Zbornik 8. mednarodne multikonference
Proceeding of the 8th International Multiconference

INFORMACIJSKA DRUŽBA IS 2005

INFORMATION SOCIETY IS 2005

Kognitivna znanost
Sodelovanje in informacijska družba
Izkopavanje znanja in podatkovna skladišča
Razvoj in prenovitev informacijskih sistemov
Vzgoja in izobraževanje v informacijski družbi
Inteligentni sistemi

Cognitive Science
Collaboration and Information Society
Data-Mining and Data-Warehouses
Development and Reengineering of Information Systems
Education in Information Society
Intelligent Systems

Uredili / Edited by

Olga Markič, Matjaž Gams, Urban Kordež, Marjan Heričko,
Dunja Mladenić, Marko Grobelnik, Ivan Rozman,
Vladislav Rajkovič, Tanja Urbančič, Mojca Bernik, Marko Bohanec

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11. do 17. oktober 2005 / 11th - 17th October 2005
Ljubljana, Slovenia

PREDGOVOR MULTIKONFERENCI INFORMACIJSKA DRUŽBA 2005

V svojem osmem letu ostaja multikonferenca Informacijska družba 2005 (http://is.ijs.si) ena vodilnih srednjeevropskih konferenc, ki združuje znanstvenike z različnih raziskovalnih področij povezanih z informacijsko družbo. V letu 2005 smo povezali šest neodvisnih konferenc v multikonferenco, kar je nekoliko manj kot leta 2004, ko smo imeli kar 11 konferenc. Odločili smo se, da bodo nekatere konference potekale dvoletno. Po drugi strani pa postaja informacijska družba vedno bolj zapleten socialni, ekonomski in tehnološki sistem, ki je pritegnil pozornost vrste specializiranih konferenc v Sloveniji in Evropi. Zato se naša konferenca postopoma usmerja v računalniške in informacijske vede. Kljub temu pa konferenca še vedno izstopa po širini in obsegu tem, ki jih obravnava.

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

Na multikonferenci, ki bo trajala teden dni, bo na vzporednih konferencah predstavljenih preko 100 referatov, okroglih miz in razprav. Nekatere predstavitve bodo posnete in bodo dostopne preko Interneta (*http://solomon.ijs.si/*). Referati bodo izšli v zborniku konference, izbrani prispevki pa bodo izšli tudi v 2 posebnih številkah znanstvenih revij, kot je Informatica, s svojo 25 letno tradicijo med odličnimi znanstvenimi revijami. Multikonferenco Informacijska družba 2005 (http://is.ijs.si) sestavljajo naslednje samostojne konference:

- Kognitivna znanost
- Vzgoja in izobraževanje v informacijski družbi
- Inteligentni sistemi
- Sodelovanje in informacijska družba
- Razvoj in prenovitev informacijskih sistemov
- Izkopavanje znanja in podatkovna skladišča

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 želiva posebej zahvaliti udeležencem za njihove dragocene prispevke in priložnost, da z nami podelijo svoje izkušnje o informacijski družbi.

Ob koncu bi rada predstavila še eno od letošnjih novosti. V letu 2005 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. Antonu Železniku. Čestitamo!

Cene Bavec, Predsednik programskega odbora
Matjaž Gams, Predsednik organizacijskega odbora

FOREWORD - INFORMATION SOCIETY 2005

In its 8th year, the Information Society Conference (http://is.ijs.si) continues as one of the leading conferences in the Central Europe gathering scientific community with a wide range of research interest on information society. In 2005, we organized 6 independent conferences forming the multi-conference, which represents a decrease compared to 11 conferences in 2004, but we decided to organize some conferences biannually. Information society displays complicated interplay of social, economics, and technological issues that attract attention of many scientific events around the Europe, so we are gradually focusing on computer and information sciences. Still, broad range of topics makes this conference unique among similar conferences.

The motto of the Conference is a synergy of different interdisciplinary approaches dealing with the challenges of information society. The major driving forces of the Conference are search and demand for new knowledge related to information, communication, and computer services. We present, analyze, and verify new discoveries in scientific community first, and prepare a ground for their enrichment and development in practice. The main objective of the Conference 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 Conference is running in parallel sessions for one week with over 100 presentations of scientific papers, round-tables, and discussions. Many events are video recorded and can be viewed through the Internet (http://solomon.ijs.si/). The papers will be published in conference proceedings, and in 2 special journal issues. One of them is Informatica with its 25 years of tradition in excellent research publications.

The Information Society 2005 Conference consists of the following conferences:

- Cognitive Science
- Collaboration and Information Society
- Data-Mining and Data-Warehouses
- Development and Reengineering of Information Systems
- Education in Information Society
- Intelligent Systems

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 2005, the Programming and Organizing Committees decided to award one Slovenian for his/hers outstanding contribution to development of information society in our country. With majority of votes, this honor went to Prof. Dr. Anton P. Železnikar. Congratulations!

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

Cene Bavec, President of the Programming Committee
Matjaž Gams, President of the Organizing Committee

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PREDGOVOR KONFERENCE KOGNITIVNIH ZNANOSTI

V letu 2005 sta dva osrednja dogodka:

- Sekcija »Znanstveno o verovanju«, ki ima samostojen predgovor, in
- Okrogla miza »Interdisciplinarno povezovanje v kognitivnih znanostih«.

Osnovni problem, ki je pripeljal do vzpostavitve znanstvenega polja kognitivne znanosti je t.i. »mind-body« problem. Vprašanje zveze med fizičnim/fiziološkim in psihičnim oziroma zveze med fizikalnim in informacijskim. Omenjen problem (in še nekateri sorodni) leži na preseku dela mnogih znanstvenih disciplin: biologije, nevrofiziologije, nevrologije, umetne inteligence, kibernetike, filozofije, lingvistike, psihologije in antropologije (odkritje analogij med nekaterimi kvantnimi in kognicijskimi procesi je v zadnjem času naštetim disciplinam pridružilo še fiziko). Vsaka od naštetih disciplin se na svoj način loteva vprašanj zavesti, spoznavanja, kognitivnih procesov itd., na žalost pa ugotavljamo, da centralno vprašanje ostaja neosvojljiva trdnjava. Mnoge od vpletenih strok so doživele izjemen napredek, pa vendar to – zaradi odsotnosti povezujočega elementa – ne prida bistveno k razumevanju osnovnega vprašanja. Nevrofiziologija, na primer, že izjemno natančno pozna dinamiko nevronskih aktivnosti ter njeno fizikalno-kemijsko osnovo, kljub temu pa to skoraj nič ne pripomore k razumevanju povezave med fiziološkimi procesi in psihičnim.

Kaže se torej izrazita potreba po sintezi sicer bogatega, a nepovezanega znanja mnogih disciplin, ki se ukvarjajo s posameznimi ravnmi delovanja možganov in duševnosti. Polje s skupnim imenom »kognitivna znanost« se bi moralo sistematično posvečati vprašanju kako združiti spoznanja posameznih disciplin v novo, sinergetsko celoto.

Lahko bi celo trdili, da je problem sinteze oziroma za problem metode povezovanja ključni problem kognitivne znanosti (okrog tega v krogih kognitivnih znanosti sicer ni popolnega konsenza). Uvedba ustrezne metode povezovanja znanstvenih disciplin s spektra kognitivnih znanosti bi že sama po sebi rešila večino najbolj perečih problemov s katerimi se trenutno ukvarjajo. Cilj kognitivnih znanosti je povezovanje naravoslovja (ki preučuje nevrofiziološke procese) ter humanističnih ved (ki preučujejo doživljajske vsebine). To povezovanje se mora 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.

Upamo, da bo letošnja konferenca »Kognitivna znanost« uspela povezati raziskovalce, ki se, vsak na svoj način, dotikajo enega najbolj kompleksnih fenomenov – zavesti. Upamo tudi, da bo naše srečanje pripeljalo do jasnejše slike stanja v Sloveniji, predvsem pa pričakujemo nove ideje za povezovanje in skupno delo slovenskih kognitivnih znanstvenikov.

Urban Kordeš, Olga Markič, Matjaž Gams

Cognitive science - Thought, machine, society

Forms of Reflection

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) 477-3131

ABSTRACT

Kleene's (second) recursion theorem provides a positive counterpart to the formal reflection in Gödel's sentence and theorems. The basic features of Kleene's theorem and its proof are presented in a fairly non-technical way. The possibility of applications in computational reflection is discussed, at a very basic level, with an eye on providing models of reflective cognitive processes.

1 INTRODUCTION

My previous contributions to this conference were centered around the concept of self-reference, mainly as it features in Gödel's sentence and his incompleteness theorems. Another, more "positive" form of self-reference was only briefly mentioned in (Bojadžiev 2000), and even that mention pointed to an exposition that was deeply flawed (Bojadžiev 1999). The result in question is Kleene's (second) recursion theorem, which establishes the existence of functions or programs that compute things about themselves. The significance of this result for cognitive science is that it shows the possibility of formal and computational models that would include the sort of reflection frequently thought to characterize cognitive functions such as self-sensing, proprioception, kinesthesia (Sheets-Johnstone 1998), introspection (Cutland 1980, p. 205), learning, reacting to unexpected circumstances, recovering from mistakes (Lemmens & Braspenning 2000) and consciousness (Bojadžiev 2000).

In the area of computational reflection, "computation about computation" (Sobel & Friedman 1996), these ideas and connections are frequently mentioned, but only on a programmatic level. Formal specifications and implementations have yet to follow, but at least these ideas and intuitions indicate some promising research hypotheses. A first step in formulating them might be to show just how much the task of implementing self-reference and reflection in common cognitive tasks can be underestimated (Pinker 1998) and show what sort of formal techniques these tasks would really require. Pinker's examples include building an internal model of the world that covers the modelling entity, programming introspection, and programming a robot to (learn to) use a mirror – all of them simple or trivial only at a first glance (Bojadžiev 2000).

One way in which reflective capabilities might be introduced into ordinary programs would basically be through additional arguments or parameters, which would give the program data about its context or manner of execution. The computational goal of providing this data would be to improve efficiency and modify performance. Adding parameters, and code to work on them, is basically what happens when features are manually added in new software versions (simple examples would be replacing internal program constants with parameters, or adding control features to various electronic devices). A more theoretical picture of this process is the "self-improvement" through meta-circular interpretation, which is then modified and partially evaluated (Smith 1986). The net effect of this is a set of additional parameters and procedures through which a program effectively reinterprets itself. The last step, partial evaluation, corresponds to what is classically called reflection in logic (going from the meta-level of a theory back down to the theory itself). More technical details on this can be found in the work on "Smithsonian" reflection in various programming paradigms (Smith's original version for LISP was later introduced into Prolog and still later into the object-oriented paradigm eg. by Maes). Another reason for mentioning this is the essential role of partial evaluation in establishing the recursion

theorem in terms of programs, overlooked in (Bojadžiev 1999) and (many) subsequent versions.

2 THE RECURSION THEOREM

Kleene proved the (second) recursion theorem in 1935, a few years after Gödel proved the incompleteness theorems. The reason for emphasizing the parallel between these results is that they both essentially depend on an important proof technique, namely diagonalization. The main self-referential features of Gödel's results were already indicated in my previous contributions to this conference, notably in (Bojadžiev 2001), and of course in "innumerable" other books and papers by various authors, so they will not be repeated here. By contrast, Kleene's results have received much less attention and have not been presented in any easily understandable form. On the contrary, the recursion theorem enjoys the reputation of being tricky (Odifreddi 1999, p. 152), »a little strange and mysterious« (Cutland 1980, p. 200, 207), and the same applies to its usual, »short but baffling« (Franzėn 2004, p. 155) proof. A better presentation of the theorem and its proof in terms of self-reproducing programs should appear as (Bojadžiev 2005), but some of the main ideas will be briefly introduced here. The "computations about computations" that the recursion theorem covers are usually discussed in terms of (partial) recursive functions, but a formulation in terms of programs is probably more appropriate in the present context. Given a certain indexing $P_0(x)$, $P_1(x)$, $P_2(x)$, … and a computable property of programs $P(i,x)$, the recursion theorem says:

$$(\forall P)(\exists n)\ \ P(n,x) = P_n(x)$$

That is, for any computable property of programs (P) there is a program (P_n) which computes this property about itself (the n in $P(n,x)$).

It should be noted that the reflection established by the theorem is limited, as expressed in the quantifier prefix: to expect $(\exists n)(\forall P)$ would be unreasonable, since such a P_n would be "universally reflective": it would compute all its computational properties. Such a program cannot exist, if only because the number of computable properties of programs is infinite, whereas a program must be finite. However, this puts no practical limitation on the amount of reflection a program is capable of, because the computable property it computes about itself can be arbitrarily complex. For modeling reflection in *conscious* cognitive processes, this is more than enough, since our insight into our own functioning is rather limited.

To appreciate some of the difficulty in understanding and proving the recursion theorem, without going into the actual proof, it may be enough to know that the theorem was originally known under the label "circular definition". This label refers to the form

$$(\forall f)(\exists n)\ \ P_n(x) = P_{f(n)}(x)$$

where f is a total computable function. This form can be used to define P_n in terms of f , by means of (its relation to) $P_{f(n)}$; as Cutland says, this defines a program in terms of a code for its own algorithm (Cutland 1980, p. 203).

The trouble with the usual proofs of the recursion theorem is that they are, as Owings says,

> completely unmotivated, seem to depend upon a low combinatorial trick, and are so barbarically short as to be nearly incapable of rational analysis (Owings 1973, p. 95)

These »features« of the proof are very much evident even in less technical expostions of the theorem and its proof (Dowling 1990). Some presentations attempt to face these difficulties and deal with them by developing several more or less intuitive approaches to the proof (Odifreddi 1999), and some explain the idea behind the standard »short but baffling« proof, though only after the proof itself (Cutland 1980, p. 206-7), so the two remain somewhat disconnected. The version of the proof in (Bojadžiev 2005) will contain a heuristic reconstruction of such proofs by developing the logical form of self-reproduction, a commmon illustration of the recursion theorem (the existence of self-reproducing or self-describing programs, for $P(n,x) = x$).

2 GÖDEL AND KLEENE REFLECTION

An obvious difference between the reflection in these two formal results is that Gödel's uses a particular, negative property (unprovability), whereas Kleene's holds for all properties. It might be said that Gödel's theorems are mainly concerned with the *limits* of reflection (imposed by consistency), whereas

Kleene's theorem indicates the *possibilities* of reflection. In its "negative" aspect, Gödel's result seems more suitable as a formal model of very cognitive specific states and processes, more "ultimate" things like questioning self-identity, gaining self-knowledge, being the subject of paradoxical drives and (the reproduction of) desire. Gödel's result might also have more to do with consciousness itself, because of the contradictory intuitions that people have about it: for some, consciousness is reflective, and *is* a certain sort of self-reflection (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).

However, the difference between the "negative" Gödel reflection and the "positive" Kleene reflection is much less apparent at the level of the proofs of the theorems: in Gödel's case, most of the proof consists in defining a meta-circular interpreter for arithmetic (in arithmetic), to put it in programming terms, and the particular predicate (unprovability) only comes into play at the last stage of the proof. Furthermore, both theorems essentially depend on the same proof technique, namely diagonalization, the difference being that in Gödel's case, the result depends on forming an *anti*-diagonal row, whereas in Kleene's case, the special row is the *diagonal* one. Thus, in terms of the contrast between "positive" and "negative" reflection, Kleene's result is a better counterpart to Gödel's than other positive uses self-reference and reflection, such as the statement of self-provability in Henkin's sentence and the "self-referential" appearance of the propositional-level reasoning in the proof of Löb's theorem.

In conclusion, to amplify and modify a point variously made in previous papers: the sort of reflection at work in formal results such as Gödel's and Kleene's suggests, though as yet only vaguely, numerous "applications" in trying to build formal and computational models of cognition. Instead of trying to use Gödel's results, in their various, more or less strong forms and simplifications (Odifreddi 2005), in questionable attempts to establish the limitations and supposed inadequacies of formal cognitive models, it seems much more promising to try to use Gödel's and Kleene's techniques to *build* such models. If the human mind is unscrutable to itself in some ultimate way, then Gödel's results about the limitations of reflective formal systems might provide a formal picture. On the other hand, many results about formal systems suggest the opposite picture: Franzén has 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 every *finite* subset of their axioms [p. 125-6], which helps to reconcile the two pictures.

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SEKCIJA: Znanstveno o verovanju

Predgovor k sekciji znanstveno o verovanju

Duhovno doživljanje sveta in verovanje je pomemben vidik človekove eksistence v vseh dobah in v vseh kulturah, vključno z današnjo. Vendar je 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 sekcija 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.
Sekcija 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 sekcije, so pa tudi prispevki, ki govorijo o izsledkih empiričnega raziskovanja na področju vernosti in duhovnosti. Poleg predstavitve posameznih referentov želi sekcija 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 sekcije, 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. Sekcija 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
prof. dr. Drago Ocvirk, Teološka fakulteta
doc. dr. Mari Jože Osredkar, Teološka fakulteta
Barbara Novak Škarja, Duhovna univerza

Swing low sweet creation
The word of God is in agreement with modern science

Dr. Avraham – Karltheodor Schmidt

Aco de Paou – Institut for Ecology, Water and Resonance – Research
F – 94200 Valernes/France
Tel. and Fax: 0033-4-92.62.13.92
e-mail: institut@acodepaou.com

Abstract

The best description of the creation we find in the Bible – the Torah. The Hebrew has a deeper meaning. The letters are also numbers. For the Jews the letters and numbers have the same value, and are therefore of numeric meaning. For the Jew is the Torah much more instructive in the expression of the original language, more than only the verbalism. We find in the Torah concrete informations about the creation. And we have to ask, weather this informations are in correspondence with the science. We can conclude: all this information of letters and numbers in the word of God are in agreement with modern scientific results. Just the last century brought new knowledge over the character of matter and energy, over the coherence in ecological systems, the natural information systems and bioresonance. The reason for the problems of modern natural science to understand these theories and accept the laws of ecology and the new view of the "living character" of water is not only the materialism. More important is the ignorance of the informations of God in the torah.

