in nekaj božanskega. Tako je vsak medčloveški odnos sestavljen iz etične in teologalne komponente, ki sta neločljivi. V vsakem odnosu je torej skrita tudi vera. Tudi pri neverniku oziroma pri osebi, ki noče imeti nič z Bogom. Kako to?

Odnos ni nekaj statičnega, temveč je neprestano gibanje. Subjekti, ki se znajdejo v odnosu, »neprestano spreminjajo razdaljo« med seboj. Odnos deluje na principu alternance – izmenjave prisotnosti in odsotnosti, ki sta edini dimenziji v svetu odnosov. Toda vsak odnos istočasno vsebuje prisotnost in odsotnost. Prisotnost in odsotnost sta kot dve vezi, ki omogočata razdaljo med dvema objektoma. Prisotnost ju vleče skupaj in skrbi, da se ne razmakneta v neskončnost, odsotnost pa skrbi, da se ne zlijeta v eno.

Zveza med prisotnostjo in odsotnostjo v odnosu se prekine s smrtjo – z odhodom partnerja, ko se prisotnost in odsotnost med subjektoma razmakneta do skrajnosti, ko drugi iz končnosti vstopi v neskončnost. Dokler je bil partner tu, je bila etična komponenta vidna stran odnosa. Ker ni več vidna, se po odhodu zdi, kot da je umrl tudi odnos. Vendar obstaja še nevidna – teologalna komponenta odnosa, ki lahko reši etično, če je izražena z vero, z upanjem in z ljubeznijo. Vera ohranja odnos in ohranja skupnost.

Le zdi se, da se je izničil, a vendar se odnos med subjektoma ne prekine. Partnerja, ki je odšel, še vedno lahko pokličemo s »ti«. Drugi se oddalji do take mere, da se naš odnos do njega popolnoma spremeni. Takrat subjekt ni več določen objekt, na katerem bi se lahko zaustavil moj pogled, temveč subjekt postane neopisljiv – iz spoznavnega se spremeni v nespoznavnega. Nad etično komunikacijo takrat prevlada teološka komunikacija. V veri se znajdemo, ko drugega v njegovi popolni odsotnosti pokličemo s »ti«.

Vera namreč ni le »prepričanje o Božjem bivanju«, temveč je predvsem odnos. Vero lahko opredelimo kot iskanje partnerja, s katerim si se znašel v odnosu, a ga (še ali nič več) ne poznaš. Zato ga iščeš. Človek kot presežno bitje išče (D)drugega zunaj sebe in to v slehernem odnosu.

Smrt ogroža človekovo eksistenco. Gledano z materialističnega stališča s smrtjo oseba preneha obstajati, ker prenehajo njene biološke funkcije. V svetu odnosov pa biološka smrt nima moči. Zahvaljujoč teološki komponenti odnosa, ki jo imenujemo vera, se odnos do neke osebe nadaljuje tudi po njeni smrti. Kljub prenehanju svojih bioloških funkcij subjekt ne izgine. Odnos z njim se ne prekine, temveč se spremeni. Zato lahko rečemo, da nas vera rešuje smrti, ker nas vabi živeti skupaj in nam omogoča ostati skupaj tudi v odsotnosti. Verovati namreč najprej pomeni zaupati. Tako »verovati drugemu« pomeni zaupati mu. Zaupanje pa pomeni približati se drugemu. Vera torej rešuje skupnost, ker vabi posameznike, da se približajo drug drugemu in s tem slehernemu omogoča življenje – ga odrešuje.

Problem krize skupnosti ni pravi problem, dokler bomo ljudje verovali. Pa naj se ta vera izraža na tak ali drugačen način. Prepričani pa smo, da bo vera obstala na zemlji, ker bi z njenim izginotjem izginila tudi skupnost in posameznik z njo.

16 Problem današnjega evropskega prostora je v tem, da migracije in velike množice prišlekov z drugačnim načinom življenja »izničujejo« staro kulturo, vrednote in tudi pomen besed.

17 Beseda »religija« izvira iz latinskega glagola »religare«, kar pomeni povezovati.

18 Prim. Osredkar M.J., *Ko objekt več ne vznemirja*, v *Informacijska družba IS 2005,* Institut »Jožef Stefan«, Ljubljana, str. 65-69.

Teologija in uporaba razuma

dr. Robert Petkovšek
Univerza v Ljubljani
Teološka fakulteta
Poljanska 4, 1000 Ljubljana, Slovenija
Tel: +386 1 434 58 32; fax: +386 1 434 58 54
robert.petkovsek@guest.arnes.si

POVZETEK:

Teologija in uporaba razuma

Namen razprave je pokazati na edinstvenost teološke misli in njene metode ter na njeno temeljno povezanost z življenjem. Tema »znanstveno o verovanju« je smiselna le, če se znanosti zavedajo meja, ki jih imajo na področju raziskovanja vere. Naloga, ki jo ima teologija v *universitas scientiarum*, je, da prečiščuje um in ga usposablja za odgovorno mišljenje.

1. Uvod

Tema »znanstveno o verovanju« odpira vprašanje o tem, kaj lahko znanosti rečejo o verovanju oz. o veri. O veri govorijo različne znanosti, predvsem antropološke, humanistične in družboslovne. Tako so se poleg filozofije vprašanja o veri najprej lotile sociologija, etnologija, psihologija in z njo tudi psihoanaliza. Te znanosti pa so v preteklosti pogosto šle prek svojih pristojnosti in poskušale pojav verovanja razložiti kot patološki pojav, ki ima svoje korenine v ekonomskih, psiholoških ali socialnih deviacijah. Njihova temeljna napaka je bila, da pojava verovanja niso sprejele v njegovi fenomenalnosti, tj. takšnega, kakršen se kaže, ampak so ga reducirale na dejavnike, ki so glede na vero zunanji. Takšno držo, ki se razglaša za čisto znanost, v resnici pa jo je usmerja slepa vera v znanost, poznamo pod imenom »scientizem«. Kakor slepa *vera v vero* pelje v fundamentalizem, tako vodi slepa *vera v znanost* v scientizem. Fundamentalizem in scientizem sta dve izrojeni, patološki drži, ki stojita druga drugi nasproti in se izključujeta. Prva prisega zgolj na razum, druga zgolj na vero. Pascal ju označi kot dvoje skrajnosti: »Dvoje skrajnosti: izključevati razum, priznavati le razum« (Pascal 1986, 120). Prav o teh dveh skrajnostih sta pred leti kritično spregovorila tudi dva eminentna predstavnika zahodne misli, takrat še kardinal Joseph Ratzinger in filozof Jürgen Habermas. Govorila sta o patologijah vere in patologijah razuma. Njuna skupna ugotovitev je bila, da vera brez razuma ostane okrnjena kakor tudi razum brez vere. Razum se mora zato odpreti religijam in se od njih učiti, kakor je od antičnih časov naprej tudi vera stopala pred razsodišče razuma.

2. Znanstvenost in eksistencialna struktura človeške biti

Prav je, da se najprej zaustavimo pri besedi »znanstvenost«. Beseda označuje določeno bivanjsko držo oz. etos, ki je odvisen od vzgoje, moje odločitve in izbire. Človek se lahko odloča in izbira, ker je struktura njegove biti eksistencialna. To pomeni, da je človek bitje, katerega bit nikoli ni dovršena. Zato biva v nenehnem preseganju same sebe. Kot bitje odločanja se človek nenehno ločuje od starega, kar ima za posledico nenehno regeneracijo oz. prenavljanje njegove biti. Kot drža je tudi znanstvenost človekova izbira in je zato nenehno na nitki negotovosti. Znanost torej ni usoda človeka, kateri se že v načelu ne bi mogel izmakniti ali pa bi mu že v načelu bila nedosegljiva. Znanstvenost je drža, za katero se znanstvenik nenehno odloča.

Teoretična drža je torej stvar izbire in odločitve. To, da se lahko človek odloča o njej, pomeni, da ima do nje neki odnos; in če ima do nje odnos, pomeni, da je odnos odvisen od njega, in mu ni vsiljen ali usojen. Z drugimi besedami: za odnos, ki ga ima do svojih drž – tudi do teoretične drže in védenja − je odgovoren. To pomeni, da ima človek odnos tudi do svojega razuma in mu je dana zmožnost, da razum uporablja na različne načine. Za uporabo razuma je zato odgovoren. Preden človek razum uporabi v teoretičnem smislu, se za to na osnovi določenih razlogov že odloči.

Vidimo, da obstajata dva miselna reda: poleg teoretičnega načina mišljenja obstaja tudi praktični način. Temu ustrezata tudi dve vrsti razlogov: praktični in teoretični. Praktično mišljenje je celo pred teoretičnim. Že Aristotel je jasno razlikoval med *prāxis* in *theōria*, med praktičnim in teoretičnim védenjem. Razliko med enim in drugim redom pa je pronicljivo spoznal tudi Pascal, ki razlikuje med razlogi srca in razuma: »Srce ima svoje razloge, ki jih razum ne razume. [...] Resnice ne spoznavamo le z razumom, marveč tudi s srcem« (Pascal 1986, 125).

Antična in srednjeveška misel je bila za to dvojnost argumentacijskih načinov veliko bolj sprejemljiva kakor novoveška, v kateri je zavladal racionalizem in teoretično mišljenje sprejel kot edino možno, teoretični razum pa kot usodo, tj. kot danost, ki ima svoj neizbežen tek in je ni mogoče spreminjati. Descartes, ki velja za očeta novoveške misli, je spoznanje izvajal iz vrojenih idej. Človeku so temeljna spoznanja položena že v zibelko in je nanje tako rekoč obsojen. Zato resnica ni nikoli *njegova* osebna resnica. Je zgolj resnica, univerzalna in do posameznika neopredeljena. Martin Heidegger in mnogi drugi prav v tem kartezijanskem racionalizmu vidijo nekakšno samoumevno nadaljevanje antično‒srednjeveškega naravnega zakona. Če je bil prej človek podrejen naravnemu zakonu, je sedaj podrejen zakonu uma. Vsakokrat je le predmet v igri usode ali moment v dialektičnem razvoju naravnih in duhovnih zakonov. Zato ni odgovoren za svoje odločitve in izbire. Kritiki takšnega pojmovanja človeka pa trdijo, da se za takšno racionalistično‒naravno interpretacijo biti sveta in človeka skriva nihilizem. Nihilizem je v nezmožnosti človeka, da bi se kot jaz ali »posamičnik« (Kierkeggard) za svojo držo odločal, jo izbiral in bil zanjo tudi odgovoren. Nihilizem Zahoda je v tem, da je ves smisel svojega bivanja videl v nevtralnem, univerzalnem, abstraktnem, praznem védenju, v znanosti, ne pa v osebni svobodi. Tudi filozofijo, ki sta jo Aristotel ali Platon opredelila kot pot do svobode človeškega duha, je Hegel opredelil kot znanstveni sistem, ki je strogo podrejen logičnim zakonom in strukturam.

To samoumevnost novoveškega racionalizma, ki je skupaj z metodologijo naravoslovnih znanosti preplavil novoveško misel, je zamajala fenomenologija. Husserl, oče fenomenologije, filozofije ni več razumel kot znanstveni sistem, ki bi s svojo logiko obvladoval stvarnost, ampak kot strogo znanost o čistih možnostih. Fenomenologiji ni do tega, da bi stvarnost obvladala, ampak da bi stvarnost zajela v vsem bogastvu njenih oblik in pojavnih logik. V tem smislu jo moramo razumeti kot strogo znanost o čistih možnostih. To je Husserlu omogočilo vrnitev nazaj k stvarem v njihovi pojavni obliki. V novoveškem mišljenju je fenomenologija naredila prodor, ker je poudarek s formalnih miselnih struktur prenesla na stvari same. S tem pa je odprla tudi povsem nove možnosti za razumevanje razmerja med razumom in vero. V nasprotju z novoveškim racionalizmom, ki je vero podrejal razumu ali pa jo je v imenu razuma izključeval, dobi sedaj vera v razmerju do razuma svojo avtonomijo. Na svoj način je to vprašanje reševal že Kant.

3. Vera in razum

Kaj je ta fenomenološki preobrat prinesel za teologijo in kako je novo pojmovanje teologije vplivalo na razmerje med teologijo in znanostmi, vero in razumom?

Vprašanje razmerja med razumom in vero je bilo živo že vse od začetkov krščanstva. Že sv. Pavel je učil, da je od stvarjenja sveta naprej mogoče večno Božjo mogočnost in božanskost spoznati »z razumom iz ustvarjenih bitij« (Rim 1, 19), na drugem mestu pa govori o tem, da je Bog modrost tega sveta preobrnil v norost. Modrosti sveta stoji nasproti križani Mesija, a ta norost križa je po Pavlu »veliko modrejša od ljudi« (1 Kor 1, 25). Sv. Pavel je tu zadel na napetost med naravnim mišljenjem in mišljenjem, ki ne izhaja iz naravnih danosti.

Konflikt, ki ga je sprožila fenomenologija, je bil podoben. Fenomenologija je na tradicionalno filozofijo naslovila kritiko, da je bila njena misel ves čas pod nekritičnim vplivom naravne drže. To pomeni, da je filozofija tudi človeka mislila na isti način in po istih kriterijih, kakor je mislila naravne danosti. Pojav človeka pa je po svojem bistvu nekaj povsem drugega, kakor so to naravni pojavi.

Zgodovina odnosov med vero in razumov je bila zgodovina nihanja med vključevanjem in izključevanjem. Prvi krščanski apologeti, med njimi najbolj poznan Tertulijan, so poudarjali, da med Jeruzalemom in Atenami, tj. med krščanskim razodetjem in posvetno modrostjo grške filozofije ni nobene skupne točke, ampak stojita na nasprotnih bregovih. Tu se kaže prepričanje, da je logika vere povsem drugačna od logike razuma, ki misli znotraj naravnega zadržanja. Naravno zadržanje imenuje Husserl tisto držo, ki si jo človek izoblikuje v skladu s potrebami svojega vsakdanjega življenja, svojih načrtov in potreb. Vera je neodvisna od ekonomije, ki obvlada človekovo naravno držo. Za Kierkegaarda, ki je kasneje prevzel to Tertulijanovo antitezo med razumom in vero, je absurdnost ali norost vere prav potrditev avtentičnosti vere.

To skrajno izključujoče stališče, ki ga najdemo pri sv. Pavlu, Tertulijanu ali Kierkegaardu, pa ni značilno za celotno zgodovino odnosov med vero in razumom. V 17. stoletju najdemo t.i. »mojzesovske in krščanske filozofe«, ki so menili, da so v razodetju, tj. v *Svetem pismu* utemeljene vsakovrstne znanosti. Ti niso govorili samo o krščanski filozofiji, ampak tudi o krščanskem pravu, o krščanski etiki in celo o krščanski fiziki. Do sprave med »znanostjo vere« ‹Glaubenswissenschaft› in filozofijo kot znanostjo uma ‹Vernunftwissenschaft› je prišlo tudi v poznem nemškem idealizmu (Christian Hermann Weiße).

Zgodovina odnosov med vero in razumom le kaže, da je razmerje med njima kompleksno, nikakor enoumno, a tudi ne nemogoče. Tega se je zavedala že pozna antika, v kateri sta razum in vera stopala vedno bolj v dialog, pa tudi srednji vek, v katerem je teologija kot znanost o veri nastala. Z Anzelmovimi besedami opredeljujemo teologijo kot »vero, ki hoče biti umljiva« ‹fides quaerens intellectum›.

Teologija nikakor ni filozofija religije, ki je antropološki razmislek o religiji in verovanju, ampak je njen predmet ‒ kakor beseda pove ‒ Bog.