1.Introduction

The best description of the creation we find in the Bible – the Torah. In The Hebrew language the Torah is the key for the right understanding of the language of G-d. The Hebrew has a deeper meaning. The letters are also numbers. The letters - not speculative - have a special expression. In the Arabian numbers received in the daily life of men a very other meaning. But for the Jews the letters and numbers have the same value, and are therefore of numeric meaning. For the Jew is the Torah much more instructive in the expression of the original language, more than only the verbalism. The end letters can be exchanged and they don't loose not there since. Also the letters have their history of developing. Both letters and numbers give a show into the things and happenings.

Images of an Exhibition.

We begin our presentation with images that relate material appearances, described by science, to their descriptions in Torah.

1. First image: **And it boils, and roars, and sizzles and cooks, as water mixes with fire and to the sky rustles the bubbling charge – and flood after flood scrapers without end as men would create a new creation**.
This is the world of chemistry, metal production and human action.

2. Second image: The greatest prophet of the world was Elijah. He did want to get contact with G-d. Which experience he had?
And he stood before G-d. "Go forth and stand upon the mount before **the Lord. And, behold, the Lord passed by, and a great and strong wind rent the mountains and broke in pieces the rocks before the Lord; but the Lord was not in the wind; and after the wind an earthquake: but the Lord was not in the earthquake. And after the earthquake a fire. But the Lord was not in the fire.**

3.The third image: And after the fire a still small voice.
And when Elijah heard it, he wrapped his face in his mantle and went out.

In this respect he learned G-d and with it the creation. Men produces like in image one. G-d doesn't create like he - noisy and with violence. He created with wisdom, love and silence.

Rain drops – leaves rushes with low noise-level, wild sow splashes with still small voice. Plants are growing silent, animals pastures with joy and noiseless. – All grows and develops with an interior law-system. Likewise are all creation processes.

2. The beginning: “Bereschit”

G-d didn’t shout, didn’t cry – HE spoke and it happened. Atoms did pose on their place and the electro magnetic fields (EMF) brought the whole to a system of molecules of each creation.

In the Hebrew language we read for right to left. The Alef א (first letter like in the word Elohim) is a strange silent letter. This means: G-d had at first the new creation of the world in his view.
This letter Alef involves in fact three letters: the Hebrew U = Waw – and two times Jot = ש (G-d) and two times men (man and woman) יי makes א. The philosophic sense is the unification of G-d and men.

The history of creation in the Torah begins with Bereshit – Beth = ב this is: the second letter of Hebrew alphabet. In the Jewish sense it is a lack of respect, because he is in the Torah the first letter.

The word Bereshit - בראוית = In the beginning - contains of the letters, who are also different words: BETH = ביר - RE = רא - ESH = או - SHIT = וית - TOV = ת

BETH = בית means house, space pot B = ב or beth = בית is a signification of the word „in“.

רא = RE, ER, RA or AR is in Hebrew the same and can be translated as „light and vision“.
או = ESH is the Hebrew word for fire (energy). This fire is a signification for “light of the tend of assembly” the tabernacle.

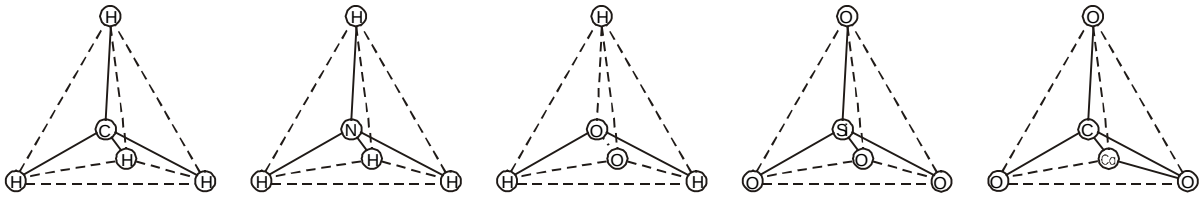
וית = SHIT comes from the Aramaic language (the mother language of Hebrew) and means thorn or six thorn = Hexagon.

The word BERESHIT = בראוית is in fact a preamble for the creation. This means, that G-d primarily some-thing creates, like a house, a container for the creation where in a inner light exists. This good ideal space we see also in the water, from where all life comes. But HE had to give its character at first to the water. This character of a matter can be seen in the smallest parts – the atoms and the molecules. They are not fixed but depended on the temperature. Water we know in three aggregate situations – fast, liquid and in form of gas. In the word BERESHIT - בראוית - we find also the word shit - וית - what is the hexagon – the molecular structure of i.e. water developed from the tetrahedron within the spiral and the tetra helix. In fact we find the structure of the hexagonal molecular structure in all materials, who are important for developing of life (like in silicon, quartz, carbon sand, soil, magnesium, calcium and many elements more).

The six thorn or hexagon - וית - (= Shit) is the Aramaic expression of the bible for the molecular combination of the creation. In the hexagons exists a space for the most scientist unknown, which is an ideal space for electromagnetic fields and informations.

Many elements have the same molecular structure.

If we put two tetrahedrons point on point and we assemble more, we get a hexagon. The ice-crystal is a good example of hexagonal structure. Also the clusters of liquid water have this structure. This is a precondition for coherent structures and relations. The hexagon has a very interesting space, who is capable to charge informations.



$C H_4$ $N H_4$ H_2O $Si O_4$ $Ca C O_3$

3. Creation in water: “Bara”

“Bara” the act of creation is the second word in this story. bara = ברא (= create) begins again with a ב = beth - בית – house.

Also the multitude of the water the creator had in his view, that HE made a system to a conformity of laws, because the water had the necessary character. This goes up to the dependence of temperature of the physical systems like density, specific temperature, melting and boiling point, what make life on earth possible. Here we cannot talk about evolution. The best example of the comparison of special molecules to combination of molecules are the so-called quasi crystal clusters in water. There exists a mixture of separate molecules and clusters of equal parts at of 37,3°C - the temperature of our physician bodies 1: 1.

What were the building stones of the creation? The modern physic has investigated that subject. With our usual methods we measure only materialistic parts. But the quanta physicists realized, that matter in fact doesn’t exist. Matter and quanta exists in material and immaterial parts. Beside the quanta of light – the photons – there exist the quanta of lattice-oscillation, the quanta of sounds, which we get by touching. In water the correlation of energy quanta to matter nuclei is a billion:1.

The German physicist Max Planck said: „So I declare that I found in my research of the atoms: There is in fact no matter. All matter originates and exists only by forces, which the nucleus parts bring to vibrate and hold together the atoms like a tiny sun system. Matter itself doesn’t exist. There exist only the invigorating, invisible and immortal spirit as the source of material." With this, Max Planck confirms, that matter is nothing else than dense energy. With this explication, if we consider this expression seriously we get a very new view of matter as well as the whole creation. The most important is not the atom matter but the energetic force! With this words he explains that matter is nothing as dense energy organized by a spirit.

Nuclear parts and energetic quanta are almost in moving – in vibration. The nucleus vibrates in their characteristic frequencies that we can measure. The electromagnetic fields receive a factor of arranges by vibrations. We can find positive as well negative charged fields – or spaces. They are structured energies. These become to a “building design” for the materialistic structures and “characteristic vibrations”, where they develop to a holistic unit. Also this has its individual personal manner. (Latin: “personare” – sound going through).

In between of little and bigger parts of matter are large spaces. All moving is marching in special lines and spaces in mostly organized symmetries. These give substances their characteristic pattern (this we can analyze with x-ray density diagrams). The whole system forms the structure and character of matter. The Chinese philosopher Lao-Tse did it explain like this: “A house exists by walls, windows and doors. But this is only the visible, but the space in between is the important.” The walls, windows and doors are the matter, but the space is important. This is the place of life, in it are all actions, the interactions and relations.

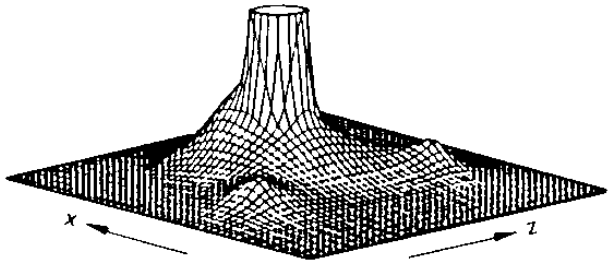
Modern research let see the whole cosmos as a space, wherein background fields are with special harmonic and varied frequency pattern – for water a ideal body of resonance: Thin in the laws of harmony.

For the creation we need two positions: the transmitter and the receiver:

G-d, Creator, G-d-Father and material, matter*, mother

*matter comes from the Latin word mother

“The word was in the beginning (I remember the word Bereshit - בראוית) and that very word was with G-d and G-d was the word. The same was in the beginning with G-d.” - There nothing exist without the word – the swinging – the vibration.



atom lattice oscillation

We have two sorts of images:
The molecules and the material

	= water

ולז	a o Sh l m

4. What is a creation ?

It is never – I'm sorry for the chemists – like a chemical element. Each creation is in fact a residential building. We take a tree as an example: The roots are in the soil with a multitude of microbes. In the points of the roots are initial cells – a sort of brain. In the tree-trunk are different pump-systems. And the treetop has leafs with different activities. In these leaves live little bacteria as chloroplasts – which produce with light by dissociation of water the chlorophyll.

Also our physical body is a complex union of many different organs, microorganisms, blood, water… If we miss one of this parts, we have no possibility for life. But also the single part can not exist without the others. Plants, animals and men are really living communities because they are creation, who contents of different vibrating parts. Each vibration of an organ has other vibration-frequencies.

The resonance in the creation is the precondition for harmony in the ecology. The most important resonance is in between creator and creation – transmitter and receiver.

5. Conclusion

We can conclude: all this information of letters and numbers in the word of God are in agreement with modern scientific results. Just the last century brought new knowledge over the character of matter and energy, over the coherence in ecological systems, the natural information systems and bioresonance. We can learn a lot about the special "living character" of water, which has the kea role of creation and ecology. With Micro optical Investigations we can see that light and words can form new structures in water.

The reason for the problems of modern natural science to understand these theories and accept the laws of ecology and the new view of the "living character" of water is not only the materialism. More important is the ignorance of the informations of God in the torah.

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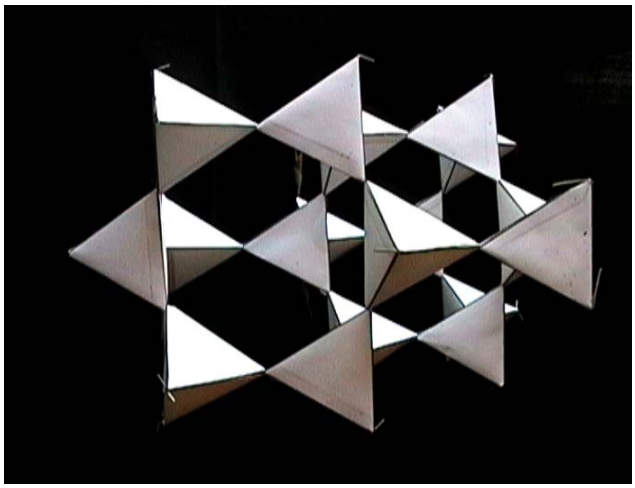

Nenavadni inspirativni pojavi - praznoverje, vera ali dejstvo

Vesna Periček Krapež
Center za duhovno kulturo, Duhovna univerza
Ruska 13, SI-1000 Ljubljana
e-mail: vesna.pericek-krapez@cdk.si

ABSTRACT

The article discusses contemporary mass-phenomena, which have been occuring all over the world over the last 50 years and which can be - owing to their characteristics – termed "the unusual or extraordinary inspirational phenomena". Their essential universal characteristics are presented: firstly, the extraordinariness or para-normality which is of para-physical and para-psychological nature; and secondly, their inspirational nature, which is based on their wholesome effect on individuals present, because in all of these phenomena some kind of help, either physical or psychological and spiritual, or both, is given. The experience of these phenomena is universal, namely they are not limited to any religious tradition or dogmatic convictions or beliefs about the existence of god. Mentally healthy, ordinary, i.e. normal, people experience them, in Europe (and Slovenia) and on other continents. The classification of these phenomena is presented, regarding: their objectiveness; presence of a person in them; religiosity of context in which they appear; duration of a phenomenon; number of participants; their influence and effect on the people present. Various hypotheses about the nature of the phenomena are given: is this all an accident or manipulation; or influence of faith and suggestion; or cognitive disturbances; or challenge to higher i. e. intuitional cognition? Further systematic investigations should give an unambiguous answer whether the extraordinary inspirational phenomena are basically of cognitional or of objective nature. In both instances they are worthy of thorough investigation, because they could offer mankind new insights into hitherto unresearched modes of human cognition and/or even new understanding of reality, which has been so far either denied (by science) or confined into stiff beliefs (by church).

UVODNO POJASNILO

Predmet obravnave je posebna kategorija sodobnih pojavov, preučevanju katerih smo se posvetili sodelavci Centra za duhovno kulturo od leta 1996 in se vrstijo zadnjih 50 let, tako v Evropi (vključno s Slovenijo) kot tudi na drugih celinah, osnovni skupni značilnosti katerih sta nenavadnost in inspirativnost, odtod poimenovanje *nenavadni inspirativni pojavi* (v nadaljevanju NIP). Mnoge druge njihove lastnosti so razvidne šele primerjalno, po pregledu večjega števila teh pojavov. Nekatere vrste teh pojavov so sicer znane tudi iz preteklih stoletij iz zgodovine religij, vendar je med njimi velik delež netradicionalnih, novodobnih. Vse pa povzročajo posebno stanje zavedanja, ki smo ga poimenovali *nenavadno inspirativno doživetje* (v nadaljevanju NID); v vsakdanji medosebni komunikaciji je za pojav in izkušnjo uveljavljena označba čudež.

PARANORMALNOST NIP

je objektivne (ontološke) in subjektivne (kognitivne) narave: to so nepredvidljivi in redki (ter večinoma razmeroma kratkotrajni) pojavi, obenem tudi nerazložljivi (v okviru znanstveno-materialistične paradigme); v človeku, ki je takšnemu pojavu priča oziroma je v njem soudeležen, pa sprožajo začudenje ter posebno kompleksno stanje zavedanja – inspiracijo.

Prva temeljna značilnost jih določa kot *para-normalne* pojave, in sicer kot 1) *parafizikalne*, ker se dogajajo v nasprotju z znanimi fizikalnimi zakoni (npr. pojavljanje in izginjanje nenavadne in kot se kasneje izkaže čudodelne osebe pred očmi prič(e); jokajoči kipi in ikone Device Marije in Jezusa Kristusa; pojavljanje religioznih simbolov in citatov na površini in sredici sadežev in drugih naravnih podlagah; pojavljanje jasnih prepoznavnih svetih podob in simbolov na fotografijah, česar pa zagotovo ni bilo na prizorišču fotografiranja; nerazložljiva nenadna ozdravljenja ipd.); kot 2) *parapsihološke*, ker gre tudi za psihološke pojave, ki presegajo normalne človeške lastnosti in sposobnosti (telepatski prenos misli, videnje v prihodnost, pravilno navajanje dogodkov iz preteklosti in sedanjosti neznanega posameznika, napovedovanje dogodkov v prihodnosti ipd.).

Na osnovi nam doslej dostopnih podatkov se obenem ponuja sklepanje, da so nenavadni tudi *verjetnostno* in *statistično*. Pri NIP gre za malo verjetne dogodke, kjer pogostost njihovega pojavljanja visoko značilno odstopa od predvidene in to brez jasnega oziroma razložljivega fizičnega razloga. V ilustracijo navajamo primer religioznega NIP, in sicer jokajočih kipcev Device Marije. Koliko verjetno je, da nekaj deset cm visok Marijin mavčni kipec izloča iz oči tekočino in koliko verjetno je pri tem, da gre za pravo človeško kri? Tak primer je Marijin kipec iz Civitavecchie v Italiji, ki je pričel točiti krvave solze l. 1995. Preiskali so ga vatikanski eksperti, DNK raziskave so pokazale, da je tekočina človeška kri; na osnovi preiskave z rentgenskimi žarki pa je bilo ugotovljeno, da kipec nima nobenih votlin, v katerih bi bila skrita naprava, ki bi občasno brizgala tekočino (1). V obdobju od l. 1991 do 1995 je bilo v Italiji opaženo še 9 takih primerov, še eden med njimi naj bi bil predmet krvne analize, ki je pokazala, da gre za človeško kri (2). Do leta 1998 naj bi kipci Marije jokali tudi v Portoriku (3), Kanadi

(4), na Nizozemskem (5), v Španiji (6), v ZDA (7) na Trinidadu (8).

Zanimivo bi bilo izdelati obširnejšo in natančno analizo populacijske razporeditve (gostote pojavov) ter frekvence pojavljanja. Na osnovi doslej zbranega gradiva (9) lahko zaenkrat le sklepamo, da je teh pojavov dosti več, kot smo jih evidentirali, da torej gre za 'vrh ledene gore' sodobnega masovnega pojava svetovne narave. Domnevamo, da je vsak človek bodisi sam doživel vsaj en NIP, bodisi pozna koga, ki je imel tako doživetje.

INSPIRATIVNOST NIP

Druga splošna značilnost NIP je njihova *dobrodejnost*, saj v splošnem vsi nudijo kako pomoč, tako fizično kot psihološko in duhovno: pomagajo pri boleznih, nesrečah in drugih življenjskih situacijah; svetujejo; zdravijo; v človeku sprožajo globlje spoznanje o sebi, svojem življenju, svetu. Posledično sprožajo v človeku stanje notranje izpolnjenosti in sreče. Za ljudi, ki jih doživijo, so to posebna, vrhunska doživetja, resnična, prepričljiva, izjemna ne samo po svoji nenavadnosti, temveč tudi po tem, česar so v njih deležni. Čeprav so večinoma kratki, imajo dolgotrajen inspirativini učinek. Delujejo mobilizirajoče za pozitivno življenjsko spremembo (v smeri osebne in duhovne rasti - večja etičnost, altruizem, bolj poglobljen svetovni nazor). Nekateri jih zato imenujejo dobri čudeži.