Zgodovina odnosov med vero in razumom je pokazala, da Bog, kolikor je predmet razuma v teologiji, narekuje specifično metodologijo. Teologija ne more prevzeti metodologije, ki jo uporabljajo naravoslovne, družboslovne ali druge znanosti. Zaradi tega pa ji še vedno ne smemo odrekati umnosti. Še enkrat prisluhnimo nekaterim mislim, ki jih je zapisal Pascal: »Vera se razlikuje od dokaza: le-ta je človeški, ona je božji dar. *Justus ex fide vivit* (Rim 1,17; Gal 3,11): se pravi iz tiste vere, ki jo Bog sam vsadi v srce in za katero je dokaz pogost pomoček, *fides ex auditu* (Rim 10,17); a ta vera je v srcu in nas navaja, da ne govorimo *scio*, marveč *credo*« (Pascal 1986, 119). Za tem pa razpravlja tudi o dokazih za vero. Našteje naslednje dokaze: morala, nauk, čudeži, prerokbe, predpodobe, krščanska vera sama po sebi, svetost, veličastnost *Svetega pisma*, Jezus Kristus posebej, apostoli, Mojzes in preroki, Judovski narod, prerokbe, trajnost krščanstva, njegov nauk (ki vse razloži), svetost njegove postave in vodenje sveta« (Pascal 1986, 128-129).

V teh Pascalovih mislih in argumentih najdemo elemente, na katerih stoji teologija kot znanost o Bogu. Teologija se od teoretičnih znanosti razlikuje po tem, da izhaja iz poslušanja, ne iz gledanja. Evangelist Janez je glede tega povsem jasen: »Boga ni nikoli nihče videl« (Jn 1,18). Prav tako sv. Pavel jasno pove, da vera ni gledanje: »V veri hodimo in ne v gledanju« (2 Kor 5,7). Ali pa drugje: »Je pa vera [...] zagotovilo stvari, ki jih ne vidimo« (Heb 11,1). V nasprotju s predstavami in shemami, v katerih teoretične znanosti skladiščijo svoja objektivirana spoznanja, izhaja teologija iz čiste, neposredne poslušnosti. Vera ni nevtralen, predmetni *govor o* nečem, ampak je poslušno sprejemanje božje besede in pričevanja. Živega Boga, ki je navzoč v pričevanju, ni mogoče spremeniti v predmet. Med božjo besedo ali kakšnim drugim pričevanjem in življenjem ni vmesnega, teoretičnega prostora, ki bi me oddaljeval od stvari. Kakor živega človeškega obraza ni mogoče spremeniti v predstavo, tako tudi Boga in njegove Besede ni mogoče spremeniti v teorijo. Teologija je zato praktično védenje. Aristotel kot *prāxis* označi tisto védenje, ki ni posredovano prek predstav in shem. Z drugimi besedami: je védenje, ki ne temelji na epistemološkem odmiku. To je védenje o tistem, česar mi zaradi njegove bližine ne uspe objektivirati in spremeniti v predmet. Če si zopet prikličemo v spomin Pascala, ki pravi: »Ne bi me iskal, če me ne bi že imel« (Pascal 1986, 208).

4. Resnica v veri

V tem se kaže povsem drugačen status, ki ga ima resnica v teologiji in praktičnem védenju kakor v teoretičnih znanostih. V teoretičnih znanostih je resnica opredeljena kot skladnost med razumom in njenim predmetom. V praktičnem védenju pa resnice ne moremo opredeliti kot skladnosti, saj med védenjem in njegovim predmetom ni tistega epistemološkega odmika ali razdalje, ki bi omogočil vzpostavljanje skladnosti. Resnico, ki jo najdemo na ravni praktičnega védenja, je Kierkegaard opredelil z besedami: »Subjektivnost je resnica« (Kierkegaard 1977, 174). Merilo resnice torej ni izven subjekta, ampak v njem, kar pa nikakor ne pomeni, da ta resnica ni objektivna. Biti moramo še natančnejši! Kierkegaard ne govori o subjektu, ampak o subjektivnosti. Subjektivnost je stanje subjekta, v katerega vstopi, ko sprejme Božjo besedo in nanjo v veri odgovori. Subjektivnost je uresničenost subjekta, do katerega se povzpne s svojimi odločitvami. Tudi za Kierkegaarda »vera verjame, česar ne vidi.« Zato pa »sklep vere ni nikakršen sklep, temveč odločitev« (Kierkegaard 1987, 87, 89). V veri je vedno navzoče neko *več*, neki presežek, nekaj, česar ne morem domisliti in izpeljati in se zato kaže kot paradoks oz. absurd. Zato je vera skok, tj. odločitev, in ne sklep. Odločitev ali skok pa je tudi tisti moment, ki konstituira subjektivnost, subjekt v njegovi posamičnosti in avtentičnosti. Na ravni *prāxis* resnica ni povezovanje različnih miselnih predstav, ampak odločanje in dejanje. Bistvo resnice je v tem, *kako* sem: »'Kako' resnice je pravzaprav resnica« (Kierkegaard 1977, 22). Na izvorni ravni človeškega bivanja resnica ni »govor o nečem«, ampak življenje samo. Na tej izvorni ravni se resnica ne kaže v stavčnih vsebinah, ampak v slogu življenja, v subjektivnosti.

To več, za katero Pascal pravi, da ga ne bi iskali, če ga ne bi že imeli, je neizbežna danost, ki je človek ne more zaobiti. Novoveška filozofija je poudarjala transcendentalno, konstruktivistično razsežnost človeškega duha, v moči katere sooblikuje stvarnost. Tega presežka, ki je globlji od človekove najgloblje notranjosti, pa ni mogoče sooblikovati. Človek ga sprejema kot čisto, kategorično danost. Še preden jo objektivira, stoji ta danost pred njim kakor »notranji učitelj«, ki je v njem globlji kakor njegova najgloblja notranjost (sv. Avguštin), ali kot »notranja Beseda« (H.-G. Gadamer). Bog, ki je predmet teologije, je torej predmet na čisto poseben način. Je predmet v nepogojeni, kategorični obliki in se razkriva kot absolutna resnica. Kot absolutne resnice ga ni mogoče pogojevati; lahko ga le sprejmemo ali ne sprejmemo. Kolikor pa človek absolutno resnico sprejme, to pomeni tudi že spreobrnjenje ‹metanoia›. Sprejeti resnico v praktičnem smislu pomeni istočasno spremeniti slog svojega življenja in ga uskladiti s sprejeto resnico. Tu ne gre za usklajevanje stavkov ali sodb s predmeti, ki jih stavki opisujejo, ampak za usklajevanje načina življenja z razodeto vsebino vere. Ni mogoče sprejeti vere, ne da bi spremenili način življenja. »Vera brez del je mrtva« (Jak 2,26).

Znanstvenost pomeni uskladiti svoja iskanja s predmetom iskanja. Bog kot predmet teologije je predmet v povsem edinstvenem smislu. Zato je nemogoče govor o Bogu podrediti metodologijam, ki izhajajo iz drugih raziskovalnih področij, npr. s področja sociologije, psihologije ali celo s področja naravoslovja. Vse te znanosti seveda lahko s svojega vidika govorijo o Bogu, zavedati pa se morajo, da so njihova spoznanja omejena zgolj na obrobne pojave verovanja. Edino merilo *teo*-logije je Bog sam, ki pa ga nihče ne more videti. Ker pa se razodeva na predmeten način v osebi Jezusa Kristusa, kot Beseda, je norma teološkega spoznanja Jezus Kristus. Korektiv teologije je torej Jezus Kristus, zgodovinsko dejstvo, oseba, ki živi in govori. Zato je teologija pozitivna znanost. Toda Jezus Kristus ni njena zadnja postaja. Koraka, ki ga naredi v veri v Jezusa Kristusa onstran njega v smeri nevidnega Boga, ne naredi več v svoji lastni moči. Ta korak ji je dan v moči vere, ki ne hodi v gledanju, ampak v poslušnosti. Tega momenta razum ne obvlada več in ga ne more objektivirati. Na to spoznanje, ki ji je dano v veri, se lahko samo pripravlja s spreobračanjem. Sestavni del teološke metodologije je zato tudi molitev. Brez nje ni teološkega spoznanja. Ta temeljni vidik teologije je znan pod imenom »klečeča teologija«.

5. Teologija v *universitas scientiarum*

Intencionalnosti teološke misli takó ne zapolni noben predmet. Usmerja se k Jezusu Kristusu, ki jo preusmerja onstran sebe v nevidno. Vsebina teološke intencionalnosti je torej ne-vsebina. Teološka intencionalnost zavesti ne napolnjuje, ampak jo prazni in »polni« z ne-vsebino. Latinski izraz, ki ga je mistična teologija uporabila za oznako tega dogajanja, je *humilitas animi* ‹ponižnost duha›.

Če se vrnemo k temi, ki smo jo izbrali za naslov »Teologija in uporaba razuma«, lahko rečemo, da poklic teologije ni samo ta, da misli Boga, ampak tudi ta, da »servisira« razum, ga prečiščuje in usposablja za odgovorno mišljenje. Tako mu pomaga, da se lažje upira že davno poznani *hybris*, ki bi ga zaradi njegovih neslutenih zmožnosti lahko zaslepila in potisnila v patološko stanje. Zato je papež Janez Pavel II. svojo okrožnico *Vera in razum* povsem upravičeno začel z mislijo, da sta »vera in razum kot dve krili, ki omogočata človeškemu duhu, da se dvigne k zrenju resnice.« V že omenjenem pogovoru Joseph Ratzinger in Jürgen Habermas nista mislila na nič drugega kakor na to. Zato lahko sklenemo z mislijo, ki jo je papež Benedikt XVI. izrekel 12. septembra letos v Regensburgu, da študij teologije opravlja poslanstvo, ki je »nujno del ‘celote’ *universitas scientiarum*, četudi morda vera ni vsem skupna.«

Seznam referenc:

Kierkegaard, Søren. 1977. *Oeuvres complètes*, 11: *Post-scriptum définitif et non scientifique aux Miettes philosophiques*. Pariz.

Kierkegaard, Sören. 1987. *Ponovitev. Filozofske drobtinice ali drobec filozofije.* Ljubljana: Slovenska matica.

Pascal, Blaise. 1986. *Misli.* Celje: Mohorjeva družba.

TEMELJI RELIGIOZNOSTI: ZGODNJA NAVEZANOST NA OČETA IN MATER KOT PREDIKTOR NAVEZANOSTI NA BOGA IN MARIJO

Barbara Simonič, *Robert Cvetek*
Frančiškanski družinski inštitut
Prešernov trg 4, 1000 Ljubljana, Slovenija
Tel: +386 1 2006760; fax: +386 1 2006766
e-mail: barbara.simonic1@guest.arnes.si; robert.cvetek@guest.arnes.si

POVZETEK
Raziskava izhaja iz predpostavke, da načini vzpostavljanja in vzdrževanja odnosov, kakor tudi njihove značilnosti v odrasli dobi temeljijo na preteklih odnosih, kjer je posameznik doživljal neko čustveno globino ter stik in v katerih se je oblikovala njegova psihična struktura. Tudi na odnos z Bogom in Marijo (Božjo materjo) naj bi bilo mogoče gledati skozi zaznamovanost z zgodnjimi odnosi. Namen te raziskave je bil prispevati k dosedanjim raziskavam o zgodnji navezanosti na očeta in mater ter navezanosti na Boga in Marijo v odrasli dobi ter povezavi med temi navezanostmi. Uporabljeni vprašalnik je meril tipe navezanosti na očeta in mater v otroštvu ter tipe navezanosti na Boga in Marijo v odrasli dobi. V raziskavi je sodelovalo 84 udeležencev iz različnih verskih skupin s katoliškim ozadjem. Rezultati nakazujejo, da navezanost na očeta in mater v otroštvu lahko delno pojasnjuje navezanost na Boga in Marijo v odrasli dobi, vsaj pri nekaterih vrstah navezanosti. Obstaja trend, da udeleženci oblikujejo podoben odnos navezanosti z Bogom in malo manj z Marijo, kakršnega so imeli v otroštvu (predvsem z materjo), kar se kaže pri nekaterih ne-varnih navezanostih. Vendar pa je povezava med določenimi navezanostmi dokaj nizka, kar nakazuje, da je navezanost na Boga in Marijo močno odvisna tudi od drugih faktorjev.

1. Uvod

Teorija o navezanosti

Posameznikovo dojemanje sebe, drugih in čustvenih vezi v medosebnih odnosih se oblikuje preko odnosov s pomembnimi ljudmi, zlasti s starši ali primarnimi skrbniki v najzgodnejšem obdobju življenja (npr. Gostečnik, Kompan-Erzar, Erzar in Cvetek, 2005; Kompan-Erzar, 2003). O tem govori tudi teorija o navezanosti (*angl. attachment theory*), ki jo je oblikoval britanski psihoanalitik John Bowlby (1973, 1980, 1982), kasneje pa so jo z raziskavami nadgradili Mary Ainsworth (Ainsworth, Blehar, Waters in Wall, 1978) in mnogi drugi (npr. Bartholomew, 1990; Hazan in Shaver, 1987, 1990, 1994).

Bowlby trdi, da otrok preko relacijskih komponent (sesanje, smeh, privijanje, jok in sledenje), ki jih ima že ob prihodu na svet, vstopi v socialno interakcijo in v primarnem skrbniku aktivira določeno stopnjo odzivnosti in ga tako prikliče v odnos (Fonagy, 2001; Gostečnik, 2005). Brez tega odnosa navezanosti otrok ne bi preživel, saj potrebuje fizično in čustveno bližino primarnega skrbnika oz. osebe navezanosti (*angl. attachment figure*) (Kirkpatrick, 1992). Mary Ainsworth, ki se je med prvimi veliko ukvarjala z empiričnim raziskovanjem navezanosti, je v opisovanju navezanosti poudarila štiri kriterije: ohranjanje bližine z osebo navezanosti (*angl. maintaining proximity*), dojemanje osebe navezanosti kot varne, trdne osnove za raziskovanje okolja (*angl. secure base*), dojemanje osebe navezanosti kot nekoga, ki nudi varno pribežališče (*angl. haven of safety*) in doživljanje separacijske tesnobe (*angl. separation anxiety*), kadar se oseba navezanosti umakne, kar vodi tudi v žalovanje, če je oseba navezanosti izgubljena (Ainsworth, 1985; po Beck in McDonald, 2004). Na osnovi raziskav Ainsworthove (ločevanje in ponovno vzpostavljanje stika med eno do dvoletnimi otroci in njihovimi skrbniki) ter poznejših raziskav so ugotovili, da lahko ločimo tri tipe navezanosti: **varna** navezanost, ki predstavlja optimalno obliko navezanosti in je kontrastna ne-varnima oblikama navezanosti (**izogibajoča** navezanost in **ambivalentna** navezanost). Kasneje je bil v raziskavah dodan še četrti tip navezanosti, ki ga imenujemo dezorganizirana navezanost (npr. Fonagy, 2001; Gostečnik, 2001; Main in Solomon, 1990). Tip navezanosti, ki ga je imel posameznik v otroštvu s pomembnimi drugimi, bo v odrasli dobi vplival na kvaliteto kasnejših odnosov v življenju ter zlasti na doživljanje tesnejših, intimnejših odnosov (Brown in Amatea, 2000; Hazan in Shaver, 1987; 1990; 1994), prav tako pa tudi na intimni odnos z Bogom (Kirkpatrick, 1992, 1997, 1999, 2005; Noller, 1992).