Doslej nismo zasledili celovite obravnave NIP (izjema je knjiga P. Škoberne in T. Gros »Svetlobni križi in drugi čudeži«) (10). Že zaradi njihove masovnosti menimo, da so vredni poglobljene sociološke, psihološke, filozofske in kognitivne obravnave kot znamenja sodobnega časa.

KLASIFIKACIJA NIP

Glede na veliko raznolikost NIP se je težko opredeliti za eno samo merilo, po katerem bi jih vse hkrati predstavili v nekaj najbolj osnovnih, jasno ločenih razredih.

Klasifikacija po objektivnosti

Glede na to, ali izkuševalec NIP tega doživlja zunaj sebe ali znotraj sebe (v svojem duševnem prostoru), so 1) o*bjektivni*, dejanski, zunanji, zaznani s fizičnimi čutili v normalnem stanju budne zavesti in 2) *subjektivni*, *psihični*, notranji NIP. Razmerje med obema razredoma je po naših podatkih 1:4. Torej vsaj nekateri med temi pojavi kažejo, da gre za stvaren pojav, s svojim izvorom zunaj človeka, oziroma da je neodvisen od slednjega.

Klasifikacija po navzočnosti osebe

Glede na obliko pojava oziroma na dejavnik, ki je sprožilec začudenja in inspiracije, so to: 1) *pojavi z ne-osebo*, to je s predmetnimi simboli oziroma znamenji ali z 'breztelesno' silo ter 2) *pojavi z osebami*, ki pomenijo nenavadna inspirativna srečanja in drugačno komunikacijo z živo posebno osebo (bodisi kot celotno pojavo, ali prek stika zgolj z vidnimi oziroma slišnimi učinki). V obeh skupinah gre za objektivne (zunaj nas) in subjektivne pojave (psevdo-objektivne, na primer sanje, vizije).

V prvo temeljno skupino, kjer ni neposredno udeležena živa oseba, smo uvrstili (i) **sodobne religiozne pojave z religioznimi predmeti in simboli,** (ii) **samaritanske pojave** (v ožjem pomenu besede)[1]; (iii) **ostale novodobne pojave** (svetlobni krogi, svetlobne proge na fotografijah, svetlobni križi). V drugi osnovni skupini NIP, kjer nastopajo osebe, gre bodisi za naključne kratkotrajne stike z neznano, vendar po izkušnjah ljudi zelo plemenito in čudodelno osebo ali pa za občasne stike s svetimi osebami (na primer z Devico Marijo, Jezusom Kristusom, s svetniki), to so (iv) **srečanja** s fizično osebo (objektivna) **in prikazovanja** (povečini subjektivna doživetja, videnja svetih oseb)**.** V to skupino sodi še razred ljudi s posebnimi nadarjenostmi, ki jih ti posvečajo v dobrobit skupnosti in ki delujejo na liniji duhovnega zdravljenja in humanitarnih dejavnosti ter živijo stalno med nami, poimenovali smo jih (v) **ljudje s posebnimi karizmami**.

Klasifikacija po religioznosti konteksta

Glede na kontekst, v katerem se dogajajo oziroma komu se dogajajo, ločimo NIP na sledeči način. 1) NIP v okviru jasnega *religioznega konteksta,* kjer se dogajajo konfesionalnim vernikom cerkva in ločin (vseh velikih svetovnih religij) ter imajo tipično verski značaj, ali 2) *zunaj cerkvene sfere,* v območju laične, civilne družbe in njene alternativne duhovnosti, pa tudi nevernikom oziroma neformalnim vernikom (ki niso zavezani nobeni religijski instituciji ali njenemu kodeksu) in so brez verskega značaja.

Po naših podatkih je večina NIP nereligiozne oziroma sekularne narave. V obdobju od začetka l. 2000 do sredine 2001 smo zbrali 225 posamičnih primerov NIP iz Slovenije ter 205 iz tujine in ugotovili sledečo porazdelitev različnih vrst inspirativnih pojavov v Sloveniji: 80 religioznih (to je 36%), 90 srečanj (40%), 15 samaritanskih (7%), 40 pa ostalih novodobnih pojavov (18%). Razmerje v tujini: 90 religioznih (44%), 25 srečanj (12%), 50 samaritanskih (24%) ter 40 ostalih pojavov (20%).

Zanimivo je, da med po vsebini religioznimi pojavi delež sekulariziranih, ki se dogajajo izven tradicionalnih religioznih prostorov in norm. Na primer pojavljanje podobe Device Marije na poslovni stavbi (ZDA) (11), na odbijaču avtomobila (ZDA) (12), na cvetnem lističu (13); pojavljanje podobe Jezusa Kristusa na cvetnem lističu (14), na granitni plošči (Avstralija) (15), na ograjah, oknih ali stenah stanovanj (Iran) (16); pojavljanje religioznih simbolov (krščanski križ (17)) na površinah sadežev (Slovenija) ali pojavljanje citatov iz Korana na prerezanih sadežih in zelenjavi (18). Pojavi, ki se zdijo povsem nereligiozni, pa imajo marsikdaj v resnici močan naboj presežnega, duhovnosti, svetosti (na primer svetlobni križi, v katerih neverujoči vidijo podobe svetih oseb).

Klasifikacija po trajanju pojava

Po trajanju (časovni dejavnik) so 1) kratkotrajni pojavi ali dogodki (minljivi, bežni) in 2) dolgotrajnejši, stabilni pojavi. Npr. prikazovanja, vizije in srečanja so praviloma kratkotrajna, od nekaj sekund do minut (lahko se ciklično ponavljajo); jokajoče ikone in svetlobni križi ter številni predmeti iz religij, ki jih ljudje doživljajo kot magnetične (ker naj bi izžarevali posebno blagodejno energijo), pa so permanentni objekti in privlačevalci ljudi.

Klasifikacija po številu prič

V tesni zvezi z merilom časa je merilo, koliko ljudi hkrati je neposredno deležno nekega pojava: 1) *individualni*

1 Poimenovali smo jih po svetopisemski zgodbi o dobrem Samaritanu. V skupino samaritanskih pojavov v ožjem pomenu besede štejemo tiste, kjer kot sprožilec čudenja in inspiracije ne nastopa oseba, ampak se dogodijo kot 'čudežno naključje' ali po intervenciji 'nadnaravne sile-energije', na primer, ko se v nenadni nesreči obvaruje človekovo življenje ali se bolnega človeka nerazložljivo ozdravi. Če v pojavu nastopa oseba, ga uvrščamo v samaritanska srečanja ali v srečanja z angelskimi bitji.

(osebni, intimni) pojavi so v prvi vrsti osebno naravnani – namenjeni posamezniku, z zelo osebnim sporočilom in so v povprečju kratkotrajni (npr. srečanja in samaritanski pojavi); 2) *masovni* pojavi pa načeloma pritegujejo velike množice ljudi v/na določen prostor ter skozi daljša obdobja in imajo navadno močno splošnejše sporočilo (največkrat so taki religiozni pojavi, npr. t. im. mlečni čudež iz l. 1995 v hindujskih skupnostih v Indiji, na Daljnem Vzhodu, Veliki Britaniji, ZDA in drugod (19) ali pa prikazovanje Device Marije nad koptsko cerkvijo v Zeitunu v Egiptu v letih 1968 do 1971) (20), seveda pa ne izključujejo tudi osebne pomoči.

Klasifikacija po učinkih

Razlikujejo se tudi po učinku na ljudi, velja pa poudariti, ima večina teh pojavov več raznih učinkov hkrati.

1) *Znamenja* (sporočila ali prerokbe); navadno govorijo o občih, obsežnejših dogajanjih in procesih v človeški skupnosti in označujejo določen čas (na primer sporočila Device Marije v Medžgorju v BIH, v Akiti na Japonskem, v Kibehu v Ruandi, v Betaniji v Venezueli in drugod).

2) *Samaritanski pojavi* (v ožjem smislu)[2]. Ta tip NIP je primarno naravnan na človekove konkretne, osebne probleme. Mnogi ljudje jih spontano povezujejo z angeli[3], kot zasledimo na spletu o poročilu raziskave E. J. Heathcote[4] (21) in na drugih spletnih straneh (22). Pomoč je lahko preventivnega ali kurativnega značaja. Glede na psihološki učinek v človeku gre za različne vrste: tolažbo, svarilo (opozorilo), življenjsko usmeritev, veliko je izraziteje vzgojnih (poučnih); od pomoči pri na videz drobnih zadevah, ki pa so človeku vendarle pomembne, do rešitve človeka iz smrtne ogroženosti in nerazložljive ozdravitve.

3) *Zdravilni pojavi*, pri čemer velja poudariti, da so vsi NIP implicitno tudi zdravilni; če pa je ozdravitev oziroma zdravljenje bolj eksplicitno prisotno v njih oziroma če ljudje npr. obiskujejo neke prostore, ki jih doživljajo kot svete ali/in se obračajo v njih na predmete, ki jih dojemajo kot svetinje, poglavitno z namenom, da bi bili deležni ozdravljenja, potem jih opredeljujemo kot poseben razred.

4) *Splošni spodbujevalci vere in upanja;* izraziti v tem učinku so religiozni pojavi, v katerih nastopajo religiozni simboli in tako imenovane svete osebe.

Med učinke lahko prištevamo tudi moč psihološkega vpliva oziroma stopnjo začudenja, ki ga pojav s svojo para-normalnostjo povzroča: od blagega začudenja ('mehki' pojavi, npr. večina srečanj, mnogi samaritanski pojavi, ti so v večini) do velikega presenečenja in osuplosti (šokantni, 'trdi' pojavi, npr. izginjanje in pojavljanje oseb in/ali predmetov pred očmi prič). Pomembna lastnost obojih pa je, da v človekovo zavedanje vstopajo *nevsiljivo*, saj sta potek in pojavnost vsakega takšna, da puščajo veliko odprtega prostora za razlago, vzroka za to pa ne kaže iskati (zgolj) v človekovih formalnih prepričanjih, temveč prav v naravi pojava.

KDO IN KJE JIH DOŽIVLJA

Navdihujoči para-normalni pojavi se dogajajo normalnim, običajnim ljudem – duševno zdravim, v prisebnem budnem stanju zavedanja[5] vseh prepričanj (verujočim in nevernim) in veroizpovedi, ne glede na starost, spol, izobrazbo ali poklic. Ne gre torej za psihološko motene ljudi niti za ljudi, ki bi bili nagnjeni k prividom ne za čudake, posebneže ali fanatike z razgreto domišljijo, prav tako načeloma ne gre za ljudi z globoko vero ali morda nagnjene k askezi.

Izstopajoča je sekularnost prostorov, kjer se dogajajo. Nanje sicer naletimo tudi v prostorih, ki veljajo za svete, na primer v cerkvah in v romarskih krajih, vendar se večinoma pojavljajo sredi vsakdanjega življenja: na ulicah in cestah, v trgovinah, kavarnah, po domovih, v urbanih središčih, v parku, v naravi; po pričevanjih ljudi pogosto tam, kjer bi to najmanj pričakovali.

RAZLIČNE HIPOTEZE O NARAVI NIP IN NID

Naključja

V teh pojavih ni nič nenavadnega, saj gre le za sicer malo verjeten splet dogodkov, v katerem pa ni prepoznavne urejenosti ali zakonitosti in v katerem ljudje hočejo videti določen smisel, ki ga ni. Še zlasti to lahko trdimo v primerih samaritanskih pojavov in srečanj. Vendar številčnost tako nepričakovanih in nenapovedljivih inspirativnih dogodkov, njihova razprostranjenost po svetu ter osrečujoča in zdravilna moč, s katero vstopajo v življenja ljudi, govorijo v prid domnevi, da imajo ti vendarle določen pomen in sporočilnost, ki je v vsakokratnem konkretnem primeru kognitivni izziv za izkuševalca, če jih jemljemo kot celoto, pa za človeštvo.

Zanimiva je tudi urejenost v njihovem pojavljanju, ki je prilagojeno konkretnim kulturnim prostorom. Ko gre za religiozne pojave, muslimani npr. ne doživljajo videnj božjih oseb, ampak se jim na prepolovljenih sadežih kažejo jasne črke z berljivim sporočilom. Mlečni čudež se je dogajal le v hindujskih templjih, ni pa tam noben kipec, ki upodablja svete osebe, jokal, kot se dogaja v katoliškem religioznem kontekstu.

Pri tistih med njimi, ki so povezani s simboli in napisi na naravnih podlagah, bi lahko domnevali, da gre za igro narave. Vendar narava s svojo entropijo oziroma stohastičnostjo (naključnostjo) ne podpira nastanka npr. miniaturnih gravur jasno in nedvoumno berljivih stihov iz Korana na prerezanem paradižniku, z genskim inženiringom pa človek temu zaenkrat ni kos. Prav tako je fizikalno gledano zelo neverjeten pojav mavrične sulhuete Marije na pročelju stolpnice.

Manipulacija

Nastanek objektivnih pojavov bi lahko povzročal in/ali spodbujal posameznik ter manipuliral z informacijami o njih. Vendar nismo ugotovili, da bi v ozadju vsega bil kak tak posameznik ali organizirana skupina, saj se NIP dogajajo po

2 V širšem pomenu so vsi nenavadni inspirativni pojavi samaritanski, ker gre pri vseh za neko obliko pomoči in dobrega dela.

3 Zlasti v ZDA, kjer je veliko poročil o tovrstnih nenavadnih inspirativnih pojavih, se je razširilo prepričanje, da so 'angeli' tisti, ki pomagajo ljudem kot skrivnostni, nevidni pomočniki. Nastalo je zelo razširjeno angelsko gibanje, ki po naši oceni ni (zgolj) modna muha, ampak je podkrepljeno s številnimi osebnimi pričevanji. Po pričevanjih ljudi angeli v teh doživetjih večinoma nimajo kril, temveč so konkretne fizične osebe, ki so včasih bleščeče, včasih pa na videz čisto navadne, imele naj bi le izjemen, topel, ljubeč in vseveden pogled; marsikdaj so oblečene v belo, v tem primeru opisi 'angelov' zelo spominjajo na opise oseb nenavadnih inspirativnih pri srečanjih.

4 E. J. Heathcote je napisala doktorsko disertacijo na Univerzi v Birminghamu, Velika Britanija, z naslovom A Study of Narrative Angelic experiences. Disertacija vsebuje več kot sto opisov srečanj z angeli, ki jih je avtorica zbrala po tem, ko je dala v množična občila oglas.

5 Ko gre za objektivne nenavadne inspirativne pojave; pri psihičnih gre lahko tudi za sanje ali pojave med meditacijo, molitvijo ipd.

vsem svetu in nepovezano, pa tudi zelo različnim profilom ljudi.

V primeru objektivnih pojavov bi lahko šlo za prevaro, vendar so nekatere raziskave konkretnih primerov (že omenjani mlečni čudež in jokajoči kipec) pokazale, da ne gre; v vseh podobnih primerih šele ustrezna znanstvena preiskava lahko potrdi ali ovrže sum prevare.

Učinek vere / sugestije

Znano je, da že izoblikovana prepričanja in pričakovanja vplivajo na človekovo kognicijo. Del dobrodejnih učinkov NIP zato zelo verjetno lahko pripišemo usmerjenosti posameznika in psihološkemu vplivu množice nanj, vendar ne vsega, saj prihajajo v stik s temi pojavi tudi neverujoči, med njimi je nemalo dvomljivcev in celo popolnih nejeverneže v, ki proti svojim pričakovanjem prav tako doživijo pozitivne spremembe.

Motnje kognitivne narave

Inspirativna doživetja bi bilo možno razložiti kot individualno ali množično histerijo in posledico praznoverja.

Tej domnevi nasprotuje dejstvo, da so ljudje, ki so doživeli tak pojav, psihološko normalni in ne razmišljajo o koncu sveta, na katerega bi se bilo treba pripraviti in se še pravi čas spreobrniti. Za pojave množične histerije pa je potrebna povezana skupina ljudi, ki ima skupne predstave in voditelja. V primerih pojavov, ki jih obravnavamo, ljudje niso povezani v skupino, niti nimajo skupnih predstav in prav tako ni videti nobenega skupnega voditelja. Pojavi se dogajajo ljudem po vsem svetu, ki živijo vsak po svoje, pripadajo različnim družbenim slojem, rasam, narodnostim in starostnim skupinam. Po svojem svetovnem nazoru so ateisti, verni, fundamentalisti, zmerno verni, pripadniki novodobnih gibanj. Sredstva javnega obveščanja lahko sprožijo množično histerijo v zvezi z nekim dogodkom, na primer nogometnim prvenstvom, političnimi intrigami, papeževim obiskom. Tukaj pa ni osrednjega dogodka, v katerega bi usmerjali pozornost in mu dajali velik pomen. (Izjema so le nekateri redki množični religiozni dogodki, ki praviloma pritegnejo pozornost medijev.) Je pa množica majhnih dogodkov, ki nimajo velike publicitete, dogajajo pa se med seboj nepovezanim ljudem (in četudi dobijo publiciteto medijev, je to nemalokrat s posmehljivim podtonom) (23).

Histerijo navsezadnje laže povzročijo neprijetni dogodki, ki zbujajo človekova elementarna čustva in nagone. Tukaj pa gre za izrazito pozitivno dogajanje, ki ga ljudje doživijo kot nekaj dobrohotnega, zdravilnega, osrečujočega, kot blagoslov in milost. NID jim pomaga vzpostaviti pravilen nadzor nad svojim življenjem. Poleg tega so ljudje, ki kaj takega doživijo, prej presenečeni in se zamišljeno umaknejo v svojo intimo, kot pa da bi začeli fanatično pripovedovati o tem dogodku.

Vabilo k višji kogniciji

Če so vsaj nekateri NIP realni pojavi, kakšne so implikacije tega?

V 'votlini' vsakdanjega življenja, v kateri je, podobno kot v Platonovi prispodobi o votlini, naša kognicija omejena na spoznavanje senc, njihovega izvora pa ne prepoznamo, NID mečejo v te sence svetlobne motnje, ki nas presenečajo, da se pričenjamo spraševati, kaj je to in od kod to. Tako nas vabijo, da sprostimo svoje omejitve, ki smo jih sami zastavili bodisi z materializmom ali s cerkvenimi dogmami in se ozremo k viru svetlobe ter prepoznamo še neko drugačno realnost od 'votlinske'. Vabijo nas, da dvignemo svojo kognicijo iz formalnih prepričanj v intuitivno spoznavanje in pričnemo izkustveno spoznavati realnost za 'sencami' vsakdanjega življenja.

ZAKLJUČEK

Po naših raziskavah predstavljajo NIP masoven (in dobrodejen) svetovni pojav; izkušnje NIP pa univerzalne, saj niso omejene na pripadnost nekemu religioznemu izročilu niti ne gre za dogmatsko verovanje ali prepričanje v obstoj boga; to so žive izkušnje, dostopne slehernemu.

Kljub močnim in v referatu predstavljenim indikacijam o stvarnem ozadju teh pojavov, bi morale bodoče sistematične raziskave dati nedvoumen odgovor, ali gre le za kognicijski pojav ali za objektivno dejstvo. V prvem primeru se odpre mnogo nadaljnjih vprašanj, od kod taka masovnost in univerzalnost, kaj nam to pove o doslej neraziskanih načinih našega spoznavanja in podobno. V drugem primeru pa lahko domnevamo, da obstaja določena stvarnost, ki hoče skozi NIP vstopati v našo zavest, se nam razodevati in nas marsikdaj dvigati v višja kognitivna stanja, vendar na nenasilen način, vedno skozi dejavno pomoč, ki jo potrebujemo.

Sklep, ki ga lahko damo za konec, je: NIP so vredni temeljite raziskovalne obravnave, ker odpirajo človeštvu pot do novih spoznanj o delovanju zavesti oziroma celo o realnosti, ki je bodisi zanikana (s strani znanosti) ali pa ujeta v toga prepričanja (s strani cerkve). To realnost tisti, ki jo v NIP doživijo, dojemajo različno, v skladu s svojim svetovnim nazorom: kot 'višjo silo', 'dobro silo', 'boga', 'angele', 'svetnike', 'izjemne modrece', 'duhovne vidce', 'mojstre življenja in smrti'. Skozi NIP ta realnost – ne glede na to, ali gre za subjektivno ali za objektivno – vabi ljudi k interakciji, h komunikaciji. Posledice resne obravnave možnosti medsebojne komunikacije med človeštvom in to realnostjo lahko korenito spremenijo naše dojemanje stvarnosti, medsebojne odnose in način skupnega življenja.

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Predmet in metoda teologije z vidika hermenevtike

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:

Predmet in metoda teologije z vidika hermenevtike

Uvodni del razprave je posvečen pozabljeni Aristotelovi razdelitvi védenja na štiri tipe, h kateri se je vrnila hermenevtika na začetku 20. stoletja. Novoaristotelizem, ki označuje ponovno aktualizacijo Aristotelove razdelitve védenja, je omogočil tudi reinterpretacijo resnice. Hermenevtika resnice ne pojmuje več kot skladnost med subjektom in objektom, ampak kot razkrivanje biti. Ideje hermenevtične filozofije je sprejela tudi teologija, kar ji je omogočilo, da se je osvobodila metafizičnega konteksta in se vrnila k razodetju po načelu: »Bog dobro govori o Bogu.«

1. Tipologija védenj po Aristotelu

O tem, da ni ene same, univerzalne oblike védenja, je spregovoril že Aristotel. Izhaja iz predpostavke, da »se bivajoče izreka na mnogotero načinov« (*Metaph.,* 1003a.33; b.4). To za Aristotela najprej pomeni, da je mogoče isto bitje opisati z različnih vidikov. Ko govorimo o zdravju, lahko govorimo z vidika tega, kaj ga varuje (npr. »zdravo podnebje«), kaj ga povzroča (npr. »zdrava prehrana«) ali kako se izraža (npr. »zdrava barva«). Govorimo o isti stvari, o zdravju, a z različnih vidikov in na različne načine. Analizi različnih možnosti razumevanja istega predmeta se je kasneje posvetila transcendentalna fenomenologija.

V 6. knjigi *Nikomahove etike* je Aristotel isto problematiko zastavil še bolj korenito. Stvarnost je razdelil po vrstah bitij glede na nastajanje. So bitja, ki nastajajo in se spreminjajo, in so bitja, ki niso nastala, ampak so večna, tj. idealna, in se zato tudi ne spreminjajo.

Z idealnimi bitji se po Aristotelu ukvarjajo znanosti (epistēmē). Znanstveno védenje je teoretično: bistva stvari ne spreminja, ampak ga odkriva in motri. Višje od znanosti pa je filozofija. Ta se ne ukvarja z bistvi posamičnih področij bivajočega, kakor matematika, fizika ali psihologija, ampak razmišlja o idealnih strukturah stvarnosti kot celote in o temeljih te celote. To, kar celoto dela celoto, je bit ali bitnost: bit je izvorna lastnost vsakega bitja. Temelj te celote pa je bog, ki je popolno, absolutno udejanjeno bitje. Aristotel ga opredeli kot misel, ki v popolni odsotnosti materije in s tem možnosti v dovršeni prozornosti misli sama sebe (noēsis noēseōs). Temelj in celota v izvoru sovpadata: najvišje bitje je bog in bog je najvišje bitje. Zato pravimo, da je aristotelska filozofija po svoji temeljni strukturi onto-teo-loška: Boga podreja ontološkemu kontekstu, bitje pa pojmuje kot nekaj božanskega. Na tej strukturi je gradil tisti del kasnejše filozofije, ki jo imenujemo metafiziko.

Nemalokrat se je teologija podredila metafiziki in je Boga izvajala in razumevala iz stvarstva, stvarstvo pa je razlagala kot nepopolnost, ki je po svoji naravi usmerjena k poslednji popolnosti, tj. k Bogu. Ta ideja, ki je po svojem izvoru platonsko-aristotelska, se je v vsej jasnosti artikulirala v racionalizmu, ki Boga in stvarstvo poveže v eno samo racionalno celoto, v kateri Bog in življenje nista več pogreznjena v skrivnost. Tu razum prevzame vlogo zadnjega kriterija resnice. Z drugimi besedami: razum, katerega vloga je iskanje resnice, najde resnico v samem sebi. S tem pa racionalizem zagreši napako, ki jo imenujemo zmotni kolobar (circulus vitiosus). To absolutno teorizacijo imenuje Heidegger tudi »skrajni pelagianizem teoretičnega spoznanja.«[1] Resnica je tu v celoti podrejena avtonomiji razuma. Po Münchhausnovi trilemi pa obstajata še dve drugi možnosti: 1) *regressio ad infinitum*, kar pomeni, da se spoznanje giblje od enega temelja do drugega, ne da bi moglo doseči poslednjega; 2) priznanje, da je vsako spoznanje umeščeno v neko konkretno situacijo, od katerega ga ni mogoče ločiti. Sodobna hermenvtična filozofija poudarja, da je vsaka misel umeščena v neko situacijo, brez katere je ni mogoče razumeti. Zato Thomas F. Torannce poudarja, da je pojem »avtonomnega razuma« patološka oblika racionalnosti.[2]

Poleg bitij, ki imajo idealna, nespremenljiva, večna bistva, pokaže Aristotel še dve vrsti stvarnosti, katerih bistvo je v njunem spreminjanju in nastajanju: to so od človeka proizvedene stvari in bit človeka samega. Opredeli ju glede na odnos, ki ga imajo do védenja: proizvedene stvari ostajajo izven védenja ontološko samostojne, bit človeka pa z védenjem sovpada. Vsaki od teh dveh vrst pripada specifično védenje.

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[1] M. Heidegger, *Einführung in die phänomenologische Forschung* (Gesamtausgabe 17), Vittorio Klostermann, Frankfurt 1994, 228.

[2] Prim. Th. F. Torannce, *Theological Science,* Oxford University Press, Oxford 1969 (fr. prev. *Science théologique,* P.U.F., 44).

a) Védenje, ki ima opraviti s proizvodnjo, imenuje Aristotel *technē*, kar prevajamo kot tehnično védenje ali umetnost. To védenje omogoča proizvesti neki proizvod. Za proizvod pa je značilno, da ostane izven védenja. Ko se proizvajalec oddalji od svojega proizvoda, njegov proizvod ostane.

b) Spremenljiva pa je tudi bit človeška (gr. *praxis*, nem. Handlung, fr. action), ki je rezultanta nenehnih odločitev in njihovih udejanjanj. Aristotel jo imenuje. Moja sedanja bit – tj. moje sedanje ravnanje – je rezultanta prejšnjih mojih umnih odločitev. To, kar sem in kako sem, izhaja iz mojih preteklih odločitev in izbir, za katere sem se odločil na podlagi nekega védenja. Védenje, na katerem *praxis,* tj. človekovo ravnanje temelji, imenuje Aristotel *phronēsis*; z njim človek vodi, usmerja in spreminja samega sebe, svojo lastno bit in ravnanje. Besedo *phronēsis* prevajamo kot »pametnost«, Martin Heidegger pa je ta Aristotelov izraz razložil z veliko bolj radikalnimi besedami: »Tu je Aristotel zadel na pojav vesti.«[3] Pametnost in vest sta védenje, ki je inherentno človeški biti sami, tj. njegovim odločitvam in ravnanju. To spoznanje zato ni teoretično-nevtralno, ampak – kakor se Aristotel izrazi – zapovedovalno. »Pametnost je namreč zapovedovalna; njen namen je povedati, kaj je treba storiti in kaj ne« (*EN* VI 11, 1143a.8). Do tega, kar mi vest narekuje, ne morem ostati neopredeljen. Zato človek z vestjo ravna drugače kakor človek brez vesti. To, kar človeka povzdiguje v resničnega, pravega človeka, je njegovo vestno ravnanje. Če nekdo tudi v skrajnih primerih ne ravna v skladu z vestjo, metaforično pravimo, da ni človek. Kakor kvas spreminja testo od znotraj, takó pametnost in vest od znotraj spreminjata in preoblikujeta način biti človeka. Bit človeka torej ni vnaprej, enkrat za vselej določena, ampak je rezultanta odločitev, ki jih človek sprejme po svoji pameti in v svoji vesti. Na tem védenju, ki je inherentno človekovemu ravnanju, temeljita etika in politika. Etika in politika sta torej v samem jedru *praxis*. *Biti* človek pomeni *ravnati* po vesti, *ravnati* pametno (esse = agere). To pomeni, da etika in politika nista prepuščeni iracionalnosti.

Omenjene štiri tipe védenja Aristotel razdeli na teoretično in praktično védenje. Pod teoretično védenje uvrsti znanost in filozofijo, pod praktično pa tehniko in etično-politično védenje. Kakor že pri Aristotelu se je kasneje teoretično védenje še bolj izrazito uveljavilo na račun praktičnega, racionalizem pa ga je povsem podredil teoretičnemu. Od pitagorejcev in Platona, ki je nad portalom svoje Akademije dal zapisati »Nič negeometričnega naj tu ne vstopi!«, je med teoretičnimi znanostmi vedno večjo veljavo imela matematika, ki ji je racionalizem pripisal vlogo občeveljavnega védenja (*mathesis universalis*). Spinozova *Etika* ima podnaslov »De more geometrico demonstrata«, Galilejo pa je menil, da stvarnosti, zapisane v matematičnih simbolih, ni mogoče razumeti brez poznavanja matematike. Po njegovem prepričanju je prava znanost v tem, da meri; če pa kaj ni izmerljivo, je treba narediti merljivo.

[3] M. Heidegger, *Platon: Sophistes* (Gesamtausgabe 19), Vittorio Klostermann, Frankfurt 1992, 56.

2. Specifični pomen resnice v hermenevtiki

Izvirni greh humanističnih ved – s tem pa tudi teologije – je bil, da so svojo metodo oblikovale po vzoru naravoslovnih ved. Za naravoslovno metodo je bistveno, da svoje predmete obravnava od zunaj. Naravoslovno védenje je nekakšno »zunanje védenje«, ki ni vpleteno v svoj predmet. Humanistične vede pa izhajajo iz razumevanja, ki ga ima človek o sebi, svoji zgodovini itd., še preden to razumevanje povnanji in popredmeti. Ker je to védenje inherentno biti človeka, je predobjektivno. Heidegger ga zato imenuje »eksistenčno spoznanje«.[4] Naravoslovne znanosti in humanističnih vede se torej razlikujejo po odnosu, ki ga imajo do predmeta. Na ta temeljni metodološki problem je opozarjal že Dilthey, za njim pa Heidegger in zlasti Hans-Georg Gadamer v delu *Resnica in metoda,* ki ga začne z mislijo: »Logični samopremislek duhovnih znanosti [Geisteswissenschaften], ki v devetnajstem stoletju spremlja njihovo dejansko izoblikovanje, povsem obvladuje zgled naravnih znanosti. [...] Duhovne znanosti se tako očitno razumevajo iz analogije z naravnimi znanostmi, da idealistični prizvok, ki je v pojmih duh in znanost duha, zato povsem stopi v ozadje.«[5] Hermenevtična filozofija, ki jo Gadamer zastopa, poudarja, da se resnica izvorno razkriva na pred-metodičen način. To polje predmetodičnega razkrivanja resnice je pravi predmet humanističnih ved.

Hermenevtika zavrača racionalistično idejo o *mathesis universalis*, po kateri do resnice vodi ena sama, občeveljavna metoda, istočasno pa rehabilitira Aristotelov pojem *praxis*. »Novoaristotelizem«, kakor imenujemo ta hermenevtični obrat od racionalizma k Aristotelu, ki ga je najprej storil Heidegger, za njim pa njegovi učenci H.-G. Gadamer, H. Arendt, L. Strauss idr., pomeni pravi preobrat v filozofiji: praktično filozofijo je postavil nad teoretično, *praxis* pred *theōria*. Izvorno védenje ni nevtralno, deskriptivno, teoretično védenje, ampak je inherentno biti človeka. Izvorno mesto resnice ni *cogito*, ampak *praxis,* tj. konkretna, v zgodovinsko situacijo vpeta bit človeka. Človek in svet si ne stojita nasproti. *Biti človek* pomeni *biti-v-svetu, biti-v-zgodovini*. »Zgodovina«, pravi Heidegger, »smo mi sami.«[6] Zgodovine zato ne razumevamo od zunaj kot predmet, ki mi stoji nasproti. Nasprotno, človek, ki je sam zgodovina, to zgodovinsko razumevanje že nosi v sebi. Naloga hermenevtike pa je, to razumevanje povnanjati, razlagati, interpretirati.

[4] *Ontologie. Hermeneutik der Faktizität* (Gesamtausgabe 63), Vittorio Klostermann, Frankfurt 1995[2], 18: »Die Hermeneutik soll ja nicht Kenntnisnahme erzielen, sondern das existenzielle Erkennen, d.h. ein *Sein*. Sie spricht aus der Ausgelegtheit und für sie. [...] Philosophie ist die im faktischen leben selbst seiende Weise des Erkennens, in der faktisches Dasein sich rücksichtslos zu sich selbst zurückreißt und unnachsichtlich auf sich selbst stellt.«

[5] *Resnica in metoda* (prev. T. Virk), Literarno-umetniško društvo Literatura (Labirinti), Ljubljana 2001, 17.

[6] »Anmerkungen zu Karl Jaspers 'Psychologie der Weltanschauungen' (1919/21)«, v: *Wegmarken*, Vittorio Klostermann, Frankfurt am Main 1978[2], 5.

Od tu naredi hermenevtična filozofija korak naprej in razumevanje opredeli kot temeljni modus biti človeka. »Biti človek« pomeni »razumeti«. To misel je izrazil tudi Ricœur: v hermenevtiki »se *razumevanje* ne kaže več kot enostavni način *čistega spoznanja,* da bi postalo *način biti* in razmerja z bitji in bitjo.«[7] Hermenevtika takó napravi temeljni premik v pojmovanju spoznanja in resnice: zanjo osnovni vir spoznanja ni več intuicija, ki subjekt odpira objektu, ampak razumevanje, ki je način biti človeka same. Zato se hermenevtika niti ne podreja metodi niti ne opisuje, ampak interpretira, razlaga, »daje ven« (nem. auslegen).[8] Razumevanje in spoznanje resnice pa sta odvisni od načina biti, tj. od načina življenja in življenjskega odnosa do obravnavane problematike.[9] Tega se je zavedal tudi Aristotel, po katerem sta etično in politično védenje odvisni od resnične bivanjske drže. Bistvo védenja, ki ga imenuje *phronēsis*, ni v izrečenih sodbah in v veljavnih teoretičnih formulacijah, ampak v resnični bivanjski, življenjski drži.[10] Brez resnične drže ni resničnega etičnega in političnega spoznanja.

Hermenevtika je humanistične vede – s tem pa tudi teologijo – osvobodila ujetosti v teoretični način mišljenja, ki vprašanje resnice podreja logičnim kriterijem in o svojih predmetih razmišlja »od zunaj«. Novoveške naravoslovne metode, po vzoru katerih so humanistične vede na začetku oblikovale svojo metodo, so le eden od načinov teoretičnega mišljenja. Hermenevtika pa poudarja, da resnica izvorno ni »skladnost med razumom in predmetom«, ki predmet v resnici podreja zakonitostim *logosa*, ampak razkritje biti stvari (gr. alētheia). Bit – in ne razum! – je gonilna sila, ki resnici daje moč, da se razkriva. Razumu resnice ni treba izvleči iz stvari, ampak mora le ustvariti prostor, da bi se resnica lahko sama razkrila, in to na različne načine: v znanosti, umetnosti, etiki, politiki, religiji itd. Zato hermenevtika veliko pozornost posveča oblikovanju etosa, tj. celostne bivanjske drže človeka.