Teorija o navezanosti in vera

Teorija o navezanosti predstavlja pomenljiv in uporaben teoretični okvir tudi v psihologiji religije (Kirkpatrick, 1992, 1997, 1999, 2005). Izhodišče za teorijo o navezanosti na področju psihologije religije predstavlja verovanje v osebnega boga, s katerim vernik vzpostavlja osebni in interaktivni odnos (Kirkpatrick, 1999), kar je zlasti značilnost Boga v judovsko krščanski tradiciji ter nekaterih drugih monoteističnih verstvih (Beck in McDonald, 2004). Zato bomo v tem članku osredotočeni na krščansko tradicijo. Oseba navezanosti je lahko tudi drugo religiozno bitje, kot je Marija, razni svetniki, zavetniki in podobno.Ljudje Boga dojemamo kot osebo navezanosti, kjer je mogoče najti trdnost in varnost, kar je velikokrat že razvidno iz samih besed vernikov (npr. Bog je »zaščita«, »varnost«, »moč«). Odnos z Bogom ustreza konceptu navezanosti tudi zaradi tega, ker ustreza vsem štirim kriterijem, ki jih je pri opisovanju navezanosti oblikovala Ainsworthova (1985; po Beck in McDonald, 2004). Bližino z Bogom posameznik utrjuje preko simbolov, ritualov in z molitvijo (Byrd in Boe, 2001). Varno pribežališče ljudje v odnosu z Bogom iščejo zlasti v stiski, še posebej v takšni, kjer se bo aktiviral sistem navezanosti (smrt bližnje osebe, ločitev, čustvene krize, problemi v odnosih). Bog je dojet tudi kot »pastir«, »oče«, »ščit«, v navzočnosti katerega je mogoče varno odhajati v vsakdanje življenje. Pojavijo pa se tudi trenutki obupa in izpraznjenosti, v katerih lahko posameznik doživlja odsotnost Boga in se zato sooča s tesnobnimi občutki (Birgegard in Granqvist, 2004). Prav tako pa je mogoče v navezanosti na Boga ločevati med varno in ne-varno navezanostjo in identificirati štiri tipe navezanosti (Belavich in Pargament, 2002).

Raziskave o navezanosti in odnosu do Boga dejansko potrjujejo, da Bog za mnoge posameznike ima psihološko funkcijo osebe navezanosti (Beck in McDonald, 2004; Belavich in Pargament, 2002; Birgegard in Granqvist, 2004; Cicirelli, 2004; De Roos, Miedema in Iedema, 2001; Granqvist, 1998; Granqvist in Hagekull, 1999, 2000, 2001; Granqvist in Kirkpatrick, 2004; Kirkpatrick, 1992, 1997, 1998; Kirkpatrick in Shaver, 1990, 1992; McDonald, Beck, Allison in Norsworthy, 2005; Sim in Loh, 2003; TenElshof in Furrow, 2000). Glede vpliva zgodnje navezanosti raziskave prinašajo kontradiktorne rezultate, saj potrjujejo dve diametralno nasprotni si hipotezi (Simonič, 2006). Hipoteza o skladnosti (*angl. correspondence hypothesis*) pravi, da zgodnji odnosi zagotavljajo temelje, na katerih so zgrajeni bodoči odnosi, vključno odnos z Bogom. Oblika navezanosti v odnosu z Bogom je tako oblikovana na osnovi odnosov navezanosti, ki jih je človek izkusil v svojem življenju. Hipoteza o kompenzaciji (*angl. compensation hypothesis*) pa predpostavlja, da se osebe z ne-varno navezanostjo nagibajo k temu, da odsotnost ljubečih in varnih skrbnikov nadomestijo z nadomestno osebo navezanosti, ki jo lahko predstavlja tudi Bog (Kirkpatrick, 1992, 1997, 1999, 2005).

2. Opredelitev raziskovalnega problema

V dosedanjih raziskavah povezava med navezanostjo v otroštvu (največkrat na mater) in navezanostjo na Boga ni povsem jasna (Granqvist in Hagekull, 1999; Simonič, 2006). Avtorji predvidevajo, da naj bi navezanost na Boga združevala tako navezanost na mater kot tudi očeta, vendar je tudi to bilo slabo empirično preverjeno. V dosedanjih raziskavah tudi ni jasno, kakšno povezavo ima navezanost na Božjo mater Marijo (v nadaljevanju: Marijo) z navezanostmi na Boga, očeta in mater. Zato smo želeli s to raziskavo prispevati k dosedanjim raziskavam in jasnosti glede povezanosti med navezanostjo v otroštvu (na očeta in na mater) ter navezanostjo na Boga in Marijo v odrasli dobi. Preveriti smo želeli, ali gre pri navezanosti na Boga in Marijo za različne značilnosti navezanosti (podobno kot za navezanosti na očeta in navezanosti na mater).

3. Metoda

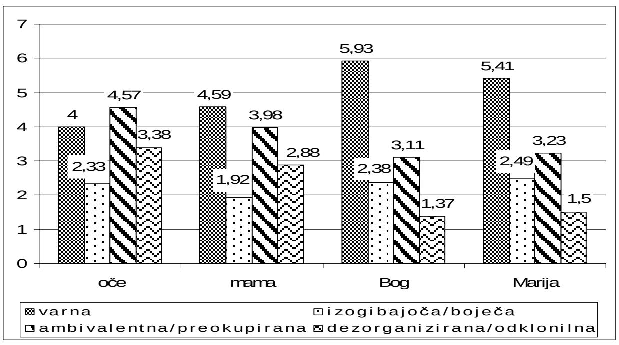
V raziskavi je sodelovalo 84 prostovoljnih udeležencev iz 9 različnih skupin, ki imajo katoliško versko ozadje. Za otroško navezanost na vsakega izmed staršev oz. osebo navezanosti je bil uporabljen preveden in prirejen vprašalnik Hazan-a in Shaver-ja (1987), za ocenjevanje navezanosti na Boga in Marijo pa Relationship Questionnaire (RQ, Bartholomew in Horowitz, 1991). Udeleženci so vprašalnike dobili, prostovoljno izpolnili in oddali na rednih srečanjih skupin, od koder prihajajo.

4. Rezultati

Tabela 1: Razdelitev udeležencev (število in procenti) glede na izbor posamezne navezanosti (v delu vprašalnika, kjer so se udeleženci morali opredeliti za en tip navezanosti)

*Opomba. * navezanost pri očetu in materi, ** navezanost pri Bogu in Mariji*

	Varna navezanost	Ne-varna navezanost			
		izogibajoča*/ boječa**	ambivalentna*/ preokupirana**	dezorganizirana */ odklonilna /izogibajoča**	ne-varna skupaj
Navezanost na očeta (N=81)	26 (32,1 %)	3 (33,7 %)	38 (46,9 %)	14 (17,3 %)	55 (67,9 %)
Navezanost na mater (N=82)	38 (46,3 %)	5 (6,1%)	30 (36,6 %)	9 (11 %)	44 (53,7 %)
Navezanost na Boga (N=83)	62 (74,7 %)	8 (9,6 %)	13 (15,7 %)	0 (0 %)	21 (25,3 %)
Navezanost na Marijo (N=79)	54 (68,4 %)	8 (10,1%)	16 (20,3%)	1 (1,3%)	25 (32 %)



Slika 1: povprečja za tipe navezanosti na očeta, mater, Boga in Marijo (v delu vprašalnika, kjer udeleženci ocenjujejo, koliko vsi tipi navezanosti veljajo za njih)

Tabela 2: Korelacije (Pearsonov korelac. koeficient) med tipi navezanosti na starše ter tipi navezanosti na Boga in Marijo (v delu vprašalnika,)

	V-	I - oče	A-	D-	V-	I-mati	A-	D-
V-	,000	,103	,127	,097	,034	-,131	-,044	,053
B/I-	-,089	,028	-	,023	-	,300**	,225*	-,026
P-Bog	-,180	,303**	,202	,177	-	,153	,365**	,152
O/I-	,055	,072	-	-,163	-	-,032	-,096	-,100
V-	,001	,101	,156	,158	,059	-,180	,025	-,016
B/I-	-,067	,016	-	,004	-	,382**	,144	-,017
P-	-,039	,137	,005	,059	-	,200	,138	,168
O/I-	,004	,138	-	-,058	,036	,181	-,143	-,041

*Opomba. V-varna navezanost; I-izogibajoča navezanost; A-ambivalentna navezanost; D-dezorganizirana navezanost; B/I-boječa/izogibajoča navezanost; P-preokupirana navezanost; O/I-odklonilna/izogibajoča navezanost; **-korelacija je pomembna na 1%-nem nivoju; *-korelacija je pomembna na 5 %-nem nivoju*

5. Razprava

Rezultati so pokazali, da je večina udeležencev našla v odnosu z Bogom varno navezanost (74%), prav tako je večina varno navezanih na Marijo (68%), medtem ko je manj varno navezanih na očeta ali mater. Lahko sklepamo, da je vsaj delež tistih, ki so ne-varno navezani na starše, našlo v Bogu in Mariji nadomestno osebo za varno navezanost.

V tej raziskavi so se pokazale nižje pozitivne povezave med določenimi vrstami navezanosti na očeta/mater ter podobnimi vrstami navezanosti na Boga/Marijo. Te ugotovitve so primerljive z nekaterimi drugimi raziskavami (npr. Sim in Loh, 2003). Pri korelacijah navezanosti na očeta ter navezanosti na Boga ter Marijo ne najdemo statistično pomembnih povezav, razen med izogibajočo navezanostjo na očeta ter preokupirano navezanostjo na Boga. Iz pomanjkanja statistično pomembnih povezav pri navezanosti na očeta torej ne moremo sklepati ne na hipotezo o skladnosti (med podobnimi navezanostmi bi morale obstajati pomembne pozitivne korelacije), ne na hipotezo o kompenzaciji (med podobnimi navezanostmi bi morale obstajati pomembne negativne korelacije). Možno je tudi, da za nekatere velja hipoteza o skladnosti, za druge pa hipoteza o kompenzaciji, kar se pri skupnem izračunu kaže kot korelacija okrog nič. Več statistično pomembnih povezav ter njihove višje vrednosti pa najdemo pri navezanosti na mater na eni strani in navezanostjo na Boga in Marijo na drugi strani. Te govorijo nekoliko v prid hipotezi o skladnosti. Tisti, ki so imeli bolj ne-varne navezanosti na mater (izogibajoče, ambivalentne), imajo večjo verjetnost, da bodo imeli bolj ne-varno (boječe/izogibajoče, preokupirane) navezanosti na Boga. To pa ne velja za varno navezanost (ocene varne navezanost na mater imajo skoraj nične povezave z ocenami varne navezanosti na Boga in Marijo, razen morda z boječo/izogibajočo navezanostjo na Boga in Marijo). Tudi tukaj je potrebno upoštevati to, da za nekatere verjetno velja hipoteza o skladnosti, za druge pa hipoteza o kompenzaciji, kar znižuje skupno povezanost.

Zaključimo lahko, da rezultati te raziskave nakazujejo, da navezanost na očeta in mater lahko v določeni meri (vsaj pri nekaterih vrstah navezanosti) pojasnjuje navezanost na Boga in Marijo. Obstaja trend, da udeleženci oblikujejo takšen odnos glede navezanosti z Bogom in malo manj z Marijo, kakršnega so imeli v otroštvu (predvsem z materjo), kar se kaže pri nekaterih ne-varnih navezanostih. V dokajšni meri pa so navezanosti na Boga in Marijo neodvisne od navezanosti na mater in očeta. Kaže, da so navezanosti na Boga in Marijo močno odvisne tudi od drugih faktorjev, ki pa bi jih bilo potrebno nadalje raziskati.

Pomembno se nam zdi, da rezultati te raziskave nakazujejo, da lahko tudi tisti, ki nimajo najbolj optimalne (varne) navezanosti z materjo ali očetom, v odnosu do Boga ali Marije ustvarijo in predvidevamo, da tudi koristijo kvalitete varne navezanosti. Rezultati tudi kažejo, da gre pri navezanosti na Boga in navezanosti na Marijo za povezane, vendar razmeroma neodvisne značilnosti navezave (podobno kot med navezanostjo na očeta in navezanostjo na mamo). Ob zaključkih pa je potrebno upoštevati tudi omejitve raziskave (npr. udeleženci so bili le iz verskih skupin).

REFERENCE:

Ainsworth, M.D.S., Blehar, M.C., Waters, E. in Wall, S. (1978). *Patterns of attachment: A psychological study of the strange situation.* Hillsdale, NJ: Lawrence Erlbaum.

Bartholomew, K. (1990). Avoidance of intimacy: An attachment perspective. *Journal of Social and Personal Relationships, 7,* 147-178.

Bartholomew, K. in Horowitz, L.M. (1991). Attachment styles among young adults: A test of a foour-category model. *Journal of Personality and Social Psychology, 61,* 226-244.

Beck, R. in McDonald, A. (2004). Attachment to God: The Attachment to God Inventory, Tests of Working Model Correspondence, and an Exploration of Faith Group Differences. *Journal of Psychology and Theology, 32*(2), 92-103.

Belavich, T.G. in Pargament, K.I. (2002). The Role of Attachment in Predicting Spiritual Coping With a Loved One in Surgery. *Journal of Adult Development, 9*(1), 13-29.

Birgegard, A. in Granqvist, P. (2004). The Correspondence between Attachment to Parents and God: Three Experiments using Subliminal Separation Cues. *Personality and Social Psychology Bulletin, 30*(9), 1122-1136.

Bowlby, J. (1973). *Attachment and loss: Vol. III, Loss, sadness and depression.* New York: Basic Books.

Bowlby, J. (1980). *Attachment and loss: Vol. II, Separation, anxiety and anger.* New York: Basic Books.

Bowlby, J. (1982). *Attachment and loss: Vol. I, Attachment.* New York: Basic Books.

Brown, N.M. in Amatea, E.S. (2000). *Love and Intimate Relationships.* Philadelphia: Brunner/Mazel.

Byrd, K.R. in Boe, A. (2001). The Correspondence Between Attachment Dimensions and Prayer in College Students. *The International Journal for the Psychology of Religion, 11*(1), 9-24.

Cicirelli, V.G. (2004). God as the ultimate attachment figure for older adults. *Attachment & Human Development, 6*(4), 371-388.

DeRoos, S.A., Miedema, S. in Iedema, J. (2001). Attachment, Working Models of Self and Others and God Concept in Kindergarten. *Journal for the Scientific Study of Religion, 40*(4), 607-618.

Fonagy, P. (2001). *Attachment Theory and Psychoanalysis.* London: Karnac.

Gostečnik, C. (2001). *Poskusiva znova.* Ljubljana: Brat Frančišek in Frančiškanski družinski inštitut.

Gostečnik, C. (2005). *Psihoanaliza in religiozno izkustvo.* Ljubljana: Brat Frančišek in Frančiškanski družinski inštitut.

Gostečnik, C., Kompan-Erzar, L.K., Erzar, T. in Cvetek, R. (2005). Relacijski temelji emocionalne inteligentnosti. V Pavšič, M., Salobir, M. in Jeraj, M. (ur.), *Inteligentnost, ustvarjalnost, nadarjenost: zbornik razprav* (str. 155-163). Ljubljana: Društvo psihologov Slovenije.

Granqvist, P. (1998). Religiousness and Perceived Childhood Attachment: On the Question of Compensation or Correspondence. *Journal for the Scientific Study of REligion, 37*(2), 350-367.

Granqvist, P. in Hagekull, B. (1999). Religiousness and Perceived Childhood Attachment: Profiling Socialized Correspondence and Emotional Compensation. *Journal for the Scientific Study of Religion, 38*(2), 254-274.

Granqvist, P. in Hagekull, B. (2000). Religiosity, Adult Attachment, and why »Singles« are more Religious. *International Journal for the Psychology of Religion, 10*(2), 111-123.

Granqvist, P. in Hagekull, B. (2001). Seeking Security in the New Age: On Attachment and Emotional Compensation. *Journal for the Scientific Study of Religion, 40*(3), 527-545.

Granqvist, P. in Kirkpatrick, L.A. (2004). Religious Conversion and Perceived Childhood Attachment: A Meta Analysis. *The International Journal for the Psychology of Religion, 14*(4), 223-250.

Hazan, C. in Shaver, P.R. (1987). Romantic Love Conceptualized as an Attachment Process. *Journal of Personality and Social Psychology, 52*(3), 511-524.

Hazan, C. in Shaver, P.R. (1990). Love and Work: An Attachment-Theoretical Perspective. *Journal of Personality and Social Psychology, 59*(2), 270-280.