3. Učiti se o Bogu od Boga

Na tleh hermenevtike je tudi teologija postala bolj *teo*-loška. Za tradicionalno, sholastično teologijo, ki se je razvila znotraj kategorij grške misli, je bila značilna njena podrejenost metafiziki. S tem, ko je Boga podrejala kategorijam bitja, lepega, dobrega, enega, resničnega, ga ni mislila neposredno kot preprosto dejstvo, ampak posredno v ontološkem, estetskem, henološkem ali logičnem kontekstu in ga tudi merila z vatli, ki ji jih je narekoval vsakokratni kontekst. Bog sholastike zato ni mogel spregovoriti neposredno, kakor je govoril svetopisemskim očakom. Hermenevtični pristop k vprašanju Boga je takó odprl možnost, da bi se uresničila napoved iz Pascalovega *Pomnika*: »'Bog Abrahamov, Bog Izakov, Bog Jakobov,' ne filozofov in učenjakov.«[11] Živi Bog teologije ni mrtvi Bog filozofije. Vidimo, kako občutljiv je bil ta veliki matematik na uporabo neprimernih metod v teološki misli, kar je še zaostril z mislijo: »Bogataš dobro govori o bogastvu, kralj mirno govori o velikem daru, ki ga je pravkar poklonil, Bog pa dobro govori o Bogu« (*Misli,* § 303 / Brunschvicg, 799).

Ta Pascalova misel, ki je naznanjala kasnejšo hermenevtično obravnavo vprašanja Boga, ima svoje korenine že pri Plotinu, nato pa v srednjeveški krščanski mistiki. Plotin je bil prepričan, da je mistično združenje s presežnim Enim nekaj tako edinstvenega, da ga ni mogoče izraziti v besedah. Edinstvenost združenja, ki bi jo opisali, ne bi bila več edinstvena. Vseeno lahko v njegovih *Eneadah* najdemo posamične poskuse razlage te mistične izkušnje, za katere pa se sam povsem zaveda, da je ne morejo primerno in zadovoljivo izraziti. Plotin opiše srečanje s presežnim Enim kot »beg samega k Samemu«, kar ne pomeni nič drugega kakor misel Atenagore Atenskega, ob kateri se je navdihoval tudi Pascal: »Učiti se o Bogu od Boga.«[12] To izkušnjo opiše tudi kot izkušnjo »izstopanja iz samega sebe, sprostitve, podaritve samega sebe, hrepenenja po dotiku, mirovanja in duhovnega iskanja usklajenosti« (*Enn.* VI, 9, 11). To doživetje je podobno doživetju tistih, »ki Boga ne kličejo z besedami, ampak hrepenijo po molitvi v svoji duši«. In kar je najpomembnejše: to je zavest in doživetje, da »smo bolj kot svobodni in bolj kot neodvisni« (*Enn.* VI 8, 15, 22). Izkušnjo primerja neizrekljivi izkušnji tistih svečenikov, ki jim je bilo dovoljeno spustiti se v najsvetejšo, za druge nedostopno »notranjost svetišča« (*Enn.* V, 1, 6, 12). Plotin si je za cilj zadal, pripeljati tisto, kar je v človeku božjega, nazaj k temu k božjemu.[13]

Plotin ni le prvi, ki mu je z nedosegljivo tankočutnostjo uspelo artikulirati specifičnost mistične izkušnje, ampak ostaja klasik, ob katerem lahko teologija vedno znova senzibilizira svojo misel. Mistična izkušnja se radikalno razlikuje od izkušnje naravnih predmetov in tudi od izkušnje, ki jo imamo ob spoznavanju samega sebe. Avguštin je dobro dojel, da gre v mistiki za izkušnjo Nekoga, ki je globlji v

[7] P. Ricœur, *Du texte à l'action*, Seuil, Pariz 1986, 76.

[8] J. Greisch, »La tapisserie de la vie, le phénomène de la vie et ses interprétations dans les 'Grundprobleme der Phänomenologie' (1919/1920) de Martin Heidegger«, v: J.-F. Courtine (ur.), *Heidegger 1919-1929*, Vrin, Pariz 1996, 150. Prim. tudi M. Heidegger, *Phänomenologie des religiösen Lebens* (Gesamtausgabe 60), Vittorio Klostermann, Frankfurt 1995, 195: »'Haben' so aneignen, daß das Haben ein 'Sein' wird.«. Prim. tudi *Ontologie. Hermeneutik der Faktizität*, n.d., 15: »Die Beziehung zwischen Hermeneutik und Faktizität ist dabei nicht die von Gegenstandserfassung und erfaßtem Gegenstand, dem sich jene lediglich anzumessen hätte, sondern das Auslegen ist ein mögliches ausgezeichnetes Wie des Seinscharakters der Faktizität. Die Auslegung ist Seiendes vom Sein des faktischen Lebens selbst.«

[9] Prim. *Resnica in metoda,* n. d., 274: »Bultmann sam poudarja, da se za vsako razumevanje predpostavlja interpretov življenjski odnos do besedila, njegova predhodna povezanost s stvarjo.«

[10] *Nikomahova etika*, VI 5, 1140b.5.20.

[11] *Misli,* Mohorjeva družba, Celje 1986, 213.

[12] *Legatio pro Christianis,* VII.

[13] Porfirij, *Vita Plotini*, 2, 25 B 27.

meni kakor moja najgloblja notranjost.[14] Drugega, ki ga mistik v mističnem zamaknjenju doživi, pa je Paul Claudel opisal kot »nekoga, ki je v mojem jazu bolj jaz, kakor sem jaz.«[15]

Te izkušnje zato ni mogoče misliti na način, kakor mislimo v naravoslovnih znanostih, v vsakdanjem življenju, v umetnosti itd., ampak na povsem svojski način, za katerega so že zahodni cerkveni očetje uporabili besedo »kontemplacija«. Beseda »kontemplacija«, ki etimološko izhaja iz latinske besede »templum«,[16] je najprej označevala opazovanje neba, nato pa motrenje najsvetejšega. V besedi kontemplacija je jedrnato povzeta vsa svojskost teološke misli. »Kontemplacija pomeni: iti v tempelj, na področje svetega, h koreninam stvari, k njihovemu stvariteljskemu temelju,« pojasnjuje Paul Tillich.[17] Kontemplacija odpira misli pogled v skrivnostno ozadje stvari, ki ni podrejeno nujnosti, značilni za predmetni svet. Svet tega skrivnostnega ozadja je svet zastonjskosti, podarjanja in tudi neizrekljivega, kar pa še ne pomeni, kakor je mislil Wittgenstein, da bi morali o njem molčati.[18] Hermenevtika dopušča, da ga poskušamo izreči, a v zavesti, da ga ni mogoče dokončno izreči. Avguštin je kontemplacijo razumel kot dovršitev človeškega življenja v čistem duhovnem zrenju Boga iz obličja v obličje, v katerem najde svoj večni mir in dovršeno veselje.[19] Pojem kontemplacije je še dopolnil sv. Bernard iz Clairvauxa: kontemplacija ni mišljenje, ki bi bilo v moči razuma, ampak je sad Božje milosti, kakršna je bila dana sv. Pavlu v ekstatičnem spreobrnjenju pred Damaskom. Temelj kontemplacije je v utelešenju Božje Besede in v povišanju človeka po Božji ljubezni.[20] Kontemplacija, ki je izvir teološke misli, je tu povsem ločena od struktur naravnega razuma, zato se tudi njena logika in dinamika razlikujeta od logike in dinamike naravnega razuma.

Kontemplacija je misel, ki zase ne terja niti eksperimentalne potrditve niti zadostnega razloga. To svobodo kontemplativne misli je posrečeno prikazal Mojster Eckhart v prispodobi »gole«, »puščavske« misli, ki se ne sprašuje: »Zakaj?« Kontemplacija se ne pušča zapreti v teleološke sisteme, v katerih en razlog utemeljuje drugega, ampak je čista očaranost nad skrivnostjo in zastonjskostjo življenja in biti. Ne išče razlogov, *zakaj nekaj je*, ampak je očarana nad tem, *da je* (Daß-Sein). Vsa teža te ideje pride do izraza v aforizmu Angela Silezija o vrtnici: »Vrtnica je brez 'zakaj': cveti, ker cveti. Zase se ne zmeni in ne sprašuje, če jo kdo vidi.«[21] Kontemplativna misel je misel začudenja in navdušenja, ki je povsem zadovoljna, četudi ostane brez temelja, brezdanja (nem. Abgrund) in brez razlogov. Že Platon je filozofijo razumel kot čudenje, kar je v nasprotju z njegovo geometrično koncepcijo filozofije. To zastonjskost kontemplativne misli pa je še poudaril Mojster Eckhart, ki uči, naj bo odgovor na vprašanje: »Čemu živiš?« ali »Čemu deluješ?« enostaven: »Zato živim, ker pač živim« in »Sem dejaven, ker sem pač dejaven.«[22] Iz tega izročila se je navdihovala tudi Heideggrova hermenevtika, ki Leibnizovi misli: »Cum Deus calculat fit mundus«[23], nasproti postavlja zastonjskost in nepreračunljivost Božjega stvariteljskega deja: »Ko se Bog igra, nastaja svet.«[24]

Kontemplacija ima s praktično mislijo skupno to, da sta obe povezani z načinom življenja. Že Aristotel in Platon sta poudarjala, da etična in politična spoznanja niso resnična, če ne izhajajo iz resnične življenjske drže. Podobno velja za kontemplacijo: »Vera brez del je mrtva« (Jak 2, 26). Na neki način je tudi kontemplacija praktično védenje, saj ima za posledico spreminjanje človekovega odnosa do življenja. Kontemplacija je mišljenje presežnega in osvajanje večno novega. »Nihče ne vliva novega vina v stare mehove, sicer vino razžene mehove in je z mehovi vred uničeno, ampak dajejo novo vino v nove mehove« (Mr 2, 22). Kontemplacija zato zahteva nenehno spreminjanje mišljenja (metanoia).

Pač pa se praktična misel in kontemplacija razlikujeta po svojih predmetu spoznanja: predmet kontemplacije ni *praxis,* ampak Bog, ki se je naredil slišnega in vidnega v razodetju. Kontemplacija »spoznanj« ne izvaja iz razumskih aksiomov, ampak jih črpa iz nenehnega vračanja k razodetju. Razodetje pa je Božji dar. Zato razodetja ne moremo misliti kot če bi bil predmet, ampak kot dar: neprisiljeno, s pozornostjo, z navdušenjem itd. Teologija je torej pozitivna znanost, ki temelji na določenem dejstvu, a to dejstvo – razodetje – nima predmetnih lastnosti. Izvor kontemplacije je Božja Beseda, ki jo je cerkveno izročilo za razliko od zunanjih, človeških besed (verbum externum) imenovalo tudi »notranja Beseda« (Verbum internum), ki je Beseda Boga v vsej njeni neizčrpnosti. Teologija napreduje in raste v poslušnosti Božji Besedi. Metafore, vzete iz avditivnega področja, imajo v judovsko-krščanskem izročilu veliko večjo vlogo pri razumevanju Boga kakor metafore, vzete iz vizualnega sveta, ki so se v metafizični misli razširile pod vplivom grške kulture.

Odnos, ki ga ima vernik do razodetja, ni objektiven, ampak bi ga lahko po analogiji s Heideggrovo definicijo človeka kot

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[14] Prim. *Izpovedi,* III, 6: »Interior intimo meo.«

[15] *Vers d'exil,* VII.

[16] Beseda »templum«, ki je sorodna grškemu glagolu »temnō« (odrežem, ločim), pomeni kraj, ki je ločen od ostalih, običajnih krajev. S tega kraja je avgur opazoval ptičje lete in iz njih napovedoval usodo.

[17] *L'être nouveau,* Planète, Pariz 1969, 170

[18] Prim. L. Wittgenstein, *Logično-filozofski traktat,* Mladinska knjiga, Ljubljana 1976, § 6.522 in § 7: »Vsekakor je nekaj neizrekljivega. To se *kaže,* to je mistično. [...] O čemer ne moremo govoriti, o tem moramo molčati.«

[19] *De immortalitate animae* 6, 10; *De Trinitate* 1, 8, 17 in 1, 10, 20.

[20] *Sermones de diversis,* 87, 3 in 87, 2, v: *MPL* 183, 704.

[21] *L'errant chérubinique* (I, 289), Arfuyen, Pariz 1993, 65. Prim. M. Heidegger, *Der Satz vom Grund,* Günter Neske, Pfullingen 1957, 72-73; 102.

[22] *Meister Eckharts mystische Schriften* (ur. in prev. G. Landauer), Insel, Frankfurt am Main 1991, 56-57.

[23] Prim. tudi B. Pascal, *De l'esprit géométrique*, v: *Œuvres complètes*, Seuil, Pariz 1963, 351: »Deus fecit omnia in pondere, in numero, et mensura (Sap. XI, 21).«

[24] Prim. *Der Satz vom Grund,* n. d., 186.

»biti-v-svetu« označili kot »biti-v-Besedi«. To je ena temeljnih idej razodetja. Stvarstvo in vsa zgodovina odrešenja raste iz Besede. Po bibličnem pojmovanju beseda nima le zmožnosti opisovanja ali ohranjanja spomina, ampak predvsem zmožnost ustvarjanja. »Bog je rekel in [...] nastala je svetloba. Bog je rekel in [...] zgodilo se je tako« (1 Mz 1). Svetopisemski pisatelji besedo pogosto primerjajo semenu, ki pade na tla in požene seme (Iz 55, 10 sl.). Takó je Beseda nekakšen transcendentalni pogoj odrešenja in tudi biti človeka. Brez besede ni odrešenja in ni človeka.

V filozofsko misel je biblično pojmovanje besede prenesel Martin Buber: »V resnici namreč ni jezik v človeku, ampak je človek v jeziku in govori iz njega – tako tudi vsaka beseda, tako vsak duh. Duh ni v jazu, marveč med jazom in tijem.«[25] Za Bubra je človek relacijsko bitje: kar je, je po svojem odnosu, ki ga ima do ti-ja. »Na začetku je razmerje: kot kategorija bitja [...]. *A priori* razmerja; *vrojeni ti*.«[26] Še preden stopim v neko konkretno razmerje, sem po Bubru že v razmerju do Ti-ja. To pomeni, da je naloga teologije razlaga in interpretacija tega izvornega odnosa do Ti-ja, iz katerega rastem.

4. Zaključek

V prispevku smo želeli prikazati specifičnost teološke metode in njenega predmeta. Zasluga hermenevtike, ki se je v humanističnih vedah vedno bolj uveljavljala od začetka 20. stoletja, je bila v tem, da je pokazala na neupravičeno posnemanje naravoslovnih ali celo matematičnih metod na humanističnem področju in tudi v teologiji. Pri tem se je sklicevala na Aristotelovo razdelitev različnih vrst védenja. Kot izhodišče spoznanja je hermenevtika vzela razumevanje, ki je razlagalcu dano, še preden ga artikulira na kognitivni ravni. Izhaja iz Diltheyevega načela, da življenje najbolje razlaga samo sebe. To je tudi teologiji omogočilo, da je zapustila metafizične sheme tradicionalne filozofije, ki je Boga mislila posredno prek najvišjega in nujnega bitja, in se preusmerila k interpretaciji razodetja samega. Zato je teologija izrazito pozitivna znanost, utemeljena na objektivnem dejstvu razodetja. Če so teologijo pred hermenevtičnim preobratom razumeli bolj kakor »intellectus quaerens fidem«, so jo po njem razumeli kakor »fides quaerens intellectum«. Hermenevtika daje prednost predmetu pred metodo. S tem pa lahko tudi teologija obravnava Boga, ki je njen predmet, brez vseh tistih predsodkov, s katerimi se je pod vplivom drugih znanosti tega vprašanja lotevala pred tem. Ker je hermenevtika opustila idejo avtonomnega razuma, za katerega meni, da je njegova patološka oblika, se je zmožna podrejati svojemu vsakokratnemu predmetu v vsej njegovi specifičnosti. S tem, ko smo na nekaj mestih pokazali specifiko teološkega predmeta, pa smo videli, da se radikalno razlikuje od predmetov, ki jih najdemo na drugih, naravoslovnih ali družboslovnih področjih. Znanstvnost neke discipline se meri po tem, koliko se je zmožna podrediti kriterijem resnice, ki so inherentni predmetu samemu.

[25] *Princip dialoga* (prev. J. Zupet), Društvo izdajateljev časnika 2000, Ljubljana 1982, 29.
[26] Prav tam, 21.

Med znanstvenim agnosticizmom in deklariranim krščanstvom

(z ozirom na miselno pot Paula Ricoeurja)

Janez Vodičar
Univerza v Ljubljani
Teološka fakulteta
Poljanska 4, 1000 Ljubljana, Slovenija
Tel: +386 1 4345810; fax: +386 1 4345854
Janez.vodicar@guest.arnes.si

Povzetek:

Ricoeur poskuša v svojem hermenevtičnem postopku ostati zvest fenomenološkemu izhodišču, ki ima v svojih začetkih zahtevo po 'strogi znanosti'. Nikoli ni tudi zanikal svoje jasne krščanske opredelitve. Vendar trdi, da v interesu bralca vzdržuje pri svojih raziskavah nekakšen začetni agnosticizem, ki mu omogoča objektivni pristop. S tem je bil deležen očitka, da gre zgolj za nekakšno kripto teologijo. V razpravi se bomo vpraševali, v koliko je sploh mogoče uporabljati v strogem hermenevtičnem pristopu tako agnostično izhodišče in poskušali pokazati, da ravno ta temeljna oddaljitev omogoča ustvarjanje novih pomenov. Ustvarjanje novih pomenov, novih vizij, je smisel tako teologije, ki raziskuje Razodetje, kot znanosti, ki odkriva in razlaga.