Hazan, C. in Shaver, P.R. (1994). Attachment as an Organizational Framework for Research on Close Relationships. *Psychological Inquiry, 5,* 1-22.

Kirkpatrick, L.A. (1992). An Attachment-Theory Approach to the Psychology of Religion. *The International Journal for the Psychology of Religion, 2*(1), 3-28.

Kirkpatrick, L.A. (1997). A Longitudinal Study of Changes in Religious Belief and Behavior as a Function of Individual Differences in Adult Attachment Style. *Journal for the Scientific Study of Religion, 36*(2), 207-217.

Kirkpatrick, L.A. (1998). God as a substitute attachment figure: A longitudinal study of adult attachment style and religious change in college students. *Personality and Social Psychology Bulletin, 24,* 961-973.

Kirkpatrick, L.A. (1999). Attachment and Religious Representations and Behavior. V Cassidy, J. in Shaver, P.R. (ur.), *Handbook of Attachment: Theory, Research, and Clinical Applications* (803-822). New York: Guilford.

Kirkpatrick, L.A. (2005). *Attachment, Evolution and the Psychology of Religion.* New York: The Guilford Press.

Kirkpatrick, L.A. in Shaver, P.R. (1990). Attachment Theory and Religion: Childhood Attachments, Religious Beliefs, and Conversion. *Journal for the Scientific Study of Religion, 29*(3), 315-334.

Kirkpatrick, L.A. in Shaver, P.R. (1992). An Attachment-Theoretical Approach to Romantic Love and Religious Belief. *Personality and Social Psychology Bulletin, 18,* 266-275.

Kompan-Erzar, L.K. (2003). *Skrita moč družine.* Ljubljana: Brat Frančišek in Frančiškanski družinski inštitut.

Main, M. in Solomon, J. (1990). Procedures for identifying infants as disorganized/disoriented during the Ainsworth strange situation. V M.T. Greenberg, D. Cicchetti in E.M. Cummings (ur.), *Attachment in the preschool years (*pp. 121-160). Chicago: University of Chicago Press.

McDonald, A., Beck, R., Allison, S. in Norsworthy, L. (2005). Attachment to God and Parents: Testing the Correspondence vs. Compensation Hypotheses. *Journal of Psychology and Christianity, 24*(1), 21-28.

Noller, P. (1992). Religion Conceptualized as an Attachment Process: Another Deficiency Approach to the Psychology of Religion. *The International Journal for the Psychology of Religion, 2*(1), 29-36.

Sim, T.N. in Loh, B.S.M. (2003). Attachment to God: Measurement and dynamics. *Journal of Social and Personal Relationships, 20*(3), 373-389.

Simonič, B. (2006). Antropološko-psihološke in teološke osnove prenašanja vrednot: zgodnja navezanost na starše in temelji religioznosti. *Bogoslovni vestnik, 66*(1), 123-136.

TenElshof, J.K. in Furrow, J.L. (2000). The role of secure attachment in predicting spiritual maturity of students at a conservative seminary. *Journal of Psychology and Theology, 28,* 99-108.

Živa prisotnost boga v sodobnih templjih
Living Presence of God in Modern Temples

Barbara Škoberne
Center za duhovno kulturo, Duhovna univerza
Ruska 13, SI-1000 Ljubljana
e-mail: barbara.skoberne@cdk.si

Abstract
Is it possible to investigate into the living presence of god? Scientists have been trying to interpret religions, but the point is to experience what religions are (speaking) about. The article reports on unusual phenomena in London temples (Christian, Hindu and Muslim) in summer 2006. The end conclusions are, firstly, that the temple of god is anyplace where god lives and is experienced, and secondly, that god does not know any restrictions (limits) as to how, when and in what shape to approach people.

Uvod

Ali je možno znanstveno raziskovati živo prisotnost boga?

(a) S stališča znanosti lahko rečemo, da načeloma da. Ker v znanosti velja, da ni nobena znanstvena teorija dokončna, oziroma velja samo na osnovi do sedaj znanih dejstev. Ko odkrijemo nova dejstva, ali pa začenjamo upoštevati že znana dejstva, ki jih iz raznih razlogov prej nismo upoštevali, moramo pogosto stare teorije dopolniti ali celo spremeniti. Znanost, ki se je izvila iz filozofsko-religiozne miselnosti in vpeljala svoj lastni nazor in metodologijo, je postala zelo uspešna in zaradi tega vzvišena nad tistimi pojavi, ki se ne ujemajo z njeno paradigmo. Razumljivo, če je teorija uspešna, kar se kaže v uspehu tehnologije, čemu si beliti glavo zaradi nekih paranormalnih, čudežnih pojavov. Vse to z eno kretnjo vržeš v koš domišljije, prevar in naivnosti.
(b) Kaj pa s stališča 'boga'? Če stopa v svet ljudi, potem verjetno dovoli, da mu ukrojimo mero. 'Meter' je ratio – razum. Ta pripada človeku. Kot pravi Protagora: "Vseh stvari merilo je človek, bivajočih, kako so, nebivajočih, kako niso."
Bog verjetno nima osebne izkaznice z imenom in priimkom, naslovom in poklicem, ki ga opravlja. Ali pač? Je sveta Trojica, Alah, Brahman, Dao, ... ? Domuje v onstranstvu, v nebesih teistov, v naravi panteistov, v srcu mistikov, v svetiščih vernikov, povsod in nikjer? Je po poklicu stvarnik, tolažnik, vrhovni sodnik, Oče (in Mati), ali pa je summa summarum vseh energij, vseh zavesti in vse inteligence? Je bog sploh še živ ali pa je umrl z razumsko-kritično mislijo in že s Ksenofanom, če ne z Nietzschejem? Kakorkoli že, bodimo še tako razumsko kritični, skeptični in posmehljivi, v različnih religijah in v številnih izkušnjah mnogih ljudi, vernih ter tudi nevernih, je bog še kako živ, ne samo kot versko prepričanje ali srčna vera ampak kot neizpodbitno dejstvo.

Znanstveniki so religije različno razlagali, gre pa za to, da jih doživimo

Če bog obstaja in je živ, potem mora biti izkušnja boga temu primerno mogoča. Od subjektivno intimnih, mističnih izkušenj, zamaknjenosti in transa, do čudežnih izkušenj, ki presegajo znane interpretacije. Ali to drži ali ne, sem šla letos poleti (2006) raziskovat v London, v svetovno metropolo, mnogo kulturno in mnogo nacionalno, kjer živijo številne religije in ljudje častijo boga na mnoge načine.
Znanost se začne z objektivnim opazovanjem, torej z empirijo. Namen tega prispevka je opisati tista doživetja, dogodke, pojave, ki delajo katerokoli religijo živo, ki jo dvignejo nad dogme in doktrino v živo izkušnjo. Tako kot je znani indijski jogi in duhovni preroditelj Vivekananda, strasten iskalec resnice in hkrati neomajno privržen zahodnjaškemu racionalnemu pristopu, nekoč vprašal mistika Ramakrišno: "Gospod, ali ste videli boga?" Brez obotavljanja je Ramakrišna odvrnil: "Da, videl sem Boga. Vidim ga tako, kot vidim tebe in mene, samo jasneje ..."
Začnimo zatorej z empirijo. Pustimo pri tem ob strani vnaprejšnje predstave in znane teorije, naj bodo še tako zanesljive. Nove možnosti v znanosti so se odprle tam, kjer je bil um vsaj nekoga dovolj odprt, da ni 'nalival novega vina (pojavov) v stare mehove (stare teorije)'.
Če parafraziram Marxa (11. teza o Feuerbachu): "Znanstveniki so religije različno razlagali, gre pa za to, da jih doživimo." Ali kot pravi kitajski pregovor: "Ena izkušnja je vredna več kot tisoč besed."

Po poteh religioznih pojavov – London, poletje 2006

1. Katedrala svetega Pavla

Katedrala sv. Pavla je mogočna že od zunaj, še posebej pa te prevzame, ko vstopiš vanjo. Za vstop v glavno cerkveno ladjo je potrebno plačati vstopnino. To mi ne gre skupaj: božja hiša in naj plačam vstopnino, če bi želela biti malo v tišini z bogom? To povem gospe za blagajno. Spravim jo v zadrego. Odgovori mi, da lahko pridem po četrti uri, ko je prost vstop, ali pa grem molit v stransko kapelo, ki je ves čas brezplačno na voljo. Zdi se mi, kot da ne govorim jaz, ampak da nekdo govori skozi mene, ko ji odgovorim, da bi si želela iti molit prav takrat in da bi šla rada v glavni del cerkve, ne v stranskega. 'Tam ne boste imeli miru, tam so turisti,' mi pravi. 'Ljudje me ne bodo motili, čutim, da bi rada molila prav v glavnem delu cerkve. Ampak če želite, lahko za to tudi plačam.' Gleda me sekundo, dve in potem pravi, naj grem naprej. 'Ste prepričani, da je tako v redu?' vprašam. 'Lahko plačam.' Gleda me v oči in ponovi, 'Pojdite naprej!'
Ko pridem do stola nekje ob robu glavne cerkvene ladje in se usedem, začutim udarec v sredino prsi, v predelu srca. Solze mi začnejo nekontrolirano teči. Ne razumem, kaj se dogaja, čutim pa, da je dobro in zdravilno, zato se ne upiram. Poiščem sončna očala in si jih nataknem, da ne bi preveč vzbujala pozornosti. Po nekaj minutah se tok solza umiri tako nenadno, kot se je začel. Začutim blago napetost na temenu, vlek navzgor, potegne me v globoko meditacijo. Samo tu in tam registriram zunanje zvoke, na primer, ko po mikrofonu napovejo kratko molitev za uboge in lačne na svetu, čemur notranje pritrdim, da je zelo lepo, da so se spomnili nanje, potem spet zdrsnem v izkušnjo brez zunanjih ali notranjih zaznav. Pravzaprav jo težko opišem, mogoče je še najbližje stanju popolne polnine in popolne praznine vsega in niča … Čez nekaj časa se meditacija sama od sebe konča. Pogledam na uro. Minila je ena ura, čeprav se mi je zdelo, da je trajalo komaj nekaj minut. Turisti se še vedno sprehajajo sem ter tja.

2. Indijski templji

Iščem tempelj, kjer se je zgodil svetovni mlečni čudež in koga (priče), ki je to videl.
Mlečni čudež se je zgodil v četrtek, 21. septembra 1995[1]. Začelo se je v nekem templju v Indiji, kjer je duhovnik med jutranjo daritvijo opazil, da je mleko, darovano bogu Ganeši, izginilo. Novica se je bliskovito razširila po celem svetu, najprej po državah in skupnostih, v katerih živijo hindujci, tudi v Veliki Britaniji. Ljudje so množično drli v templje in gledali, kako mleko izginja. Ponujali so ga celo božanstvom po domovih – in bogovi so vse mleko popili! Božanstvo, ki ga je spilo največ, je bil ravno Ganeša, s slonjo glavo in človeškim trupom, za katerega so hindujci prepričani, da odstranjuje ovire na poti in prinaša v dom radost in blagostanje.
O tem nenavadnem pojavu so obširno poročali televizija, radio in časopisi. Celo skeptiki so ponujali božanstvom žlice z mlekom in niso mogli verjeti, ko so ga ti pred njihovimi očmi 'popili'. Znanstveniki in razni strokovnjaki so poskušali pojav sicer pojasniti z množično histerijo vernikov in s 'kapilarno absorpcijo', po kateri naj bi kipi iz kamna, medenine, srebra, ... 'vsrkavali mleko'. Ne glede na ta strokovna mnenja so množični dokazi govorili v prid temu, da se je zgodil nerazložljiv masovni in svetovni čudež. Na nekaterih lokacijah naj bi se dogajal celo nekaj dni.
Na internetu najdem podatek, da je deset tisoč ljudi - največ zunaj Indije - prisostvovalo mlečnemu čudežu v hindujskem templju v Southallu.
Ker ne vem, kako naj ga najdem, se odpravim v največji indijski tempelj v Londonu (v Neasdenu), ki je hkrati tudi največji, kar jih je zgrajenih zunaj Indije. Če kje, mi bodo tam vedeli kaj povedati. Po avanturi, ki je bila sama polna nenavadnih naključij, najdem Souhallski tempelj.

2.1 Southallski tempelj

'Torej vas zanima čudež z mlekom?' je vprašal gospod Sudarshan Bhatia, predsednik southallskega templja osebno. 'Lord Ganesh je pil mleko tudi tukaj. Pravzaprav je mlečni čudež v tem templju videlo največ ljudi zunaj Indije. Dogodek je bil deležen velike publicitete.' Ste to na lastne oči videli tudi vi? 'Da, jaz in veliko ljudi tukaj okoli je to videlo.'
Gospod Bhatia me je povabil, da se usedem, mi ponudil kozarec vode in potem sva se pogovarjala. Dialog, je rekel, je zelo pomemben. Značilen je za hinduizem. In nadaljeval, da Bhagavadgita, temeljna knjiga hinduizma, temelji na dialogu med bogom (Krišno) in človekom (Ardžuno). Oba, bog in človek, sta v pogovoru enakopravna sogovornika. Iz tega načela oziroma potrebe po dialogu, pogovoru, izhajajo hindujci še danes.
Potem sem šla v dvorano, kjer je Ganeša pil mleko. Vzdolž glavne stene so pisano in zlato odeti kipi hindujskih božanstev. Čisto na koncu je kip

[1] 21. avgusta 2006 so mediji poročali o tem, da se je ta pojav ponovno zgodil na več lokacijah v Indiji.

Ganeše, v beli marmornati vitrini v steni. Predstavljala sem si, da je večji. Oblekli so ga v svileno rdečo-zlato oblekico in poslikali, kot znak spoštovanja, tako da se je zdel še manjši. Za razliko od drugih kipov božanstev, ki so iz mavca in sorazmerno veliki, je ta iz belega marmorja in ni večji od treh decimetrov. Gospa, ki me spremlja, se mu pokloni in mi gestikulirala, naj se mu poklonim tudi jaz. Pomislim, zakaj pa ne: poklon božanstvu sreče in obilja.

2.2 Presenečenja v foto trgovini

Splet naključij ali usoda, naslednji dan mi je dobra znanka, Londončanka, povedala, da se v velikem templju v Neasdenu, kjer sem bila najprej, dogaja 'ongoing miracle': eno izmed tempeljskih božanstev jé hrano, ponujeno kot daritev. O tem je izvedela v neki foto trgovini, kjer je bila prvič pred enim tednom, ko je nesla tja razviti fotografijo s svetlobnimi krogi, prvimi, ki jih je 'v živo' videla v življenju[2]. Odpravim se v foto trgovino, povem, kako in zakaj sem se znašla tam in povem, kaj me zanima.

Izkaže se, da lastnik foto trgovine ve vse o čudežu v velikem templju iz Neasdena in še veliko več. 'Taki in drugi čudeži niso v hindujskih skupnostih nič novega,' mirno pravi. 'Dogajajo se vsak dan.' To se mi zdi precej drzna trditev, splošna in pretirana. 'Kako pa, da se potem o tem nič ne ve, nič ne sliši,' vprašam.

'Ker ljudje o tem ne govorijo,' odgovori. 'Te stvari ostajajo v zaprtih krogih, ljudje jih jemljejo kot nekaj osebnega in samoumevnega. Ne želijo publicitete, napačnega razumevanja, posmehovanja.' Nato mi je povedal za čudeže, ki jim je bil tudi sam priča.

Čudež v Neasdenskem templju

V velikem templju so v petih kapelicah marmorni kipi hindujskih božanstev in svetnikov, bogato oblečeni in okrašeni. Vsak dan jim simbolično ponudijo hrano kot daritev. Med 'obroki' svete kipe zagrnejo, da v miru použijejo hrano. Pred časom so opazili, da eno izmed božanstev hrano fizično použije: po 'obroku' hrane ni na krožniku, razmazana pa je okoli ust kipa in popackana po njegovi obleki. Zato ga morajo kar naprej preoblačiti.

Mlečni čudež v živo

V živo je videl mlečni čudež in sicer pri njih doma. Ko so slišali za novico po TV, so poskusili tudi sami. Vendar niso vsi kipi pili mleka, nekateri so ga, drugi ne. Njihov manjši srebrni Ganeša je pil mleko, večji marmornati pa ne. Ne ve, zakaj je bilo tako. Da nekateri pravijo, da je do tega prišlo zaradi kapilarne absorbcje v materialu. 'Zakaj pa potem srebrna žlica ne vpije mleka?' vprašam. Skomigne z rameni.

Rast kipa plemenitega božanstva Hanumana

Njegov prapraded je bil krojač. Zgodilo se je, da nekoč živo sanjal boga Hanumana (plemeniti opičji bog znan iz epa Ramajana). Ta mu je ukazal, naj začne zjutraj kopati pod nekim drevesom. Tega ni storil, zato so se sanje naslednjo noč ponovile. Ukaz je bil tako nedvoumen in odločen, da se je zbudil in šel sredi noči kopat na vrt. Na svoje presenečenje je pod drevesom izkopal kipec Hanumana. Kot mu je rekel notranji glas, ga je pustil tam in ga vsak dan umival z vodo, kot je običaj v hindujskih svetiščih. Kip je počasi rastel (!). Ko ga je videl prapravnuk (lastnik foto trgovine) je bil visok že skoraj en meter. In še eno presenečenje. Poleg tega kipa je pred nekaj leti začel na novo rasti drugi, majčken kip Hanumana!

Na koncu vprašam, ali dovoli, da ga vsaj fotografiram. – Ne. – Ali lahko še kdaj pridem naokoli? – To lahko.

2.3 Kraj, kjer se čudeži dogajajo vsak dan

Vrstna hiša v severnem delu Londona, kjer živijo pretežno Indijci, se na zunaj po ničemer ne loči od drugih. Niti vsi sosedje ne vejo, da bi se v njej kaj posebnega dogajalo. Ko vstopiš v dnevno sobo, pa zagledaš večje in manjše slike Sai Babe, ki ga milijoni vernikov po celem svetu častijo kot avatarja ali utelešenje boga, in drugih indijskih božanstev. Po vseh slikah, kipcih, tudi pod steklom uokvirjenih slik, kamorkoli pogledaš, je sveti prah, t.i. vibhuti. Na nekaterih slikah so iz njega napisi kot SERVE ALL LOVE ALL, hindujski znak OM in podobno. Prah in napisi se pojavljajo čez noč ali čez dan, ni pravila. Baje naj bi vse to ustvarjal Sai Baba.

V hiši je tudi sobica v prvem nadstropju, kjer se je prvič pred 12 leti pojavil Sai Baba. V njej je stol, da se usede, ko pride. In prihaja vsak dan, fizično, ne kot privid. Na vratih je napis, da potrkaj, preden vstopiš. Kajti lahko je v sobi. Obiskovalci lahko vidijo odtis telesa na stolu, na katerem je sedel, vidi se, da na krožniku manjka hrana, ki mu jo vsak dan ponudijo, sveže sledi vibhutija so po tleh, slikah …

V Londonu se podoben pojav dogaja pri nekaj družinah. Zakaj ravno pri njih, še sami ne vedo. O tem ne govorijo okoli. Gospa Hema, pri kateri sem bila, pred tem ni bila častilka Sai Babe. Pravzaprav se je posmehovala vsem, ki so bili prepričani vanj. Neke noči pa se je zbudila in zagledala, kako Sai Baba sedi na njeni postelji in jo gleda. Vprašal jo je,

---

[2] Svetlobni krogi so pojav, ko šipe ob sončnem vremenu mečejo okrogel odsev z znakom X na sredini (zabeleženi so tudi drugi zanimivi vzorci). Prvič so jih opazili 1997 v ZDA, danes jih videvajo po celem svetu, zelo veliko po Sloveniji.

zakaj tako grdo govori o njem. To se je ponavljalo, dokler ni nehala grdo govoriti, in prepoznala v njem boga. Še vedno se dogaja. Njen mož Sai Babe ne vidi, vidi pa vibhuti, ki je zjutraj tam, kjer ga zvečer ni bilo.

3. Mošeja

V glavno islamsko mošejo stopim z ruto, kot se spodobi. Iščem koga, ki bi kaj vedel o muslimanskih čudežih – napisih iz korana na prerezanem sadju, zelenjavi in ribjih luskah.
Medtem se začne molitev. Nekaj sto moških stoji v vrstah tik ob drugem, vsi, z duhovnikom vred obrnjeni proti Vzhodu, kjer je njihova sveta dežela Meka. 'Alah akbar' zazveni iz zvočnikov. Stotine grl ponovi in glave se sklonijo. 'Alah akbar'. Možje pokleknejo in se s čelom dotaknejo tal. 'Alah akbar'. Vstanejo. In tako naprej. Nič drugega kot 'Bog je velik', petnajst minut. Stojim v preddverju, zaradi vročine so vsa vrata odprta. Občutek je, da je vse obstalo in da je – bog velik.
Po molitvi me predstavijo enemu od Imamov (glavnih duhovnikov mošeje). Imam je impozanten mlajši moški, ki se zaveda svojega položaja. Povabi me v pisarno in se predstavi: pove ime in kje vse se je šolal. Slišati je zelo impresivno. Potem pravi: Jaz sem se predstavil, prosim, predstavite se zdaj še vi! Moja predstavitev je neprimerno bolj skromna. Potem načneva pogovor o čudežih. Po enem stavku, ko povem, kaj me zanima, me prekine in reče: 'Največji čudež se je že zgodil!' O, nekaj, česar še ne vem, pomislim! 'Največji čudež je koran', pravi z glasom, ki ne dovoljuje pomislekov ali oporekanja. Potem v zanosu govori naprej. Vljudno omenim, da so napisi iz korana v zelenjavi pritegnili pozornost velikega števila muslimanov in ne samo njih. 'To je za tiste, ki nimajo prave vere', je neomajen.
Prodajalec v knjigarni v preddverju mošeje je njegovo nasprotje. Pozorno mi prisluhne in pove, da je pred dvema tednoma v mošejo prišel moški s prerezanim paradižnikom, katerega semena so očitno izpisovala ime Alah. V splošnem navdušenju, ko je kazal nenavadni pojav okoli, se nihče ni spomnil na fotoaparat …

Sklepne misli

Po svetu se dogajajo mnogi navdihujoči pojavi:
- subjektivna in objektivna videnja kot v Medjugorju, kjer se dogaja najdaljši do sedaj izpričani čudežni pojav (25 let), ali Zeitunu v Egiptu, kjer je bilo videnje Marije najbolj javno, saj ga je v živo snemala in predvajala nacionalna televizija;
- materializacij v živo kot pri Sai Babi v Indiji, ali materializacij človeške krvi, olivnega olja ali dišav na nabožnih slikah ali materializacije svetih podob ali svetih rekov v svetiščih, v naravi, v mestih ali stanovanjih;
- nepojasnjenih ozdravljenj in rešitev v nesrečah zaradi prisotnosti neznane dobrohotne osebe, ki je potem izginila; ...

Mnogi od teh nenavadnih in navdihujočih pojavov, čeprav so eni individualni drugi množični, praviloma ne iščejo popularnosti. Dogajajo se v intimi posameznikov ali skupin.
So prevare, naivnost in domišljija? Ali gospa Hema sama potrese prah za steklom slik Sai Babe in po kipcih? Ko jo to vprašam, se zasmeji in pravi, da je polno zaposlena cel dan in nima časa za to. Skeptiki pravijo, da ljudje vidijo tisto, kar hočejo videti. Vendar če to obrnemo, potem skeptiki ne vidijo tistega, česar nočejo videti. Obnašajo se kot ozki verniki, ki se bojijo za svoja prepričanja.

Kaj nam torej govorijo ti pojavi
a) s stališča znanosti?

Predvsem kažejo na pogosto ozkost in strah znanstvenikov, čeprav se kitijo z razumnostjo, kadar gre za pojave, ki ne gredo v splošno paradigmo znanosti. Če je med vsemi temi pojavi samo ena pristna izkušnja, si zasluži, da se poglobimo vanjo in jo raziščemo.

b) in kaj s stališča religije?

Morda, da je svetišče tam, kjer prebiva bog, pa čeprav je to skromen dom v stranski ulici. Boga se prav tako ne da ujeti v forme. Alah, Kristus, Krišna, to so njegove oblike, ampak on sam je očitno duh, ki veje koder hoče in lahko nagovori človeka na svež način tudi skozi druge oblike.

Za konec še to. Morda bo kdo kritičen, zakaj sem morala iti v London za vse te izkušnje, mar ne bi mogla dobiti pričevanj in izkušenj o bogu tudi doma. Lahko in marsikaj smo zabeležili tudi tukaj. V Zavodu CDK smo napisali knjigo (Svetlobni križi in drugi čudeži) in izdali DVD (Čudeži na prehodu v novo tisočletje). Vendar so ti pojavi univerzalni in bolj jih bomo spoznavali pri nas in drugje, bolj bomo uvideli potrebo, da jih raziščemo, da spoznamo njihovo ozadje. Kajti očitno je, da ne pripadajo nobeni religiji, marveč da so univerzalen pojav za vse ljudi, in da govorijo o nečem presežnem, čemur pravimo bog, tukaj in zdaj.

Reference

http://www.milkmiracle.com/
http://www.mcn.org/1/Miracles/allaharchive.htm
http://www.saibaba.ws/miracles.htm
http://www.apparitions.org/apparitions.html

Model O-S vidika in univerzalna religija
Model of O-S Aspects and Universal Religion

Primož Škoberne
Center za duhovno kulturo, Duhovna univerza
Ruska 13, SI-1000 Ljubljana
e-mail: primoz.skoberne@cdk.si

Abstract
Terms Objectivity – Subjectivity are generally used in antropocentric way. Article expands their meaning: subjectivity to everything what exists, even anorganic matter, whereas objectivity is assigned also to subjective phenomena, like thoughts, emotions.
Objectivity and subjectivity are two aspects, which are unreducible of each other, but paradoxically cannot exist alone.
Article speculates about subjectivity, if it is localised phenomena of highly evolved living organisms or is it the universal field. According to mystical experiences and also much more everyday experiences it is a field phenomena.
Intelligence and fragmentation are characteristic of objective aspect, love and universality of subjective aspect.
Living according to objective or subjective aspect presupposes different ethics: competition versus cooperation ethics.
All religions arise from contact with subjective aspect - subjective field. Subjective aspect is in the process of externalization through spiritually inclined people in whatever field of human endeavour.

I. Uvod

Namen

Namen tega prispevka je predstaviti abstraktni miselni model, ki bo povezal materialne pojave z duhovnimi in jih postavil v skupen okvir.

Problem

Pojma objekt – subjekt filozofski misleci običajno obravnavajo antropocentrično. Nič pa ne povejo o subjektivnosti živali, rastline ali kamnine. Ta subjektivnost ni nujno primerljiva s subjektivnostjo človeka, vendar to še ne pomeni, da je ni. Lahko obstaja, čeprav precej drugačna.[1] Obratno tudi pojem objektivnosti ničesar ne pove o morebitni objektivnosti subjektivnih vsebin. Ali so sanje na svoji ravni lahko objektivne? To pomeni, ali lahko dva sanjalca srečata drug drugega v sanjah in se potem oba v budnosti spomnita tega sanjskega srečanja? Če je to možno, potem ima tudi subjektivnost neko objektivno resničnost, oziroma je prišlo do interakcije subjektivnih doživetij.

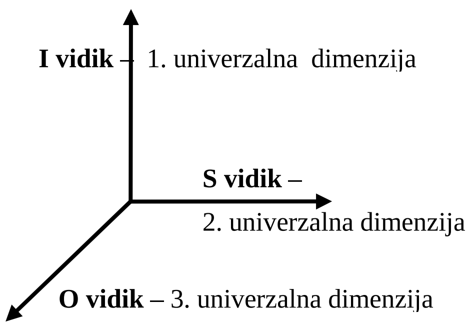
II. Model O-S vidika

Model

Izhodišče za model nam bodi delitev objekt – subjekt. Pri tem je subjekt bitje, ki ima ustrezno samorefleksijo kot človek (spoznavajoči jaz, mislec). Subjektivni vidik temelji na zavesti. Predstavlja sposobnost neke refleksije. Osnova subjektivnosti je čisto zavedanje, zavedanje samo.

Ta delitev še ni zadostna, ker se zdi, da je v subjektivnosti skrito še nekaj, kar se ne da reducirati na golo reflektirajočo subjektivnost niti na objektivnost z njenimi lastnostmi. Gre za osrednjo točko subjektivnosti, čisti jaz, ki vključuje samoidentiteto (jaz sam), namero (po samouresničitvi sebe samega) in z njo povezano voljo (samoudejanjanje). To plat imenujmo identičnost, intencionalnost, namenskost, bistvo, sui generis nečesa. Torej imamo trojnost objekt – subjekt – identiteta. Pri človeku telesnost – zavestnost – jaznost.

Naredimo sedaj drzen preskok. Trojko Objekt – Subjekt – Identiteta posplošimo v **tri univerzalne dimenzije**, ki jih imenujmo **trije vidiki**[2]. Tako imamo tri-dimenzionalni oziroma tri-vidični model, v katerega lahko postavimo karkoli in poiščemo njegove vidike.



Opomba

Prostorske dimenzije nam služijo samo kot analogija. Vidiki se namreč med seboj razlikujejo kot se razlikujeta dimenziji prostora in časa. Zato bi bil ustrezen izraz tudi kategorija, ki pa ne pojasni, da se nanašajo na isto resničnost.

---

[1] O živalski subjektivnosti vemo nekaj iz proučevanja njihovega obnašanja (etologija) in živalske psihologije. O subjektivnosti rastlin ne vemo skoraj nič. To možnost so nakazali nekateri avtorji (Tompkins, Bird), ki so proučevali odzivanja rastlin na človeška dejanja in tudi namere.

[2] Takšna trojnost vidikov se ujema s trojstvi kot so telo-duša-duh, Brahma-Višnu-Šiva, sv. Duh-Sin-Oče...

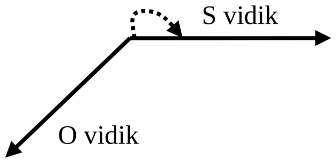
Primerjava

I vidik	S vidik	O vidik
namen	zavest	telo
bistvo	vsebina	oblika
življenje	kvaliteta	pojavnost
opazovalec	opazovanje	opazovano

Objektivni – Subjektivni – Intencionalni vidik preimenujemo, zato da jih ločimo od izpeljave in antropocentrizma. Poimenujmo jih z nevtralnimi številkami 1, 2 in 3: I vidik s prvo številko v **1. vidik**. Vidik subjektivnosti v **2. vidik** in vidik objektivnosti v **3. vidik**. Število ena za 1. vidik utemeljujemo s tem, da je to prvo, začetno število, tako kot je namen na začetku dejanja. Število 2 za subjektivni vidik, ker je 2 število polarnosti. Subjektivnosti ni brez polarnosti objekt-subjekt. Število 3 namenjamo za objektivni vidik, ker je število množtva[3] in simbolično pomeni vse stvari, vse ustvarjene oblike.

Redukcija

Model skrčimo na dvodimenzionalni ali **dvovidični model**. Razlog za to skrčitev je v tem, da je I vidik skrit v S vidiku in nastopata kot eden (identiteta je skrita v zavesti). To je podobno, kot je S vidik skrit v O vidiku (zavest v telesu) in šele na določeni razvojni stopnji O vidika (s pojavom človeka) postane razviden kot samostojen vidik. Do takrat je O vidik **dominanten**, S vidik pa še ni **razviden**.