1. uvod

Pred kratkim preminuli francoski mislec Paul Ricoeur (1913-2005) je poznan kot deklarirani kristjan, ki je skušal tudi aktivno živeti svoje versko prepričanje in je prevzemal odgovorna mesta v svoji verski skupnosti. Javnost ga je tudi takega poznala, čeprav velja v strokovnem okolju za zahtevnega in doslednega misleca. Njegov spekter razmišljanja sega od lingvistike in psihoanalize do klasične hermenevtike in socialne filozofije. Kljub tej obsežnosti se je lotil vseh teh področji zgolj z vidika hermenevtične filozofije. To lahko rečemo tudi za področje teologije. Ob aktivni vlogi v reformirani francoski Cerkvi ni nikoli imel pomislekov sprejeti določeno izhodišče, ki bi bilo nasprotno njegovemu verskemu prepričanju ali uradni doktrini in ga kljub temu integrirati v lastno razmišljanje. Pri tem moramo vedeti, da ne gre za nekakšen sinkretizem, ampak v prvi vrsti za željo na tak način bolje razumeti sebe in svet okrog sebe. Izhodišče mu je blizu fenomenološkemu obratu s poudarkom na Descartesovem cogitu, ki pa je zanj vedno že v naprej ranjen oziroma razbit.

Vsako njegovo zgodnje delo je ravno zaradi izhodišča o ranjenem subjektu, ki je še bližje kalvinistični tradiciji iz katere tudi izhaja, v ključnih poglavjih vključevalo ta ali oni vidik religiozne dimenzije človeka. V svojih poznih delih pa poskuša zavzeti nekakšno agnostično izhodišče, ko pot raziskovanja nanese na področja verovanja. Čeprav se s tem ne odreka svoji krščanski zaznamovanosti, poudarja, da poskuša v svoji filozofiji zavzeti stališče, ki bo bližje interesom bralca. Pred bralca noče postavljati argumentov, ki bi vsebovali predpostavke biblične vere. »Opazili boste, da ta askeza v argumentaciji, ki, verjamem, zaznamuje vse moje filozofsko delo, vodi k določenemu tipu filozofije, kjer je dejansko poimenovanje Boga odsotno in kjer vprašanje o Bogu, kot filozofsko vprašanje, ostaja ravno tako v nekakšnem suspenzu, ki bi mu lahko rekli agnostičen.«[1] Postavlja se vprašanje, če je sinonim kritičnega bralca lahko zgolj nekakšno agnostično izhodišče, čeprav je celotna misel naravnana na govorico, ki predpostavlja religiozno ozadje.

Kljub vsemu omenjenemu trudu, da se izogne nekritični argumentaciji, je mnogokrat doživel obsodbo nekakšne kriptoteologije. Sam pa pravi, da se brani pred preveč teološkim pristopom, ker želi poudariti svoj napor, da ne bi biblični veri pripisoval nekakšne kriptofilozofije.[2] Gre torej za zavestno vzpostavitev odmika, ki onemogoča, da bi prišlo do mešanja pojmov. Še posebej je to pomembno, ker je njegov spekter razmišljanja tako raznolik. Nasploh je to vprašanje postalo aktualno, ko je poskušal filozofsko brati Freuda in so mu očitali, da kot ne strokovnjak govori o tem. Zato se je podobnega očitka poskušal ogniti tudi pri teologiji. Reči pa je treba, da je pred hermenevtičnim branjem Freuda pošteno poglobil znanje o njem, celo poslušal je Lacanova predavanja. Enako je storil tudi na področju biblične hermenevtike in teologije. Tu lahko vidimo dediščino fenomenologije, ki poskuša v svoji zahtevi po znanstvenosti in objektivnosti do konca izpeljati eidetsko redukcijo, še bolj pa njegovo lastno zahtevo po dodelanosti, ki temelji na objektivno preverljivi metodi. Vendar je vse njegovo filozofsko razmišljanje od vsega začetka povezano s krščanstvom in njegovo sklicevanje na Spinozovo trditev, da več ko vemo o posameznih stvareh, bolj poznamo Boga,[3] je jasen dokaz, da gre za metodološki odmik, ki povratno še bolj poudari njegovo življenjsko in tudi znanstveno povezanost z biblično tradicijo in vero v Jezusa Kristusa. »Če zavrača etiketo 'krščanski filozof', se Ricoeur ne obotavlja govoriti o svojem 'krščanstvu filozofa' [christianisme de philosophe], po izrazu, ki ga je podedoval od Léona Brunschvicga preko Jeana Naberta, ki ga ne bi nikakor mogli imeti za krščanskega filozofa ali njegov nadomestek.«[4]

2. Hermenevtično izhodišče

Ob taki oddaljitvi znanstvenega pristopa od priznanja religioznega izhodišča nam ta drža, če hočete lahko prevzamemo pojem 'znanstvena', postavlja novo vprašanje o njeni možnosti in doslednosti. Očitek kriptoteologije ostaja realnost, saj vsa Ricoeurjeva hermenevtika v končni fazi odpira polje iskanja totalnega pomena, ki res ne more biti dokončno razkrit, je pa v stalnem ustvarjalnem procesu razodevanje poetične poti do zapolnitve zadnjega človeškega hrepenenja. To pa v skladu s Kantom vseskozi veže na človeško pot do Boga. Hkrati vedno znova poudarja pravico in dolžnost mislecev, da etiko in s tem posledično zakonodajo utemeljijo zgolj na človeški ravni, brez sklicevanja na določene religiozne predpostavke. V utemeljevanju svojega vztrajanja v religioznosti pa deklariranemu ateističnemu znanstveniku Jean-Pierre-u Changeuxju odgovarja, da je pripadnost veri predvsem pripadnost tradiciji. Ta daje zmožnost govorice, razumevanja in sporazumevanja in hkrati tudi zavest, da gre samo za eno pot, ki je drugačna kot je to drugih. Šele v okviru te govorice in tradicije lahko posameznik ustvari lastno samozavest.[5] Sprejetje izhodišča njegove hermenevtike, da se subjekt razume le v toliko, kolikor se najde zunaj sebe, v očeh drugega, svojih stvaritvah, tradiciji in celotnem miselnem okolju, je nujna podlaga vsake etične drže posameznika celotno ozadje vzpostavitve samozavesti. Ustvarjalnost in rast lastnega samozavedanja je mogoča samo v polnosti novim pomenom odprtem prostoru. Ta je za Ricoeurja sinonim transcendence. Ob tem lahko tudi razumemo skrito podrazumevanje, da vsak, ki ne sprejema religijskega sveta, nima pravega in celostnega dostopa do polja, v katerem se sproža govorica, ki lahko vzpostavi neko avtonomijo moralne danosti določene družbe. Izhodišče naše razprave je razmejeno v zahtevi po začetni vzdržnosti in na drugi strani prikritem ozadju in cilju v religiozni podobi celotnega polja razumevanja.

Vodilna poteza, ki se kaže skozi vse Ricoeurjevo filozofsko razmišljanje, je priznanje mej. K tej ponižnosti filozofije pripomore ravno raziskovanje teoloških vprašanj. »Ta filozofija mej odpira prostor zmožnosti sprejetja besede, ki prihaja od Drugega.«[6] Te meje so po njegovem dane s t. i. sodobnimi mojstri dvoma, kamor prišteva Nietzscheja, Marxa in Freuda, ter razbijajo v prvi vrsti samopostavljajoči subjekt. Če veljajo v svojih osnovnih danostih kot misleci ateizma, so za Ricoeurja ravno ti tisti, ki odpirajo možnost novega pristopa v teološkem razmišljanju, predvsem pa postavljajo jasno zahtevo po 'razbitem cogitu', ki živi samo iz sprejemanja in dialoga. Človek se vedno rodi v nekem okolju, zato se ne more zavedati samega sebe, če se ne poistoveti s pomenom, ki se nahaja najprej zunaj njega.[7] To ga je vodilo tudi na poti raziskovanja hermenevtike simbolov v *Simboliki zla*. V razmišljanju o religiozni dediščini zahodnega človeka postavi dva vira. Prvi je grška filozofija, ki nas je v svojem spraševanju o bivajočem naučila misliti.[8] Ob njej se judovstvo pojavlja kot prvi Drugi te filozofije, ki ji vedno ostaja tudi njen bližnji. »Srečanje judovskega vira z grškim izvirnikom je temeljno in utemeljujoče križanje za našo kulturo.«[9] Zato je zanj vsako razmišljanje v okviru te filozofske dediščine, ki ne bi sprejelo poleg filozofskih korenin grštva tudi drugega v judovstvu, ki temelji veliko bolj na religioznem, brez možnosti, da zaobseže celotno stvarnost naše civilizacije.

Če torej filozofija ni brez virov in predpostavk, ki jih mora upoštevati in se jih v vsakem trenutku tudi zavedati, ne more biti zaprta v neko totaliteto samo na sebi. Stalno zavračanje Hegla, ki se mu najprej pusti zapeljati z močjo njegove analize, je večna tema v njegovem razpravljanju, še posebej ko gre za zlo in trpljenje. Poskusi teodiceje, da bi zaobjela vprašanja zla in jih ustrezno definirala, so se vedno izjalovila. Zato pri Ricoeurju ostaja prostor simboliki zla, ki vedno daje misliti. To pa je vedno že domena religioznega, saj posega na področje 'presežka smisla' [surplus de sens]. Ta simbolika, ki ga vodi na pot hermenevtike, vedno prinaša s sabo razbijanje vseh poskusov zajetja celotnega pomena in smisla. Zato razumemo, zakaj se njegova filozofija tako izogiba teologije, kajti sicer bi lahko izčrpala smisel in zaprla simbol, ki mora dati misliti, ali iz žive metafore, če smemo uporabiti ta izraz, ne da bi ga obdelali, ustvari mrtvo, ki ne zmore več ustvarjati novega pomena.

V kritiki Hegla se pojavi vrnitev h Kantu, da bi tako odprl prostor svojemu razmišljanju. V poheglovskemu pristopu do Kanta poskuša odpreti prostor upanju, ki ga zadnji postavlja kot jasni nasledek vprašanju, kaj moram storiti. V razpravi o S*vobodi po upanju*[10] predlaga, potem ko zavrne možnost filozofiranja v smislu ignorance tega, kar verujemo, ter filozofije kot dekle teologije, svojo pot. »Med abstinenco in kapitulacijo je avtonomna pot, ki sem jo postavil pod naslov 'Filozofski pristop'.«[11] V tem pristopu nakaže pot, po kateri bomo varno hodili, ne da bi zašli v zgoraj omenjeni skrajnosti. To možnost najde v upanju. Kantovo spraševanje po tem, kaj moram storiti, torej njegova morala, ni nauk, kako postati srečen, temveč kako postati vreden te sreče. V tem spraševanju o človeku, ki v upanju odpira svoj prostor, ne gre za razširitev vedenja ali spoznanja, temveč za približevanje temu, kar naj bi bilo skupno srečanje med filozofijo in teologijo: 'zgolj človeška svoboda'. Zato govorjenje o mejah človeka in njegovi neizvirnosti ni samo sebi cilj, temveč pot k upanju, ki je zanj filozofski pristop do religioznih vprašanj. Čeprav se je ta pristop pojavil že v njegovem prvem delu in ga je hotel zaključiti v nekakšni poetiki izkušenj ustvarjanja in poustvarjanja in bi ob razpravljanju o prvotni človekovi ranjenosti, ki jo odkriva v osnovnih simbolih o zlu, poskušal doseči novo nedolžnost, po njegovih besedah ostal neizvršen,[12] bi se težko strinjali z njim. Ravno pojem upanja sega tja, kamor naj bi tudi, kakor sam pravi na istem mestu, t. i. 'šifre Transcendence', ki so mu bile takrat blizu zaradi poglabljanja v Jaspersa. Ravno zahteva po filozofskem pristopu k religiozni odprtosti človeka, ki najde svoj temelj v upanju, je dovolj jasno znamenje, kje moramo iskati vzrok potrebe po ustrezni distanci v razpravljanju o Bogu. Vsa njegova hermenevtična pot in ukvarjanje s tekstom, metaforo in končno tudi z ideologijo in utopijo, je iskanje možnosti, kako odpreti človeka za Presežno. Skupaj z njim se lahko vprašamo: »Ali dešifriranje teh šifer Transcendenčnega ne postavlja popolnega modela filozofije transcendence, ki bi bila hkrati tudi poetika?«[13] Zato lahko vidimo, da je poetika, ki bo našla v etiki svoj odmev in regulator v upanju, pot k pravemu razumevanju njegovega razmišljanja, ki poteka med nekakšno religiozno abstinenco in jasno željo po končni podobi hermenevtičnega polja v tradiciji, ki se ne brani pojma Boga. Poetiko razumemo kot ustvarjalnost, ki nastopa v konfliktu med nekakšnim racionalnim agnosticizmom in hotenskim vidikom sveta v luči Boga.

Zanimiva je tudi trditev, ki jo navaja v enem izmed zadnjih intervjujev, ki ga je imel za belgijski radio.[14] Vrača se k vedno prisotnemu in nikoli jasno predstavljenem mislecu, ki je sam v svojem času povzročil veliko dvomov o svoji vernosti ali

nevernosti. Spinoza ostaja nekakšno diskretno ozadje njegove misli.[15] V tem pogovoru se zopet vrača k Spinozi, resda v smislu etike, ki pa najde svoj odmev ravno zato, ker presega zgolj moralo. Pravi, da gre za pot filozofije »v totalnost vesoljstva. Pa naj se ta totalnost imenuje Narava, Bog, panteizem, ni pomembno, to, kar šteje, je dejstvo, da smo del velike celote [d'un grand tout]. Pot v to celoto, kar še ne poznamo na začetku, prepoznamo pa kot delež na koncu, nas vodi k svobodi.«[16] Sklicevanje na začetke, ki ponazarjajo Platonov Eros ali Leibnizov "appetitio", je najbolj zaobjeto v conatusu, ki ga najde pri Spinozi in predstavlja notranjo moč bivajočega. Takoj lahko pomislimo ob začetkih, ki jih predpostavlja, ob tisti osnovni strastnosti, ki iz tega absolutnega začetka izhaja, da gre za nevarnost panteizma. Sam Ricoeur se tega zaveda in v istem intervjuju kot že prej v *Sam kot drugi*[17] ovrže možnost panteizma, ko ga izpraševalec zaradi navedka iz Spinoze po tem povpraša: »Ne. Prvič, ker nisem gotov, da gre za panteizem, in končno, ker me tu ne zanima vprašanje, ali gre za panteizem ali monoteizem. Toda dejstvo je, da naj bo to etika, natančneje rečeno, od morale različna stvar. Morala, to je obligacija, to je prepoved, kaznovanje, ki ima nujno svoje mesto, v bistvu zaradi nasilja […]. Vendar je kakšna stvar, ki sega preko dolžnosti, to je etika.«[18] To osnovno najdenost v območju etike pripisuje ravno pojmu življenja in conatusa, kot najde opredeljeno pri Spinozi. Res gre za totaliteto, ki nas obkroža in postavlja. Ta se pojavlja tako v pojmu karakterja, ki ga obdela v svoji tezi o hotenem in nehotenem, kot tudi v libidu, ki ga najde pri branju Freuda. Vendar ob obeh pojmih, conatusu in libidu, postavlja tudi telos, v smislu Aristotela, prvič kot nedosegljiv horizont našega hotenja, ki ga poimenuje sreča, drugič kot princip sploh vsake terapije, ki ga poimenuje kar s teleološkim principom psihoanalitičnega zdravljenja. Hkrati nam nakaže smer razmišljanja, ki poskuša upoštevati v svoji arhitekturi subjekta tako najdenost v smislu Heideggerja kot odprtost in preseganje v smislu Hegla: »To je Spinozova lekcija: najprej se najdemo kot sužnji, razumemo svoje suženjstvo, nato se ponovno najdemo svobodne v razumljeni nujnosti. *Etika* (mišljeno je Spinozovo delo) je prvi model te askeze, ki naj preseže libido, voljo do moči, imperializem vladajočega razreda. Toda vzvratno, ali v tej disciplini realnega, tej askezi nujnega, ne manjka milost imaginacije, pojavitev možnega? In ta milost imaginacije, ali nima ničesar skupnega z Besedo kot Razodetjem?«[19]

3. Naše vprašanje

Ne moti nas njegovo sklicevanje na nekakšen filozofski agnosticizem, ker se zavedamo, da je vseskozi navzoče iskanje resničnega odgovora na vprašanje po Besedi, ki jo lahko pišemo z veliko ali malo, naj gre za Boga ali nov ustvarjalni pomen hermenevtične poti. Ta pa se po njegovem lahko najde le z doslednim spoštovanjem etičnosti vsakega posameznika in pozornostjo do fragmentarnosti, v katerih se zrcali celota. Njegov agnosticizem se vedno bolj kaže v zgolj filozofskem pristopu. Filozofovo razmišljanje o verskih vprašanjih mora nujno izbrati zgolj iz človeka izpeljanega. Nič razodetega ali dogmatsko predpisanega. Biblična hermenevtika lahko samo pomaga subjektu pri njegovem samorazumevanju. Ta pomoč pa je zanj temeljna in odločilna brez katere ostaja subjekt zaprt za temelj vsake ustvarjalne najdenosti v okviru bivanja kot takega.

Ricoeurjev odgovor na prej zastavljena vprašanja ni enosmeren. Njegov agnosticizem kot izhodišče omogoča osnovno napetost, ki je edino ustvarjalno polje novih pomenov za hermenevtični pristop, kot si ga sam zamišlja. Oddaljitev od cogita, lastne zaverovanosti, sproži osnovno zmožnost subjekta - zmožnost ustvarjalnosti. Šele v tem poetičnem okolju je mesto za svobodo in samozavest. Ta je pogoj etičnosti, ki je pot do moralnosti. Dolžnost, ki se mi postavlja, pa naj bo to od zunaj (zakoni, postava) ali od mene samega (obljube, načrti, pričakovanja), je mogoče šele, ko imamo jasno vzpostavljeno samopodobo. Znanstveni agnosticizem je predvsem začetek neobremenjene etike, ki bo razreševala in ne razrešila osnovno potrebo po bivanju v razumevanju samega sebe.

V tej vlogi je nastopal tudi v zadnjem času. V pogovoru s prej omenjenim znanstvenikom, ki se ukvarja predvsem z raziskovanjem človeških možganov, akademikom Jean-Pierrom Changeuxjem, vedno bolj zavzema stališča človeka, ki krščanstvo sprejema z vso širino, predvsem pa z njegovo odgovornostjo v etičnem smislu in smislu dajanja smisla. Pred kratkim je preživel nekaj časa v krščanski ekumenski skupnosti brata Rogerja v Taizéju. V dnevniku *La croix* se sprašuje: »Kaj sem prišel iskat v Taizé? Rekel bi, da gre za nekakšno eksperimentiranje s tem, kar najgloblje verujem: vedeti, da ima vera opraviti z dobrim. Krščanska izročila so na to nekoliko pozabila. Gre za nekakšno stisko, zaprtost v krivdo in zlo. Nikakor ne podcenjujem tega problema, ki me je zaposloval več desetletij. Toda moram preveriti, da še tako, kot je lahko radikalno zlo, nikoli ni tako globoko, kot je to dobrota. In če ima vera smisel, je ta v tem, da globino človeške dobrote osvobodi, da jo poišče tam, kjer je popolnoma pokopana.« Če temu dodamo še besede, ki jih je izrekel v pogovoru s Changeuxjem: »Dobroto je treba osvoboditi, postala je ujetnica svobodnega dejanja, svojo največjo absurdnost svoboda najbolj izrazi v Auschwitzu,«[20] lahko jasno vidimo, kaj je temeljna stvar, ki je vodila vse njegovo raziskovanje in je zagotovo dosegla svojo znanstveno višino v delu *Sam kot drugi*, kjer vsemu hermenevtičnemu raziskovanju, ki postavlja znova najdeni subjekt, pridruži kot iz vsega tega nujno izhajajoče, brez česar te poti ni, etično raven.

Ta 'mini etika', kot jo sam poimenuje, nikakor ni drugorazredna ali samo posledica neke hermenevtične poti, je temeljna poteza njegovega razmišljanja. V njem mora biti vedno prostor svobode. Zato je edino agnostično izhodišče tudi verniku zagotovilo prave ustvarjalnosti. Šele z odprtostjo različnim pomenom, z izstopitvijo iz tradicije naravnane usmeritve, zmore vernik postaviti zavestno in ustvarjalno držo pred Bogom. Na drugi strani se mora agnostično naravnani znanstvenik potruditi poglobiti svoje izhodišče in pričakovanja, da bo zmogel svojem pogledu ustvariti zadostno oddaljitev, ki odpira pot ustvarjalnosti. Še posebej, ker je nuja vsakega znanstvenega pogleda kritičnost in ustvarjalnost. Ta je mogoča le v odprtosti novim pomenom. Če je agnostična drža dobra za znanstveno izhodišče, ne sme biti postavljena kot edini cilj, saj zapira možne pomene pred izzivom presežnega in hkrati vrojenega hermenevtičnega polja.

4. Zaključek

Da Ricoeur pristane po svoji prehojeni filozofski poti v teizmu in jasni opredelitvi za krščanstvo je razumljivo. V primeri, ki jo da Changeuxju, da na krogli, kjer bi vsak iskal le na površini z lepa ne bi zbližali svojih stališ, to pa lahko storimo le tako, da vsak na svojem mestu raziskuje v globine, kar nas bo proti središču vedno bolj združevalo, jasno pokaže zavestno namero vztrajanja tudi pri biblični hermenevtiki.[21] Omeniti velja, da je njegovo spopadanje z biblično hermenevtiko vedno tudi strogo znanstveno še posebej je zaznamovano z analitično in strukturalistično metodo. Vendar v vseh bibličnih tekstih išče odgovor na izhodiščno hrepenenje zapisano v človeku. Zato sedaj lahko razumemo njegovo utemeljitev agnosticizma. Bralec je tisti, ki je središče vsakega raziskovanja in razmišljanja, tudi na področju Razodetja. Ta končna zaznamovanost v svet vrženega subjekta s krščanstvom mu omogoča, da sprejme sebe in svoje predpostavke, ki jih vnaša v ustvarjalni hermenevtični proces. Da je končna totaliteta vedno zaznamovana s teizmom, mu lahko štejemo kot poštenost in doslednost njegove poti. Na vsej poti je kazal na nujnost oddaljitve iz samega sebe. Ta končna in najustvarjalnejša oddaljitev, ki je hkrati tudi gibalo vse znanosti, se mu kaže ravno v religiozni govorici. Miti in simbolika, ki so temeljna religiozna govorica, jasno kažejo subjektu, ki se pred njimi razumeva, da je omejen in hkrati sposoben te meje preseči. Sprejetje mej in predpostavk je končno eno izmed temeljnih pogojev znanosti kot take, ki bi bila tudi po meri človeku. Ta je namreč začetek in konec vsega znanstvenega prizadevanja.

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[1] P. Ricoeur, *Soi-même comme un autre*, Seuil, Paris 1996, 36.
[2] Prim. P. Ricoeur, *n. d.*, 37.
[3] Prim. P. Ricoeur, *Histoire et vérité,* Seuil, Paris 1955, 11. V tej drugi popolnoma samostojni knjig, torej čisto na začetku znanstvene kariere, se poimenuje tudi kot 'poslušalec Besede'.
[4] F.X. Amherdt, *Introduction,* v: P. Ricoeur, *L'herméneutique biblique,* Cerf, Paris 2001, 14. Prav tam navaja tudi trditev, ki jo je Ricoeur dal l. 1999 za *Panoramo*, kjer trdi, da je vernik, kristjan protestanske veroizpovedi, ki pa se je vedno trudil vzdrževati potrebno distanco med vero in svojo filozofsko potjo.
[5] J. P. Changeux, P. Ricoeur, *Ce qui nous fait penser*. *La nature et la règle,* Editions Odile Jacob, Paris 1998, 300.
[6] A. Thomasset, *Paul Ricoeur Une poétique de la morale,* University press, Leuven 1996, 233.
[7] Prim. P. Ricoeur, *Le conflit des interprétations,* Seuil, Paris 1969, 26.
[8] Prim. P. Ricoeur, *Philosophie de la volonté,* Aubier, Paris 1988, 186. »Ne bo izginilo prepričanje, da smo rojeni za filozofijo z Grki in da, kot filozofi, smo srečali Jude preden smo srečali Hindujce in Kitajce.« Zato bomo v njegovi misli vedno našli ukvarjanje z našo dediščino, ki ne sme pozabiti nobenega pola, ne grškega ne judovskega.
[9] P. Ricoeur, *n. d.*, 183.
[10] Prim. P. Ricoeur, *Le conflit des interprétations,* 393-415.
[11] P. Ricoeur, *n. d.*, 394.
[12] Prim. P. Ricoeur, *Réflexion faite,*Esprit, Paris 1995, 25.
[13] P. Ricoeur, *n. d.*, 25.
[14] Prim. P. Ricoeur, *L'unique et le singulier,* Alice, Liège 1999.
[15] Prim. A. Thomasset, *n. d.*, 472.
[16] P. Ricoeur, *n. d.*, 44s.
[17] Prim. P. Ricoeur, *Soi-même comme un autre,* 365s. Na tem mestu iz heideggerjanske misli v spinozističnem izrazu conatus najde ustrezen odgovor na zahtevo po postavitvi ipseitete. Pravi, da mu ni bistveno vprašanje, ali gre za panteizem ali celo za ateizem, bistvena je njegova trditev, da gre za bitje, ki je po definiciji "essentia actuosa". Tu se srečata po njegovih besedah tako Spinoza kot sv. Pavel, ki trdi, da se v Bogu gibljemo in smo.
[18] P. Ricoeur, *L'unique et le singulier,* Alice, Liège 1999, 44.
[19] P. Ricoeur, *De l'interprétation,* Seuil, Paris 1965, 44.
[20] J. P. Changeux, P. Ricoeur, *n. d.,* 253.
[21] Prim. J. P. Changeux, P. Ricoeur, *n. d.,* 301.

Edukativnost Svetega pisma
na primeru pripovedi iz Prve Mojzesove knjige

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:
Erziehungsdimensionen der Bibel am Beispiel der Bibelgeschichten aus dem Buch Genesis

Die alttestamentlichen Geschichten und Erzählungen tragen in sich mehr Erziehungskraft als wir im ersten Moment denken. Bereits im ersten Buch, Genesis, finden wir eine Fülle von Herausforderungen, die uns unmittelbar ins Feld der gegenwärtigen Erziehungsfragen bewegen. Im Abrahams Zyklus entdecken wir z. B. Problematik der klassischen kompulsiven Wiederholungen, die zur Abrahams Zeiten offensichtlich nicht weniger aktuell waren, als heute – und umgekehrt. Es ist faszinierend, wie die Bibel bildhaft und einprägsam Geschichten schildert, die uns verhelfen Konflikte erfolgreich zu meistern. Weiters finden wir in der Bibel, was es heißt, sich zu einer gesunden integrativen Persönlichkeit heranbilden zu lassen. Bibel lesen und meditieren hilft nicht nur religiöse, sondern auch persönliche Kompetenzen zu erwerben. Es ist allerdings dabei wichtig, dass wir die Erzählungen nicht nur kognitiv studieren. Vielmehr ist die Fähigkeit gefragt, sich von den Geschichten im Sinne vom Ganzheitlichen Lernen ansprechen zu lassen.

Po vidikom edukativnosti nas Sveto pismo navaja na holistično učenje, ki predpostavlja aktivnost in uporabo obeh možganskih hemisfer *(Jensen 2005, 14)*. Ne nazadnje je Sveto pismo knjiga odnosov in relacij, ki pod vidikom učenja sodijo pretežno v domeno desne hemisfere *(Williams 1986, 26)*, kjer se pravzaprav oblikujejo temeljne življenjske odločitve.

V skladu z edukativnim namenom in naravo sporočila biblični jezik ni faktografsko informativen, marveč evokativen in motivacijski, poln metafor in podob, ki bralca postavijo pred bivanjske izzive in ga zato prevzamejo prek razumskih meja *(Papeška biblična komisija 2000, 37)*. Pedagoške in psihološke interpretacije seveda ne »izklapljajo« razuma oz. kognicije. Postavljajo pa kognitivno razmišljanje občasno nekoliko v ozadje, saj bi nas prevelik poudarek objektivistične in hladne interpretacije oddaljeval od doživljajskega in s tem izkustvenega učenja *(Höfer 2003, 27)*.

Tako v marsikakšnem besedilu lahko najdemo več, kot je bilo vanj načrtno položeno. V tem je upravičen morebitni ugovor proti pedagoški in psihološki interpretaciji, da Sveto pismo ni seznam vzgojnih navodil. Drži pa tudi, da kljub odsotnosti eksplicitnega namena bodisi celotno Sveto pismo ali vsaj velika večina njegovih besedil mnoge vzgojitelje, tako teoretike kot praktike, inspirira in usmerja njihove konkretne, tudi vzgojne odločitve. Pri tem fascinirajo ugotovitve, kako se religiozna oz. odrešenjska razsežnost bibličnega sporočila dopolnjuje in ujema z nadvse konkretnimi edukativnimi izzivi.

1. Kompulzivno ponavljanje in reševanje konfliktov

V »Abrahamovem ciklusu«, ki obsega štiri generacije (Abraham, Izak, Jakob in Ezav ter Jožef in njegovi bratje), zaznamo prve resnejše družinske konflikte v znamenju lakote,[1] ki njega in ženo pripelje v anonimni Egipt. Tam iz strahu pred posledicami svetuje svoji ženi Sari, naj se obnaša kot njegova sestra *(1 Mz 12,10-20)*. To pomeni, da sta prenehala živeti kot mož in žena. Ta konflikt, ki eskalira v ločitev, se v različnih oblikah in na različnih ravneh vleče vse do Jožefa v Egiptu. Hipotetično je torej Jožefovo izgnanstvo v Egipt posledica Abrahamove ločitve od Sare, saj je prav to dejanje vplivalo na odločitve vseh prihodnjih generacij.

Z ločitvijo sta Abraham in Sara zarezala v medsebojni odnos tako globoko rano, da povzročene bolečine nista uspela zaceliti. Pod pritiskom kompulzivnega ponavljanja bi enako zarezo ponovil tudi Izak, a ga je Bog pravočasno opomnil, naj ne ponavlja očetovih napak *(1 Mz 26,1-11)*. Tako se Izak ni ločil, čeprav je pogosto čutil, kako ga življenje sili v »očetovo obleko«.

Ker sta dotlej že dve generaciji znani po prepirih in konfliktih, se ta drža naseli v Izakova in Rebekina otroka že pred rojstvom, kajti »prepirata« se že v materinem telesu *(1 Mz 25,22)*. Konflikt, ki sta ga njuna starša in stara starša preživljala kot mož in žena, se je kot model prenesel na konflikt med bratoma, hkrati pa se je razširil na vso družino tako, da jo je razdelil na dve koaliciji, ki se vse življenje – tudi s spletkami – borita za prevlado v družini. Prvo koalicijo sestavljata oče in njemu podobni prvorojeni sin Ezav, drugo pa mati in njej podobni drugorojeni sin Jakob *(1 Mz 25,24-28)*. Iz teh koalicij sta brata Ezav in Jakob težko izstopila, saj sta za medsebojno spravo potrebovala večino ustvarjalnega

[1] Lakoto v deželi je moč interpretirati tudi kot lakoto po odnosih in ljubezni v lastni družini.

življenja. Ob spravnem srečanju sta imela oba številčno že skoraj popolno družino *(1 Mz 33,1-17)*, saj se po spravi Jakobu rodi le še Benjamin.

Vzporedno s transformacijo in celo zaostritvijo konflikta med Ezavom in Jakobom je razvidno, da nihče ne razmišlja o zakonski ločitvi.[2] Na področju partnerskih oz. zakonskih odnosov sta torej oba presegla pritisk kompulzivnega ponavljanja, ki izhaja iz obnašanja njunih staršev in starih staršev. Zlasti v Jakobovi družini pa je kljub temu čutiti, da s tem družinske napetosti še niso dokončno presežene.

Jakobovi otroci poznajo in boleče spremljajo konflikt med bratoma, ne čutijo pa več neposrednih posledic zakonskih konfliktov. Jakob jih še čuti in si vsaj delno pod vplivom negativnih izkušenj iz otroških let »izbere« enega otroka, namreč Jožefa, ki ga privilegira ter s tem ustvarja nove »bratske« konflikte *(1 Mz 37,1-11)*.

Iz tega sledi, da v življenju povzročamo tako globoke bolečine, da jih ena sama generacija ne more preboleti in do konca predelati. Nasprotno, po senzibilnem in konkretnem svetopisemskem pripovedovanju se konfliktna »hrana« prebavlja najmanj štiri generacije, kajti šele z Jožefom se dokončno razreši partnerski konflikt med Abrahamom in Saro. Bolečina Abrahamove ločitve se sicer iz generacije v generacijo manjša, saj je vsaka naslednja generacija močnejša. Dokončno pa jo preseže šele Jožef, ko doseže spravo na generacijski in medgeneracijski ravni, z brati in očetom. Ta učni proces se je uspešno zaključil, ker si je kljub pritiskom posesivnosti vsaka naslednja generacija priborila svojstvene sposobnosti »živeti, ljubiti in delati«, kar so pozneje – čeprav komaj pred smrtjo ali celo po njej – sprejeli tudi starši. Biblični poudarki na intenzivni povezanosti z Bogom ponazarjajo, kako gre pri verovanju za intenzivno interakcijo *(Fowler 1991, 119)*, ki v človeku prebuja sposobnosti, katerih brez vere ne bi odkrili.

Čeprav pri povzročanju večgeneracijske bolečine sodeluje le prva generacija, jo naslednje generacije sprejemajo, trpijo in prenašajo brez obsojanja in obotavljanja. Po eni strani je prav to dejanje potrebno, da jo lahko ozdravljajo in presegajo, po drugi strani pa je sprejemanje »grehov« prednikov tudi znamenje ljubezni do njih in solidarnosti z njimi. V tem »bratstvu v trpljenju« *(Krašovec 1999, 854)* podobno brezpogojno sprejemamo svoje starše in prednike, kot si v vlogi otrok želimo, da bi oni sprejemali nas.

Če biblične pripovedi transformiramo na področje deviacij, npr. na alkoholizem, kjer so izzivi po kompulzivnem ponavljanju v našem prostoru najbolj pogosti, dobimo naslednjo (možno) sliko:

Prva generacija: Oče je alkoholik in vsej družini povzroča veliko bolečine.

Druga generacija: Sin je abstinent, saj pozna posledice alkoholizma v družini in se z vsemi močmi bori proti njemu. Zaradi stalne napetosti in strahu pred kompulzivnim »padcem« je pogosto agresiven in se na drugih področjih težko obvlada.