Paradoks

Odnos med objektivnim in subjektivnim vidikom je **paradoksen**. Med njima je kartezijanska dvojnost; nobenega se ne da izpeljati iz drugega, nobenega se ne da reducirati na drugega, vsak je svoja bitnost. Hkrati sta soodvisna, ne obstajata ločeno, sama zase.

Podobno velja za vse tri vidike. So svoje bitnosti, vendar ne obstajajo sami po sebi. Ne moremo jih izpeljati iz drugega ali ga zreducirati na drugega, vendar ne obstajajo ločeno. Zato jih tudi imenujemo vidike.

Evolucija in eksternalizacija

Prejšnja lastnost je povezana z evolucijo vidikov. Evolucija vidikov je različna, ker so svoje bitnosti. Evolucija O vidika je evolucija oblik v smeri **diferenciacije** in **kompleksnosti**: nastanek vesolja in atomov, osončja in planetov, molekul in živih bitij.

Evolucija S vidika je drugačna, gre v smeri **eksternalizacije** (pozunanjanje) globin zavesti. Ne gre za nastajanje, marveč za odstiranje, odpiranje, eksternalizacijo zavesti, kar pa je tesno povezana z evolucijo O vidika. Skozi bolj kompleksno formo, na primer živčni sistem, se lahko reflektira večja globina zavesti.

S vidik se ne pojavlja sam po sebi, marveč se eksternalizira skozi O vidik – O vidik je njegovo telo, nosilec, vendar telo ni zavest, ki se izraža skozenj[4]. Eksternalizacija pomeni, da bitnost v svojem O vidiku začne slediti zakonitostim S vidika.

Zavest doseže pri človeku samoozaveščenost, lahko pa tudi ozaveščenost o svojih globinah in potencialih.

Lastnosti vidikov

Opredelimo O vidik kot **formativne narave**, je oblikotvoren in je **fragmentaren**. Oblike lahko na nek način vedno ločimo med seboj.

S vidik opredelimo, da je **refleksivne narave** in je **celovit**. To pomeni, da deluje kot nekakšno polje. S stališča posamezne bitnosti predstavlja njen O vidik **telo**, S vidik pa **zavest**.

Kot temeljno lastnost O vidika postavimo nekaj, kar imenujmo **inteligenca**. Inteligenca opisuje lastnost, da znotraj O vidika velja zakon minimalne akcije[5] in predstavlja nekakšno racionalnost znotraj O vidika. Dinamika med oblikami se podreja tej zakonitosti.

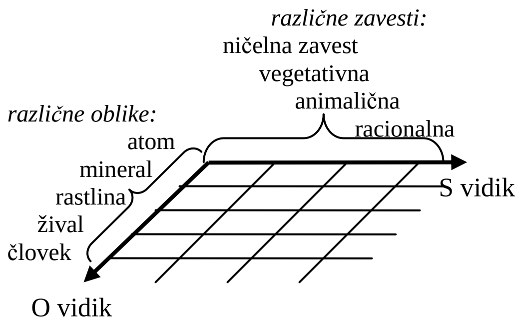
Kot temeljno lastnost S vidika postavimo nekaj, kar imenujmo **ljubezen**. Ljubezen opisuje lastnost, da znotraj S vidika velja načelo, ki ga fizika imenuje **nelokalnost**. Vsak pojav v S vidiku je povezan z drugimi pojavi. Ni ločenosti.

Obravnava modela

a) Vsak objekt ima svojo subjektivnost.

V tem modelu smo razširili subjektivnost na vse, kar obstaja, neodvisno od antropocentričnega gledanja in tudi neodvisno od organskocentričnega gledanja.[6] Tudi anorganska materija ima neko rudimentarno subjektivnost ali zavest, čeprav je ta na stopnji skoraj ničelne zavesti.

Evolucija oblik znotraj O vidika omogoča torej vse boljšo refleksijo S vidika. Po Aristotelu so to pri človeku vegetativna duša, animalična duša in racionalna duša.



[3] Lao dzi: "Dao rodilo je Enoje, Enoje rodilo je Dvoje, Dvoje rodilo je Troje, iz Trojega vse so stvari." (Dao de jing, 42)

[4] Podobno velja za življenje (t.j. I vidik), ki se ne pojavi samo po sebi, marveč skozi ustrezno organizirano materijo.

[5] To je zakon gospodarnosti v naravi. Na različnih področjih najde ta zakon analogije, kot na primer zakon ekonomije na področju menjalnih odnosov med ljudmi. To ne pomeni, da gre za isti zakon, marveč da gre za isti arhetip, isto paradigmo, ki se pojavlja v različnih zakonitosti na različnih področjih.

[6] Znano je, da so nekateri mistiki in jogiji opisovali svoja doživetja, v katerih je bilo vse živo, tudi t.i. anorganski, mrtvi svet.

b) Vsak subjektiven pojav ima svojo objektivno obliko, torej telo.

Objektivnost smo posplošili ali razširili tudi vertikalno v sfero subjektivnosti. Tako lahko razložimo uvodni primeri s sanjalcema. Model nam omogoča, da iščemo rešitve tudi za druge nenavadne pojave: obsmrtne izkušnje, v katerih so ljudje zapustili telo, zunajtelesne izkušnje, astralna potovanja, fenomeni bilokacije in podobno, govorijo da lahko subjekt obstaja zunaj fizičnega telesa. Tisti, ki so to doživeli, so navajali, da so imeli neko drugo, finejše telo.

Sedaj lahko razmišljamo, da tudi čustva niso samo subjektivna vsebina, marveč tudi otipljivi čustveni objekti podvrženi nekim zakonitostim. Ko nekdo intenzivno čustvuje, lahko drugi 'otipa' njegovo čustveno gostoto? So tudi misli miselni objekti? Tako pridemo še do Platonovih idej kot objektov na ravni teh idej.

Objektivni vidik predstavlja Aristotelov formo, telo (strukturo, organizem). Kakšna snov zapolnjuje to formo, ni pomembno, je to fizična, 'čustvena', 'miselna', ...

Ponazoritev modela

Za ponazoritev obeh vidikov bomo uporabljali fizikalne opise. Konkretni fizikalni opis ni isto kot ta abstraktni model. Lahko je zavajajoč (npr. osončje kot model za atom: planeti sledijo natančnim orbitam, medtem ko elektroni ne).

O vidik naj nam ponazarja klasična mehanika in njen opis sveta kot ločenih delcev.

S vidik naj nam ponazarjajo fizikalna polja in kvantnomehanski pojav nelokalnosti. To ne pomeni, da so teorije polja, kot jih poznamo iz fizike, že S vidik, morda pa so kvantni pojavi, pojavi valčno-delčne narave mejni pojavi med O in S vidikom ali nekakšen vezni člen.[7]

S vidik deluje kot polje nelokalnih interakcij (vse je povezano z vsem); s hologramskimi lastnostmi (vanj se vtiskuje kot univerzalni spomin vse, kar se dogaja); in ustreza Bohmovemu implikatnemu redu (ni amorfno, marveč se zdi, kot da ima neko svojo matrico, subtilno strukturo, ki jo počasi vtiskuje v O vidik – evolucionizem). Dinamika med S in O vidikom ustreza dinamiki hologibanja. Osnovno hologibanje je gibanje iz S vidika v O vidik in obratno, je introjekcija (ponik) in projekcija (vznik).[8]

III. S vidik in univerzalna religija

Raziskovanje S vidika

O naravi subjektivnosti same ne vemo dosti in nimamo razvitih orodij, s katerimi bi jo raziskovali.

Če bi šli dovolj globoko v sfero subjektivnega, bi se dalo empirično ugotavljati njegove lastnosti in v kakšnem odnosu je do posameznika? Je univerzalen ter si ga delimo kot ribe morje ali je individualni pojav kot balonček, ki ga ustvari vsak sam?

Človek je najprimernejši 'subjekt' za raziskovanje subjektivnosti, ker je v njem sposobnost refleksije največja.

Metoda za raziskovanje subjektivnosti mora izhajati iz subjektivnosti. Ne spozna se je z logičnim diskurzom, marveč z meditacijo v mističnem smislu kot izkustveno zrenje.

- **Izkušnje mistikov in jogijev**, ki gredo v smeri univerzalne zavesti, božanske zavesti in podobno, kot jih opisujejo vzhodnjaške teorije zavesti: zdi se, da gre po vsej verjetnosti za univerzalno polje, ki pa se okoli posameznika zgošča kot 'gravitacijsko' polje (avra?), v kateri se oblikuje njegova specifična subjektivnost.
- **Paranormalni pojavi**, ki jih sicer ne znamo razložiti z obstoječimi znanstvenimi teorijami, lahko razumemo kot pojave v sferi S vidika ali kot interakcijo med S in O vidikom. Na primer telepatski prenos misli; videnje dogodkov, ki so se dogodili tisti trenutek na veliki oddaljenosti; videnje na določenih lokacijah travmatičnih dogodkov, ki so se tam dogodili v preteklosti; osebe, ki so čustveno povezane (npr mati – otrok), zaznajo, če je drugi v hudi stiski, čeprav ju lahko loči velika fizična oddaljenost; materializacija ...
- **Enostaven primer**, ki obravnava vsakdanja doživljanja, prav tako kaže na možnost subjektivnih interakcij. Kot poskus ga lahko izpeljemo v skupini. Skupina sedi v krogu. Izbrana oseba je v sredini in se vživi v eno od osnovnih čustev ter podoživi situacijo, v kateri je čustvo doživela. Čustev pri tem ne kaže navzven z mimiko, gestikulacijo, verbalizacijo. Da bi izključili nezavedno opažanje minimalnih telesnih sprememb (rahla rdečica, spremembe v dihanju, napetost v dlaneh itd.), imajo drugi zaprte oči. Navodilo je, da so odprti in introspektivno opazujejo, kaj se psihološko dogaja v poskusni osebi. Tovrstni poskusi izpeljani na sicer selekcionirani populaciji, so pokazali, da dobra polovica ljudi zazna vrsto čustva, nekateri uganejo tudi situacijo. To je pojav, ko začutimo, kar čutijo drugi.

Verjetno so prav izkušnje čistega S vidika v ozadju spoznanj o univerzalni enosti, ki jo opisujejo mistiki ter univerzalne ljubezni, ki je njen praktični izraz.

Zavest sama v sebi, ko je osvobojena fragmentiranosti vtisov, deluje povezovalno, integrativno. Subjektivnost deluje torej drugače kot O vidik, ki fragmentira. Subjektivnost združuje – to je še druga definicija za ljubezen.

Etika in vrednote

Etika in vrednote so drugačne znotraj O in S vidika.

Etika O vidik

Posamezne ločene enote sledijo poti najmanjšega napora. Ker vse sledijo temu, ustvarjajo trenje in entropijo. Na človeški ravni se to kaže kot etika *prerivanja za najboljše mesto*. Vrednote O vidika so: zmagati, uveljaviti se, premagati druge, biti boljši v tekmovanju – to je inteligenca v praksi.

Inteligenca O vidika teži h globalizaciji, tako kot entropija, ki se naravno širi. Na človeški ravni se to tipično kaže skozi ekonomijo dobička.

Etika S vidika

Ker je narava S vidika povezanost, nelokalnost, ima etika S vidik za vrednote: vzajemnost, sodelovanje, razumevanje, pomoč – to je ljubezen v praksi.

Posamezniki, ki pridejo v dovolj globok stik s tem poljem, začutijo ljubezen, ker začutijo druge subjekte kot sebe (tretja definicija ljubezni). To so izražali in izražajo vsi tisti ljudje, ki jim lahko rečemo duhovni ali poduhovljeni ljudje, pa naj so bili to svetniki, humanitarci,

[7] Takšen vezni člen med fizičnim telesom (objektivnost) in zavestjo (subjektivnim) je po jogijski teoriji prana (vitalna energija – negativni ioni?).

[8] Na primer, ko zaspimo in se prebudimo. Objekt s prebujeno subjektivnostjo je isti in ni isti kot takrat, ko nima prebujene.

veliki politiki s čutom za potrebe ljudi in časa ... Takim ljudem lahko rečemo, da so neke vrste duhovniki, ker so nosilci kvalitet S vidika in njegove etike.

Konflikt med obema etikama je ponazorjen v konfliktu med etiko stare in nove zaveze, med talionskim pravom in odpuščanjem, med stereotipoma 'židovstva' (kako inteligentno in na račun drugih poskrbeti zase) in človekoljubjem, altruizmom.

Religija in univerzalna religija

Religija je verovanje, da ima širše življenje neko svojo zavest, torej da ima svoj S vidik. Za poganske religije je širše življenje narava, za človeka pred novim vekom je to predvsem prostor, ki ga obsega Zemlja z nebesnim svodom.

Ker S vidik širšega okolja lahko človek spoznava samo preko svojega S vidika, to pomeni, da je ta izkušnja odvisna od prebujenosti njegovega S vidika.

Zato je religija izkušnja in spoznanje nekaterih ter verovanje drugih.

Mistik ne verjame v boga (v univerzalni S vidik), marveč ga pozna. Vernik ga ne pozna, vanj verjame. A zares verjame, ko ga izkusi. Prava vera je izkušnja in takrat ni več prazna vera.

Univerzalna religija predstavlja S vidik v njegovi celoti, je eksternalizacija (pozunanjanje) S vidika.

Univerzalna religija je hipotetična religija, ki bi povsem eksternalizirala vrednote in etiko S vidik.

Krščanstvo je bilo prinašalec etike čistega S vidika, ni pa več edini nosilec. Danes so nosilci tega vsi tisti, ki jih etika S vidika navdihuje, neodvisno od religioznih prepričanj.

Vsaka religija je fragment univerzalne religije. Fragment zato, ker izhaja iz objektivnega časa in prostora, ter iz te delne pozicije vzpostavlja stik z istim univerzalnim S vidikom. To izkušnjo in spoznanje prilagodi času in kraju, torej določenemu O vidiku.

Prihodnost religij je v znanstveni religiji, v raziskovanju paranormalnih in čudežnih pojavov, mističnih in meditativnih izkušnjah, ter na ta način raziskovanje S vidika in njegove interakcije z O vidikom. Morda bo šlo za sintezo med znanostjo in mistiko, objektivnim in subjektivnim pristopom, ki bo spremenila obe, znanost in religijo.

IV. Zaključek

Opisovanje in privzemanje kot model za duhovne in mistične pojave tiste iz kvantne fizike je sicer privlačno, ker obstaja dosti vzporednic med enimi in drugimi, vendar gre za dve zelo različni stvari. Eno so pač pojavi na najbolj mikro ravni, drugi pa obsegajo mnoštvo različnih stvari, od subjektivnih in ekstatičnih doživetij do objektivnih nenavadnih pojavov, ki jih težko pojasnimo znotraj sedanje znanstvene paradigme, tudi kvantne fizike.

Model posplošene objektivnosti in subjektivnosti kot O in S vidik je bolj abstrakten, in zato nudi več prostora in več možnosti za obravnavo tovrstnih pojavov.

Predstavlja paradigmo, ki želi združiti res extensa in res cogitans v enoten okvir, ki pa nista več omejeni samo na fizično resničnost in človekovo duševnost, marveč v sfero tiste subjektivnosti, ki ni samo domišljija, marveč je objektivna na način, da jo lahko subjekti doživijo mimo poznanih interakcij.

Izziv pa je, kako znotraj te paradigme oblikovati konkretnejše teorije, jih z znanstveno metodologijo preverjati in tako razširiti meje našega poznavanja sveta v katerem živimo in katerega del smo.

Reference

Bailey, A. A. (1962), Esoteric Psychology. London: Lucis Press. Str. 14-22

Bentov, I. (1977), Stalking the Wild Pendulum. New York: E.P. Dutton.

Bohm, D. (1983), Wholeness and the Implicite Order. London: Ark.

Capra, F. (1990), The Tao of Physic. Fontana: Bungay.

Hawking, S. (2003), Kratka zgodovina časa. Ljubljana: DMFA, knjižnica Sigma.

Milčinski, M. (1995), Kitajska in Japonska med religijo in filozofijo. Ljubljana: Trias wtc.

Russell, P. (1993), Sedaj. Ljubljana: Alpha center.

Talbot, M. (1992), The Holographic Universe. New York: Harper Perennial.

Tompkins, P., Bird, C. (1973), The Secret Life of Plants. New York: Harper & Row, Publisher.

Weber, R. (1990), Dialogues with Scientists and Sages. London: Arkane.

Koeksistenca znanosti, filozofije in religije z indovedskega vidika

Miroslav Tošič
Inštitut Vedanta,
Inštitut za komplementarne znanosti in interkulturne študije
Žibertova 27, Ljubljana
miroslav.tosic@gmail.com

POVZETEK

Indovedski misleci so tisočletja pred pojavitvijo evropske kulture prišli do zaključka, da je z materialnimi čuti pridobljeno znanje nepopolno. Sočasen razvoj določenih znanstvenih in kulturnih vzorcev je dovolj utemeljen razlog za razumno oceno, da je samo vprašanje časa, kdaj bo zahodni svet stopil na isti čoln. V sodobni znanosti se soočamo z vse večjimi nasprotji, ki jih ne moremo in ne smemo prezreti. Skrbno je treba preučiti razloge za njihov nastanek in če bo potrebno, opraviti temeljito analizo epistemoloških korenin empirične znanstvene metode. Pri iskanju rešitev bo potrebno premostiti terminološke ovire, pogledati čez kulturna obzorja in postati odprtejši do drugačnosti. Dogmatičnosti, najsibo religiozne ali znanstvene, si ni več mogoče privoščiti. Analizirali bomo nekaj temeljnih razlik med sodobnim in indovedskim epistemološkim pristopom. Predstavil bom nekaj primerov zanimivih nasprotij v procesu empiričnega raziskovanja na istih ali sorodnih znanstvenih področjih kot tudi dva epistemološka modela.

ABSTRACT

A conclusion that knowledge acquired through material senses is imperfect has been arrived at by Indovedic thinkers many thousands of years before the appearance of European culture. Synchronic development of certain scientific and cultural patterns presents a cogent reason for a sound estimation, that it is only a matter of time before the western world boards the same boat. Modern science is facing growing contrasts, that can not and should not be overlooked. It is indispensable to closely examine the reasons for their appearance, and if necessary scrutinizingly analize epistemological roots of the empirical scientific method. While searching for solutions it is important to cross the terminological barriers, to look past cultural horizont and to become more open to diversity. We can not afflord to pay the price of dogmatism, either religious or scientific. Some basic differences in modern and Indovedic epistemological approach will be analized. I will present some interesting cases of contrast in the process of empirical research within same or related scientific fields as well as two epistemological models.

Uvod

Če na preprost način povežemo fotocelico, rdeči filter, ojačevalec in kasetofon lahko naredimo napravo, ki ob zaznavi rdeče svetlobe izgovori: »Vidim rdečo luč.« Ko naprava izgovori, da vidi rdečo luč, ne bo nihče verjel, da zares vidi. Snemalnik sprejema zvočne signale, vendar ne sliši, kamera sprejema vizualne signale, vendar ne vidi, avtomobil se premika, vendar ne izkuša gibanja. Stroji sicer lahko opravljajo določene funkcije, ki spominjajo na človeške, toda za njihovo delovanje vedno obstaja mehanistična razlaga. Tudi če človekovo telo deluje kot kompleksen stroj in lahko njegovo delovanje do določene mere razložimo v fizično merljivih okvirjih, pa tega ne moremo storiti s človekovo zavestno izkušnjo.

Thomas Huxley je bil vnet Darwinov zagovornik, vendar ni mogel sprejeti mehanistične narave zavesti. Rekel je [1]: »Razumem, da temeljna doktrina materializma pravi, da v vesolju ni ničesar razen materije in sile ter da lahko vse naravne pojave razložimo z deduciranjem lastnosti teh dveh primarnih dejavnikov ... Zdi se mi precej očitno, da v vesolju obstaja še tretja stvar, razum ali zavest, ki je ne moremo enačiti s silo in materijo ali kakršno koli modifikacijo obeh.« Več kot sto let pozneje je podobno mnenje izrazil matematik in kvantni fizik Richard L. Thompson, ki ocenjuje [2] da »nad temi fizično merljivimi opisi, ki se ukvarjajo izključno z mehanistiko vedenja in zaznave, obstaja nemerljivo področje zavesti. Znanost je resnično uspela razložiti določene pojave v strogo fizičnem kontekstu, vendar tega ne bi smeli ekstrapolirati in zaključiti, da lahko vse – tudi zavest – razložimo mehanistično. Obstajajo tudi drugačne razlage, ki so pogosto razumnejše in obširnejše. Morali bi biti odprti in jih pretehtati«.

Tema proučevanja zavesti ni nova. Razumevanje zavesti v vseh njenih različicah in odtenkih je bil skupni imenovalec jogijsko-teološke, psihološke in znanstvene tradicije indovedske civilizacije, ki je cvetela več tisočletij pred rojstvom grške kulture. Zapuščina te bogate civilizacije je zaradi evrocentrično obarvanega kulturno-izobraževalnega sistema zahodne civilizacije preslabo raziskana, če ne celo neupravičeno zanemarjena. Ker je zahodna civilizacija grško-rimskega porekla, pogosto mislimo, da so dosežki drugih kultur izšli iz omenjene sredozemske korenine. Francoski filozof Rene Guenon [3] je takšno vsesplošno pripisovanje izvora napredne civilizacije Grkom in Rimljanom imenoval »klasični predsodek«. Po Guenonovi oceni večina intelektualcev zahodne civilizacije zaradi svoje globoke kulturne pogojenosti psihično ni zmožna premostiti sredozemlja.

V članku bomo analizirali kontrastne poglede in dognanja v sodobni znanosti. Na koncu bomo naredili primerjavo med sodobno in indovedsko epistemologijo.

Problem verodostojnosti

Filozofi in sociologi znanosti ugotavljajo, da obstajajo v rutinski praksi znanstvenega raziskovanja raznovrstne napake in nedoslednosti. Pojavljajo se pri zajemu podatkov, izvajanju poskusov, interpretacijah in tako dalje. Znanstveniki so navsezadnje samo ljudje in ljudje delamo napake. Bolj skrb vzbujajoče je dejstvo, da na istem raziskovalnem področju raziskovalci z uporabo sorodnih ali celo enakih znanstvenih metodologij prihajajo do popolnoma drugačnih rezultatov.

Naj ugotovitev ponazorim s primerom. Pretiravanje glede kakovosti, napredka in družbene vrednosti posamičnega znanstvenega dela je danes skorajda bistvena sestavina znanstvenega raziskovanja. Skromna in poštena ocena lastnega dela ni zanimiva in največkrat tudi ni zadostna podlaga za pridobitev potrebnih sredstev. Širokousten nastop prinaša denar in vox populi, vprašanje pa je, ali ga še lahko obravnavamo v kontekstu odkrite, pristne znanosti. Spodaj navedene napovedi Harolda Ericksona z Univerze Duke asociirajo na nepokrit ček s šestmestnim številom in nevpisanim datumom [4]: »Skrivnost življenja ni več skrivnost. Že vsaj dvajset ali trideset let vemo, da življenje ni nič bolj skrivnostno od kemičnih reakcij, na katerih je zasnovano. Obstaja neverjetno kompleksen niz kemičnih reakcij, ki pa so logične in razumljive. Veliko jih že razumemo, čeprav ne še vseh, in ni težko predvideti, da jih bomo nazadnje razumeli v celoti.« Erickson ni edini, ki daje strokovno nepodprte izjave. Tom Pollard, direktor svetovno priznane kalifornijske ustanove Salk Institute in nekdanji predsednik Ameriškega društva za celično biologijo, se sprašuje, kdaj se bo človeštvo končno prebudilo in dojelo, da je življenje samo skupek kemičnih in fizikalnih procesov. »Kar so molekularni biologi verjeli dve generaciji, danes velja za nedvoumno dokazano. Življenje je v celoti plod fizikalnih in kemičnih procesov v celicah in med celicami. Sprašujem se, kdaj bodo ljudje to sprejeli?« [5]

Mnenje nekaterih drugih, še bolj uveljavljenih, strokovnjakov je popolnoma nasprotno. Nobelov nagrajenec Albert Szent-Gyorgi je svoje iskanje misterija življenja začel s proučevanjem organizmov v njihovem naravnem okolju. Nato je začel proučevati celice. Potem se je lotil kemične sestave beljakovin. Končno se je v upanju, da bo tam našel odgovore, ustavil pri elektronih. Ob koncu svojega življenja je zelo lepo ubesedil svoje občutke [6]: »V iskanju skrivnosti življenja sem se na koncu znašel med atomi in elektroni, ki življenja sploh nimajo. Nekje vmes mi je življenje spolzelo med prsti. Zato se zdaj v starosti vračam po istih stopinjah.« Stanley Miller, ena največjih svetovnih avtoritet na področju kemije in biologije, je po štiridesetih letih trdega znanstvenega dela prišel do sklepa, da iz kemikalij ni mogoče ustvariti življenja. Tudi Joyce in Orgel se strinjata, da je molekularna biologija na tem področju zašla v slepo ulico.

Že kar nekaj let je minilo od Schroedingerjeve izjave, da je življenje mogoče razumeti v kontekstu fizike in kemije. Fiziki so zdaj bolj previdni v svojih mnenjih in napovedih. Nobelov nagrajenec Steven Weinberg ugotavlja, da fizika ne more rešiti problema, ki se imenuje zavest. V knjigi Before the Big Bang podaja za marsikoga nepričakovano pesimistično sliko [7]: »Vzporedno z našim vse večjim razumevanjem širjenja vesolja raste tudi sam problem, zato se ves čas zdi, kot da se nam rešitev izmika.« Stephen Hawking, ki je v osemdesetih letih prejšnjega stoletja napovedoval petdesetodstotno možnost za postavitev TOE (Theory of Everything – Teorije vsega) še pred koncem tisočletja, je priznal [8]: »Čeprav smo v zadnjih dvajsetih letih močno napredovali, ni videti, da smo se kaj dosti približali cilju.«

Epistemološki kontrast

Čeprav znanost še zdaleč ni uniformna, se vseeno lahko upravičeno vprašamo, zakaj med znanstvenimi rezultati na istem raziskovalnem področju prihaja do tolikšnih nasprotij. Komu verjeti? In zakaj bi sploh verjeli? Vera naj bi bila stvar religije ... Zagata, v kateri se je znašla empirična znanost, je očitno veliko resnejša, kot je videti na prvi pogled. Širša znanstvena skupnost se tega ali ne zaveda ali pa to tematiko preprosto ignorira.

Frank Salter iz Max Planckovega inštituta v Nemčiji trdi, da je znanstveno védenje na številnih področjih tako dobro razvito, da lahko edino sprejemanje empirične znanstvene doktrine velja za merilo razumnosti. Posledično lahko zavračanje dejanske avtoritete naravoslovnih ved kot celote velja za primer empirične nerazumnosti ali primer zavračanja trdnih dejstev. [9]

Salterjeva stališča ne podpirajo druge avtoritete naravoslovnih ved. V referatu z naslovom Meeting Ground of Philosophy and Science, objavljenem na World Congress of Philosophy leta 1973 je Adžit K. Sinha zapisal: »Max Born opaža, da v naravi ni objektivnega obstoječega stanja, elementarni delci so le tvorba človekovega uma. Brillouin meni, da so znanstvene teorije iznajdbe človekovega razuma ... Znanstvene teorije so modeli, ki predstavljajo aspekte narave. Ti modeli ne predstavljajo same narave [poševni tisk: avtor]. Brillouin zato opozarja, da znanstvenik ne bi nikoli smel zamešati dejanskega zunanjega sveta z lastnim samoustvarjenim fizičnim modelom. Prav tako meni, da tako imenovani zakoni narave niso nič drugega kot povzetki izkustvenih dejstev, ki jih izbira in razvršča človekov razum. Po njegovem mnenju so znanstveni zakoni produkt človeške domišljije.«

Tudi ti dve perspektivi sta v popolnem nasprotju. Vse bolj očitno postaja, da se je po vseh udih in organih telesa sodobne znanosti razširil epistemološki rak. Stare teorije nadomeščamo po tekočem traku, nove bodo čez nekaj let na intelektualni deponiji. Navadili smo se že, da je to del življenja, da je to normalno ...

Ohranjanje paradigem

Na začetku devetdesetih let prejšnjega stoletja je ameriška Državna akademija znanosti ustanovila skupino za revizijo raziskav o izvoru življenja. Predsednik komisije, Harold P. Klein, je ugotovitve komisije povzel z naslednjimi besedami [10]: »S stališča kemika je tudi najmanjša bakterija tako presneto zapletena, da si je tako rekoč nemogoče predstavljati, kako je nastala.« Na koncu so se v ZDA odločili, da bodo še več sredstev namenili iskanju odgovorov in znova prezrli temeljni problem – domet empirične znanstvene metode. Ni zagotovila, da je odgovor na podobna vprašanja mogoče najti v laboratoriju. Rezultati zadnjih stotih let kažejo, da je reprodukcija procesa nastanka življenja znanstvena utopija. Poleg tega smo preskočili pomembno vprašanje. Preden poskušamo ugotoviti, kako je življenje nastalo, bi se morali vprašati, kaj življenje sploh je? Kako bomo našli nekaj, česar ne znamo niti opredeliti?

Nekaterim se zdi znanstveno nekorektno, da ob mnogih skrbno dokumentiranih dokazih o obstoju zavesti in njenem vplivu na materijo, o obstoju človekovih nadčutnih sposobnostih in številnih drugih »anomaličnih« pojavih, še vedno prevelik del znanstvene skupnosti trdovratno in brez znanstvene podlage vztraja pri svojih mehanističnih razlagah življenja, narave in njunih interakcij. Jerry A. Fodor, ki je na Massachusetskem tehnološkem inštitutu raziskoval področje umetne inteligence in je eden glasnejših zagovornikov teorije funkcionalizma, je po neuspešnem poskusu razlage človekove izkušnje glavobola izključno na temelju relacije med dražljajem in odzivom nazadnje rekel [11] : »Številni psihologi, ki so pripravljeni sprejeti funkcionalistični okvir, so vseeno zaskrbljeni glede neuspeha funkcionalizma pri razlaganju narave zavesti. Funkcionalisti so naredili nekaj bistroumnih poskusov, da bi sebe in svoje kolege z besedami izvlekli iz zagate, vendar vsaj po mojem mnenju, niso imeli prav veliko uspeha. Glede na zdajšnje stanje problem kvalitativne vsebine [zavesti: opomba avtorja] resno ogroža trditev, da funkcionalizem lahko zagotovi splošno teorijo v zvezi z mentalnim področjem.«

Ko je tema o zavesti sprožila fundamentalni zastoj v vseh mehanističnih poskusih razlage človekovega obstoja, so se nekateri znanstveniki opogumili in zavrnili široko sprejet mehanistični pogled. Nobelov nagrajenec Eugene Wigner je tako napisal [12]: »Obstajata dve vrsti resničnosti oziroma obstoja; obstoj moje zavesti in resničnost oziroma obstoj vsega drugega. Slednja ni absolutna, temveč relativna.«

Selekcioniranje podatkov

Dodaten problem iskanja odgovorov na pomembna vprašanja je selekcioniranje podatkov, ki se ne ujemajo z izhodiščnimi hipotezami. Vzel bom primer iz arheologije, čeprav je ta pojav navzoč na vseh področjih znanosti. Ko se je Michael Cremo pred dobrimi dvajsetimi leti odločil testirati hipotezo o alternativnih možnostih starosti homo sapiensa, s katerimi se je srečal med študijem indovedske literature, ni vedel, da mu bo raziskovanje, zbiranje gradiva in pisanje knjige [soavtor knjige je Richard L. Thompson] vzelo osem let. Leta 1994 je luč sveta ugledala knjiga Forbidden Archeology, v kateri sta avtorja objavila dokumentirane primere najdb, ki zgodovino nastanka človeka postavljajo v popolnoma drug zorni kot.

Cremo odgovarja na vprašanje o določanju obdobja nastanka človeka [13]: »Če preučimo celotno zgodovino arheologije ter čim bolj pošteno in objektivno ocenimo vsa odkritja, bomo ugotovili, da so arheologi in drugi znanstveniki v zadnjih stopetdesetih letih odkrili ogromno dokaznega gradiva, ki se sklada z vedskimi [staroindijskimi: opomba avtorja] opisi izjemno dolge starosti obstoja človeka. Dokazi, o katerih poročajo v znanstvenih publikacijah, so ali ostanki okostij anatomsko sodobnega človeka ali ročni izdelki človeške izdelave. Te dokaze so iz znanstvene razprave odstranili predvsem zato, ker spodbijajo darvinistične evolucijske ideje.«

Cremo meni, da je proces pristranskega selekcioniranja podatkov največkrat nezaveden in posledica nezdravo uniformnega izobraževalnega okolja. Usmerja ga zaupanje v nadaljevanje dela, ki so ga že opravile prejšnje, prav tako doktrinalno homogene generacije. V ozračju doktrinalne homogenosti ni prostora za drugačnost. Sodobna znanost si je tako sama zgradila visok zid, pred katerim se je ustavila. Največji sovražnik znanosti je predsodek.

Odmeven lanskoletni primer doktrinalnega spora v šolstvu med zagovorniki darvinizma in zagovorniki teorije inteligentnega načrta, do katerega je prišlo v Dovru v Pensilvaniji, je končal na sodišču [14]. Sodnik je sicer po skrbnem razmisleku, vendar brez tehtne znanstvene utemeljitve, zavrnil možnost vzporednega poučevanja teorije o inteligentnem načrtu v ameriških šolah. Upoštevajoč epistemološko krizo v znanosti in kulturi lahko realno pričakujemo, da bo tovrstnih doktrinalnih sporov v prihodnosti še več, vse dokler ne bo vzpostavljeno ravnovesje med radikalno drugačnimi pogledi v šolstvu, medijih in javnem življenju. Teofobija znanstvene skupnosti med intelektualci ustvarja nepotrebno napetost, ki stanje dodatno polarizira. Morda je rešitev iskanje skupnega imenovalca.

Indovedska epistemologija

Indovedski misleci so tisočletja pred rojstvom evropske kulture razpravljali o tem, zakaj je z materialnimi čutili pridobljeno znanje nepopolno. Človekova prva pomankljivost je, da so njegovi čuti, um in razum omejeni in nepopolni. Ta lastnost se v sanskrtu imenuje karanapatava. Ker človek svet okrog sebe zaznava nepopolno, živi v subjektivno popačeni resničnosti (razlike nastajajo pri zmožnostih čutil in sposobnostih deduciranja) oziroma subjektivno pogojenem navideznem svetu. To se imenuje pramada. Človekova tretja pomankljivost je, da se moti in dela napake, kar se imenuje bhrama. Ko ohromljen s popačenimi zaznavnimi sposobnostmi, osebno pogojenostjo in delanjem napak vseeno trdi, da razume resnico, in jo oznanja drugim ljudem, priplava na površje njegova četrta pomanjkljivost, zavajanje v zmoto. Temu se reče vipralipsa. Z nepopolnimi čuti in tremi zgoraj navedenimi nagnjenji je nemogoče priti do absolutnega znanja.

Naši čuti so torej nepopolni. Kaj pa naši instrumenti? Eugene Wigner pravi, da tudi pri fotografiranju zvezd navsezadnje s svojimi čuti »zajamemo« tisto, kar je na fotografiji. Brez čutov sploh ne bi mogli uporabljati fotoaparata. Povsem očitno je, da si znanje pridobivamo z uporabo lastnih čutov. Vsa tehnologija je zgolj nedovršen podaljšek nepopolnih čutov. Zato človekovo znanje ostaja nepopolno, saj temelji na čutni zaznavi, ki jo uporaba instrumentov lahko le delno poveča ali izboljša.

Indovedska filozofija, ki temelji na korpusu besedil s skupnim imenom Vede, pravi, da do znanja vodita dve poti. Po prvi poti, ki se imenuje aroha-pantha, hodi sodobna znanost. To je induktivni proces eksperimentalno-hipotetičnega raziskovanja. Druga pot, pravaroha-pantha, pa je deduktivni proces, pri katerem človek dobi informacije iz popolnega vira, ki nima štirih zgoraj omenjenih pomanjkljivosti. Ta vir je v vedskih besedilih označen z različnimi izrazi: param brahman, param satjam itd.

Razliko bomo osvetlili s primerom nekoga, ki mu bomo rekli Andrej. Predstavljajmo si, da Andrej ne pozna svojega očeta, saj je ta dom zapustil že pred Andrejevim rojstvom. Kako lahko Andrej zagotovo izve, kdo je njegov oče? Ena možnost je, da temeljito izpraša vsakega moškega, ki bi bil po starosti lahko njegov oče. Ta induktivni postopek bi bil dolgotrajen, težek in statistično neučinkovit. Druga Andrejeva možnost pa je, da se obrne na mamo in jo vpraša, kdo je njegov oče. To je primer pridobivanja znanja z deduktivnim procesom.

Pojem deduktivni proces ima v indovedski filozofiji čisto drugačen pomen kot v sodobni filozofiji. V sodobni filozofiji dedukcija pomeni proces logičnega sklepanja z uporabo čutov (indrija), uma (manas) in razuma (budhi). S stališča indovedske filozofije je to povsem induktiven postopek glej dodatek.

Vsa indovedska filozofska besedila razlagajo, da materija nima zavesti. Zavest je domena atme, nedeljive zavestne enote, ki je prekrita z materijo, skozi katero se zavest zrcali. Zaznava je domena zavesti. Kadar je zavest čista, je čista tudi zaznava. Zaradi narave materialnega ovoja je fizična čutna zaznava v nasprotju s čisto zaznavo atme zgolj necelovito doživljanje in je podobna močno zadušenemu zvoku.

Indovedski filozofi pridejo do nedvoumnega znanja s pramanami. Sanskrtska beseda pramana označuje tehtne vire informacij. Obstajajo tri temeljne pramane:

- pratjakša (čutna zaznava),
- anumana (sklepanje),
- šabda (transcendentalna aksiomatična informacija v zvočni obliki).

Med temi tremi je šabda nujna, pratjakša in anumana pa imata podporno vlogo. Vzemimo za primer umrljivost. V Vedah piše, da je umrljivost v tem svetu stoodstotna. Ta podatek lahko preizkusimo z eksperimentom ali sklepanjem in prišli bomo do istega zaključka. Indovedski filozofski, znanstveni in religijski kontekst je dovolj širok in globok, da lahko absorbira široko paleto običajnih in anomalnih pojavov, za katere daje empirične preizkuševalne metodologije. V članku sem omenil jogijsko-religijsko tradicijo, ki v indovedski filozofski šoli ne temelji na veri, temveč na empiričnih verifikacijah, značilnih za posamično disciplino. Metodologije so različne, ker so tudi področja preučevanja različna. S termometrom ne moremo meriti teže, z uro pa ne višine. Nekatere metodologije zahtevajo preobrazbo zavesti. Kljub temu pa ne vidim utemeljenega razloga za to, da bi določeno metodologijo označili za neznanstveno samo zato, ker se nam zdi nenanavadna ali ker je nismo vajeni. Hipotezo lahko upravičeno in znanstveno utemeljeno opustimo le, če natančna in dosledna izvedba poskusa ne prinese pričakovanih rezultatov.

Aksiomatične vedske informacije lahko torej preizkušamo z obema znanstvenima metodama. Džagadiš Čandra Bose, indijski multidisciplinarni raziskovalec, ki je svoje hipoteze snoval na indovedskih vidikih, je obstoj zavesti v rastlinah s poskusi empirično dokazal že v prvi polovici 20. stoletja. Nobelovec Neville Francis Mott je menil, da je bil Bose vsaj šestdeset let pred časom. Mnenje, da indovedska besedila posegajo zgolj na področje duha je nestrokovno in zmotno. Carl Sagan je med snemanjem oddaje za televizijsko serijo Cosmos v Indiji povedal, da so najbolj visoko razvite starodavne kozmološke zamisli prišle iz Indije. »Hinduizem [ki temelji na Vedah: opomba avtorja] je edina religija, v kateri se časovne lestvice ujemajo z znanstveno kozmologijo.« Namen tega članka ni podrobna analiza indovedske znanstvene zapuščine. Razveseljujoče pa je, da se je število projektov in raziskovalcev, ki z empirično metodo analizirajo različne za znanost in industrijo zanimive indovedske teze (te se v Vedah pogostokrat prepletajo z jogijsko-teološkimi temami in v prispodobe zavitim izrazoslovjem) v zadnjih dveh ali treh desetletjih občutno povečalo.

Sankrtolog Howard Resnick takole povzema zgodovinski spor med znanostjo in religijo: »V zahodnem svetu teologi niso uspeli znanstveno predstaviti božjih zakonov. Zato je v zahodni intelektualni zgodovini med teologijo in znanostjo prišlo do stroge dihotomije. V poskusu razrešitve spora so nekateri teologi svoje doktrine prilagodili in uskladili z dokazanimi znanstvenimi ugotovitvami ter celo psevdoznanstvenimi spekulacijami in hipotezami, ki so kljub nedokazanosti hipokritično vključene v svet znanosti. Po drugi strani pa nekateri fanatični teologi popolnoma zavračajo znanstveno metodo in vztrajajo pri verodostojnosti svojih zastarelih, ločinsko obarvanih dogem.« [15] Za združitev znanosti in religije se bo potrebno potruditi na obeh straneh.

Luknja v človekovem razumevanju zgodovine starih neevropskih civilizacij, neevropske filozofije, znanosti in religije ima lahko visoko ceno. Če nič drugega, bi lahko po načelu ne bis in idem – ne ukvarjajmo se dvakrat z isto zadevo – prihranili veliko časa, živcev in sredstev.

Zaključek

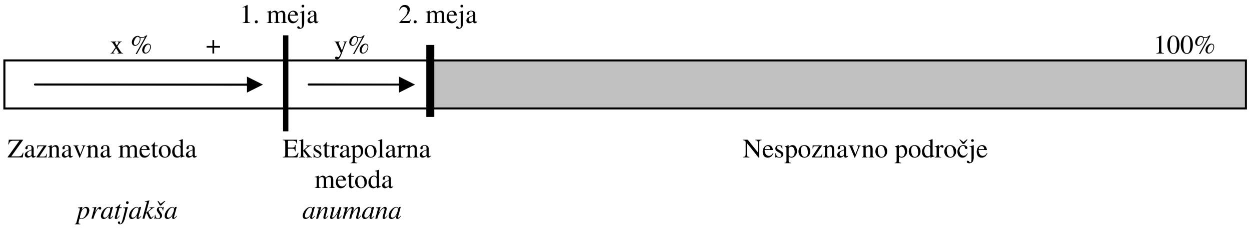
Človeštvo je pred zahtevno in obsežno nalogo. Če hočemo biti znanstveno dosledni v svojih poskusih razumevanja vseh razsežnosti diametralne različnosti ponavljajočih se izkustev, ki jih pred nas postavljata tako zgodovina kot sodobna kultura, nas čaka temeljita revizija znanstvene metodologije. Iskanje skupnega imenovalca za koeksistenco empirične znanosti, filozofije in jogijsko-teoloških sistemov je prvenstveno epistemološka naloga. Treba je ustvariti kulturo razumevanja lastnih sistemskih omejenosti ter hkratne spoštljivosti in odprtosti do vidikov, ki lahko spremenijo obstoječo znanstveno paradigmo. Če nam to ne bo uspelo, nismo dosegli zadanega cilja: soočiti se s poskusom spoznavanja resničnosti, ki smo jo ujeti v takšno ali drugačno fobijo predolgo tlačili v prašne predale. Dejstva ne prenehajo obstajati, če jih ignoriramo.

Viri

1. Thomas H. Huxley, Essays Upon Some Controverted Questions, (London: Macmillan & Co., 1892), str. 220.
2. Richard L. Thompson, Origins Magazine, (Bhaktivedanta Book Trust, 2003)
3. Rene Guenon, Introduction to the Study of the Hindu Doctrines, (London: Luzac, 1945), str. 38
4. Boyce Rensberger, Life Itself: Exploring the Realm of the Living Cell (Oxford: Oxford University Press, 1996), str. 24
5. Isto, str. 25
6. Albert Szent-Gyorgyi, Biology Today (California: CRM Books, 1972)
7. Steven Weinberg, »Before the Big Bang«, The New York Review of Books, 12 junij 1997, str. 20
8. Burt Herman, »Hawking Awaits Unified Theory Proof,« Associated Press, 21 julij 1999
9. Skeptic magazine, številka 4.1, str. 50
10. Scientific American, februar 1991, str. 72-78
11. Scientific American, »The Mind Body Problem,« januar 1981, str. 119
12. Eugene P. Wigner, »Two Kinds of Reality,« The Monist, Vol. 48 (1964). str. 250.
13. Back to Godhead magazine, februar 1998, odgovori na vprašanja
14.http://evolutioncreation.blogspot.com/2005_09_01_evolutioncreation_archive.html
15. A.C. Bhaktivedanta Swami Prabhupada, Srimad Bhagavatam, (Bhaktivedanta Book Trust) 12.2.1., komentar
16. Suhotra Swami, Shadow and Substance (Govinda verlag, 1996),
17. Mišo Tošič, Prerokbe iz Ved (Veda, 2004)
18. Devamrita Swami, Searching for Vedic India (Bhaktivedanta Book Trust, 2002)

DODATEK

EPISTEMOLOŠKI MODEL – INDUKTIVNI SISTEM (model sodobne znanosti)

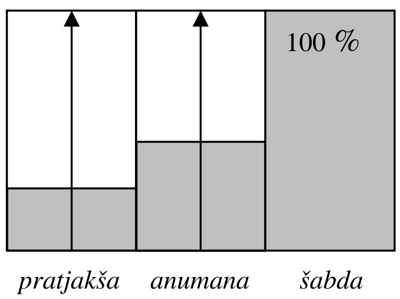


<u>Metodologija</u>

a) uporaba čutov in njihovih podaljškov (tehnologija)
b) uporaba logičnih sistemov

Temeljni problem tega epistemološkega modela je, da le-ta zaradi nepopolnih vhodnih podatkov in z napakami prepletene extrapolacije (x + y %) ne nudi celovitega spoznanja resničnosti.

EPISTEMOLOŠKI MODEL – DEDUKTIVNI SISTEM



<u>Metodologija</u>

V deduktivnem sistemu je izhodišče transcendentalni zvok (aksiomatična informacija), ki jo vsi trije iskalci resnice (znanstvenik, filozof in jogi-teolog) s svojo metodologijo spoznavajo vzporedno.

Index avtorjev / Author index

Conference / Konferenca
Edited by / Uredili

1 Information society

Intelligent Systems
Inteligentni sistemi
Marko Bohanec, Matjaž Gams

2 Information society

Education in Information Society / Vzgoja in izobraževanje v informacijski družbi
Vladislav Rajkovič, Tanja Urbančič, Mojca Bernik

3 Information society

Data Mining and Data Warehouses
Izkopavanje znanja in podatkovna skladišča
Dunja Mladenić, Marko Grobelnik

4 Information society

Collaboration and Information Society
Sodelovanje in informacijska družba
Marjan Heričko

5 Information society

Cognitive Sciences
Kognitivne znanosti
Urban Kordeš, Matjaž Gams, Olga Markič

6 Information society

Borderline Cognitive Sciences
Mejne kognitivne znanosti
Janek Musek, Mari Osredkar, Igor Kononenko, Barbara Novak Škarja, Matjaž Gams