Tretja generacija: Otroci poznajo razloge očetove agresivnosti in vedo, da ima njegova »živčnost« izvor v alkoholizmu njegovega očeta oz. njihovega deda. Posledic dedovega alkoholizma neposredno ne čutijo, saj njihov oče »abstinira«, so pa bili zato deležni njegove agresivnosti in so se je tudi sami nalezli. Oni so že tretja generacija, ki živi v agresivnem okolju, saj je bil tudi njihov ded pod vplivom alkohola velikokrat agresiven. Tako je agresivnost postala sestavni del njihovega življenja in komuniciranja, hkrati pa – kot Jakob in Ezav – ugotavljajo, da so konflikti vendarle rešljivi, pa tudi agresivnost je mogoče obvladati in presegati.

Četrta generacija: Otroci vedo, da so se njihovi starši pogosto prepirali, a so mnenja, da je kljub napetostim med brati in sestrami, kakor tudi med njimi in starši, medsebojne odnose mogoče harmonizirati in konflikte reševati. Vsekakor se počutijo sposobne oblikovati trajne generacijske in medgeneracijske odnose. Četrta generacija »vé«, da so se starši prepirali, ker so bili otroci »nervoznega« očeta, ta pa je bil nervozen, ker je bil otrok alkoholika. Četrta generacije vé torej le še to, da je bil njihov praded alkoholik, njihov ded pa »abstinent«, a zaradi popolne doslednosti in stalne borbe proti »očetu« nervozen in agresiven. Njihov oče se je agresivnosti še močneje nalezel in je potreboval veliko časa, da jo je sploh prepoznal in se kot tak tudi sprejel,[3] šele nato se je lahko začel spreminjati. Komaj četrta generacija je torej sposobna dokončno razrešiti tak boleč in globok konflikt.

Najbrž v veliki meri drži, da se na različnih življenjskim področjih rodimo v »različne« generacije. Čeprav marsikaj ni preverljivo, obstaja velika verjetnost, da smo ali bomo na kakem področju kot predstavniki »prve« generacije povzročili rane in bolečine, ki jih bodo predelovale, reševale in celile naslednje tri generacije. V tem kontekstu v interpretiranih pripovedih vidimo, da naslednjih generacij ne prizadene le Abrahamova ločitev v Egiptu, marveč so tudi nosilci ostalih generacij povzročali bolečine, ki jih bodo čutili in zdravili tako njihovi otroci kot vnuki. Izakova slepota npr. oslepi tudi Jakoba, Jakobovo varanje nauči varati tudi Jožefa itd. Na področju odnosov niso izključene boleče »zareze«.[4]

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[2] Jakob se sicer čuti prevaranega pri poroki, saj mu tast v poročni noči »podtakne« starejšo sestro hčerke, s katero se je želel poročiti. Toda če je želel dobiti za ženo mlajšo in lepo Rahelo, je moral najprej sprejeti starejšo Leo, na kar Jakob brez resnih pomislekov pristane.

Psihološko-edukativna interpretacija se seveda ne ustavi pri faktografskih opisih. Tako lahko v različnih sestrah prepoznamo različna obraza iste žene. V tem smislu nas pripoved pouči, da je moral Jakob sprejeti senčne strani svoje žene, šele nato je bil sposoben (ponovno) odkriti tudi njene sončne in lepe razsežnosti in lastnosti *(1 Mz 29,1-30)*.

[3] Kot boj s samim seboj in z lastno preteklostjo lahko interpretiramo Jakobov boj z Bogom *(1 Mz 32,23-33)*. Čeprav sprejetje in priznanje zgrešene preteklosti Jakoba rani, je sposoben prebroditi reko in stopiti na »drugo stran« ter začeto novo in drugačno življenjsko pot.

[4] V to kategorijo zagotovo sodijo spolne zlorabe, pa tudi ponavljajoče se neprimerne »vzgojne« reakcije. Groba prisila

Še tako dobri in skrbni starši nehote povzročajo bolečine svojim otrokom, ki jih ti ne bodo uspeli popolnoma preseči.

Morda smo se na kakem področju rodili v »drugo« generacijo, kjer čutimo bolečino, a se proti njej borimo, ker nas je strah ponovitve. Zaradi prizadetosti postanemo morda nekomunikativni in se zapiramo vase, ali pa agresivni in napadalni.

Verjetno smo na kakem drugem področju rojeni v »tretjo« generacijo, kjer sta večino težav prenesli že prvi dve generaciji, ki jih nista le reševali, marveč sta se privadili z njimi živeti in s tem tudi nas tako »potegnili« v to obliko življenja. Šele z odraščanjem se zavemo svojih hib, jih sprejmemo in delno tudi presežemo.

Na kakem področju pa brez dvoma »pademo« v četrto generacijo, kjer so »težave« že skoraj rešene in smo jih sposobni dokončati. Ko bomo težave enega področja »dokončali«, bomo verjetno na drugem področju in v drugem kontekstu odprli rano, s katero se bodo ukvarjale generacije za nami.

Pod vidikom kompulzivnega ponavljanja nam Bog obljublja svoje odpuščanje. Ne prizanaša pa nam na ravni izkušenjskega učenja, ki ga na različnih področjih in na različnih ravneh sprožajo izzivi kompulzivnega ponavljanja.[5] Bog pozna psihologijo učenja in vé, da je ponavljanje najboljša učna metoda. Tako je vsaka naslednja generacija položena v dovolj podobne okoliščine, da ne more ignorirati učnih izkušenj svojih prednikov.

Vsakdo je torej rojen v vse štiri generacije oz. ima izzive vseh štirih generacij v sebi. Ti se prebujajo v različnih situacijah in okoliščinah. Kljub temu nismo »sužnji« zakonitosti posameznih generacij. V okviru sposobnosti, motivacije in volje smo zmožni življenje sprejemati in spreminjati. Čim bolj delamo na sebi, tem boljše pogoje posredujemo naslednji generaciji. Življenje je tako zahtevno, da ima vsaka generacija dovolj priložnosti za vaje v ponižnosti *(Cohen 1998, 64)*, pa tudi tako lepo, da smemo upati v še lepšo prihodnost.

2. Konflikti se rešujejo tam, kjer so nastali

V Egiptu sta nekaj časa živela in se ločila Jožefova praded in prababica, Abraham in Sara. Tja je želel tudi njun sin in Jožefov ded Izak, a na podlagi religiozne komunikacije spozna, da bi bil zanj tam izziv po kompulzivnem ponavljanju še močnejši. Naslednji dve generaciji, Jakobova in Jožefova, sicer nista načrtovali življenja v Egiptu, a so družinske razmere tja pripeljale najprej Jožefa, nato pa še njegovega očeta Jakoba. Tako kraj primarnega konflikta in greha postane tudi kraj dokončne sprave in rešitve. To je eno temeljnih pedagoških in psiholoških pravil, ko govorimo o edukacijski razsežnosti reševanja konfliktov in napetosti in velja tako za kratkotrajne in vsakdanje konflikte kot za dolgotrajne, celo take, ki trajajo več generacij.

Konflikti se torej rešujejo tam, kjer so nastali. Le tako izčrpamo njihov edukacijski potencial in jih transformiramo v uspešen učni proces, ki prinaša trajne rezultate. Naučimo se reševati konflikte in oblikovati trajne odnose.

Če se npr. mož in žena sporečeta doma, v kuhinji za štedilnikom, postane štedilnik obremenjeno mesto, kjer se nehote spomnita medsebojnih napetosti. Dogaja se, da prav na tem mestu vse pogosteje prihaja do novih konfliktov. Marsikdaj se napetosti intenzivirajo do »vrelišča« na konfliktno najbolj obremenjenem mestu – v tem primeru »za štedilnikom«.

Sodobna civilizacija kljub hektiki nudi nekaj priložnosti za pogovor in morda se bosta mož in žena strinjala, da se npr. na dopustu v miru pogovorita o stvareh, ki povzročajo konflikte in bolečine. Tako si na dopustu vzameta čas, si razložita različne poglede in posredujeta občutke itd. Drug drugemu dasta vedeti, da se razumeta, sprejemata in ljubita, da je konflikt predelan in pozabljen, da se kaj podobnega ne bo več ponovilo ipd.

Ko se v tej dopustniški harmoniji vrneta domov in padeta v utečeni delavnik, kjer se žena »po ustaljenem redu« znajde na starem mestu za štedilnikom, ji – kljub predhodni obljubi in trudu, da se kaj takega ne zgodi – silijo v ospredje bolečine ter spomini preteklih konfliktov in prepirov. Izgubljajo se spravni in romantični dopustniški objemi in poljubi. Vse bolj se boji, kdaj bo njen mož stopil v kuhinjo in – kot običajno – ignorantsko segel po časopisu ali se usedel pred televizor. S svojimi občutki in reakcijami bo storila vse, da se bodo dosedanje utečene konfliktne navade še naprej ohranjale.

Ko stopi mož v kuhinjo, opazi ženo v znanem konfliktnem okolju, celo v ustaljeni drži in gestikulaciji, z istimi pikrimi besedami na ustnicah, čeprav jih morda še ni izgovorila. Tudi mož bo vse storil, da jih bo izgovorila, in ustaljena igra konfliktov in prepirov se nadaljuje.

Pogovor in sprava na dopustu sta potreben in dober trening, pravzaprav nekakšna pripravljalna »tekma«, ne pa še dokončan spravni proces. Brez treningov in »pripravljalnih tekem« za resno spravo nismo pripravljeni in je navadno ne zmoremo. Res pa je tudi, da je potrebno spretnosti in znanje, ki smo si jih pridobili na treningih, pokazati in izraziti v resni tekmi, v resni spravi, ki se vedno dogaja na »mestu konflikta«. To pomeni, da se bo konflikt izza štedilnika prevesil v proces reševanja, ko se bosta mož in žena spravila tudi za štedilnikom. Ko bo mož za štedilnikom prosil ženo odpuščanja in žena njega, ko se bosta – podobno kot na morju ali kje drugje na dopustu – za štedilnikom pogovorila, se spravno objela in poljubila, štedilnik ne bo več le mesto konflikta, marveč tudi mesto sprave in ljubezni. Ko bo naslednji dan žena stopila k štedilniku, se ne bo spominjala le bolečine in konfliktov, marveč tudi moževega objema in poljuba. Ko bo mož stopil v kuhinjo, bo to storil z željo, da objame in poljubi svojo ženo – in ona bo to vedela ter ga v

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ali groba prepoved se lahko v človeka tako zareže in povzroči takšno bolečino, da jo bo čutilo še več naslednjih generacij.

[5] »Gospod, Gospod, usmiljen in milostljiv Bog, počasen v jezi in bogat v dobroti in zvestobi, ki ohranja dobroto tisočem, odpušča krivdo, upornost in greh, toda nikakor ne oprosti krivde, ampak obiskuje krivdo očetov na sinovih in na sinov sinovih, na tretjih in na četrtih« *(2 Mz 34,6b-7)*.

hrepenenju pričakovala. Tako lahko ob rednem treningu in vsakdanjem prizadevanju ter zlasti sprotnem reševanju konfliktov mesto greha in konflikta spremenimo v mesto odpuščanja in ljubezni. Podobno, kot se je zgodilo z Jakobovo Rahelo oz. Leo, se lahko zgodi tudi z mestom konflikta. Ko se na takem mestu brezpogojno sprejmemo ter si ponovno služimo in se vzljubimo, se konfliktnost (Lea) izgublja in na istem mestu je vse močneje navzoča Rahela. Tudi mesto konflikta se torej lahko iz Lee spremeni v Rahelo.

Te možnosti se nam odpirajo, če konflikte rešujemo. Dokler namreč konkreten konflikt ni rešen, se bo vedno znova pojavljala nevarnost ponavljanja in celo njegovega poglabljanja *(Kille 1995, 48)*. Šele takrat, ko smo v spreminjanje Lee v Rahelo vložili vso iskrenost in vse moči, začutimo, da se »prostor« zares spreminja, in sicer tako, da se sami spreminjamo.

Načelo, da se konflikti rešujejo tam, kjer so nastali, ni omejeno s fizično dimenzijo prostora. Pomembneje od krajevnega in fizičnega določila je zavest, da rešujemo konflikte v podobnih oz. enakih okoliščinah, kot so nastali. Gre torej za globlji pomen »mesta konflikta«, ki vključuje tudi občutke in emocionalno razsežnost življenja. Kljub temu velja poudariti, da igra v mnogih primerih fizična lokacija pomembno vlogo.

3. Razsežnosti biblične »integrativne pedagogike«

Nekatere smeri sodobne psihologije zagovarjajo možnost, da ima vsak človek več različnih »kompletnih« osebnosti. Tradicionalna, zlasti globinska psihologija, pa govori o arhetipih kot »prapodobah« oz. kompozicijah osebnosti, ki se pokažejo v različnih okoliščinah in kontekstih *(Kille 1995, 41-42)*.

Ob prebiranju bibličnih besedil in psiholoških interpretacij doživljamo občutek, da so nam vsaj do neke mere podobni vsi biblični liki. Upravičeno opažamo, da svetopisemske osebnosti odslikavajo tudi naše življenje, kjer v mnogih primerih prepoznamo lastne reakcije. Marsikdaj čutimo, kako smo jim podobni ne le v reakcijah, marveč tudi v najglobljem čutenju, ki ga ponazarjajo in izražajo prav biblični liki.

Psihološke vezi med moškimi in ženskami so zelo prepletene in pod vidikom psihološke strukture osebnosti ni čistih moških in čistih žensk. To pomeni, da se v vsakem izmed nas oglašajo tako moški kot ženski liki, kar zaslutimo zlasti pri Jakobu in z njim povezanih pripovedih.

Sveto pismo o nosilnih osebnostih navadno govori pestro in jih postavlja v kontekste, ki jih izzovejo, da pokažejo svoj resnični obraz. Tako so vse osebnosti predstavljene v senčnih in sončnih odtenkih. Ko se z njimi srečujemo, nas psihologija učenja in vzgoje vabi, da si ne lažemo in se ne sprenevedamo, marveč da se z njimi identificiramo tako v grešnem kot krepostnem kontekstu. Za našo osebnostno rast je zdravo, da vsak lik spregovori s celim obrazom ter tako vsestransko bogati našo notranjost in sooblikuje našo osebnost.

Vsakdo torej lahko v sebi nosi in prepoznava Abrahama, ki veruje, hrepeni po družinski sreči in pogumno odhaja v življenje, pa tudi Abrahama, ki se v preizkušnji ustraši zase, zataji svojo ženo in izgubi občutek zanjo. V nas sta oba, ko iskreno ljubita, a tudi oba, ko »igrata« ljubezen. V nas je Abraham, ki ga je strah in je posesiven do svojih najbližjih, pa tudi Abraham, ki prisluhne svoji vesti, v njej prepozna Božji glas in je sposoben verovati in zaupati takrat, ko je najbolj potrebno.

Tudi Izak in njegova žena Rebeka sta v nas v vseh njunih posamičnih in skupnih razsežnostih. Izak nismo le takrat, ko premagujemo in presegamo »izzive po Egiptu«, marveč tudi takrat, ko popuščamo in morda celo nepravično izkoriščamo svoj položaj in moč, ki izhaja iz njega. V slehernem človeku se oglaša zvita in nikoli zadovoljna Rebeka, pa tudi Rebeka, ki se z vsem življenjem postavi na stran šibkejšega.

Ne glede na to, kateri otrok v družini smo po vrstnem redu, sta v vsakem izmed nas navzoča oba lika, Ezav in Jakob. Vsakdo je kdaj razvajen in išče trenutne koristi in užitke, drugič podjeten in ustvarjalen, pa tudi sposoben izsiljevati ter celo varati in goljufati. Skupaj z Jakobom smo sposobni sprejemati tudi posledice lastnih dejanj, se iz njih učiti ter spreminjati svoj obraz in druge obraze.[6] V tem kontekstu smo tudi Lea in Rahela. V njune občutke smo vsi vpeti in vpleteni, tako moški kot ženske. Pravzaprav pri Lei in Raheli prepoznamo žensko verzijo konflikta med Ezavom in Jakobom *(Cohen 1995, 126)*. Šele vsi štirje liki – Ezav in Jakob ter Lea in Rahela – kompletirajo obraz integrirane osebnosti.

Sleherni se lahko prepozna tako v Jožefu kot v njegovih bratih. Včasih smo Jožef, ki toži in se pritožuje, hkrati pa sanjari o svoji veličini in pomembnosti ter druge spravlja ob živce, znamo pa biti tudi Jožef, ki je sposoben globoko dojeti življenje in v dejanjih preseči celo lastna pričakovanja. V nas se oglašajo tudi njegovi bratje, ko težko prenašamo konkurenco in vse, kar je »boljše« od nas, kajnovsko ubijamo ali vsaj preziramo in »prodajamo«. Ko pa zaidemo v stisko, iščemo pomoč in prosimo odpuščanja.

Vsi ti liki nas nagovarjajo ter vzgajajo in sicer ne tako, da bi se izogibali njihovim senčnim vsebinam, marveč da težave in konflikte rešujemo in se iz njih učimo. Čim izraziteje jih bomo zaznavali in čim glasneje se bodo oglašali v naši notranjosti, tem senzibilnejši bomo na njihove izzive ter tem hitreje in celoviteje bomo nanje reagirali. Čim celoviteje bomo torej biblične like integrirali v svojo notranjost, tem bolj integrirane in močnejše osebnosti bomo tudi sami. Tako nas svetopisemske pripovedi učijo ne le, kdo smo, marveč v pedagoškem in psihološkem kontekstu še bolj, kdo moremo postati *(Cohen 1998, 13)*.

[6] Zlasti pri Jakobovem boju z Bogom je mogoče v »možu« oz. »Bogu« prepoznati tudi Ezava v njem, s katerim se bori in se brani, da bi ga brezpogojno sprejel. Morda ob spravi, ko se brata objameta in drug ob drugem jokata, Sveto pismo aludira prav na ta boj, saj objem marsikdaj simbolizira notranji boj, ki ga moramo dobojevati kot pripravo na spravni objem *(Cohen 1995, 114)*.

Skupaj s predstavljenimi liki bomo marsikdaj v življenju začutili srečo in blagoslov enosti in celote sončne in senčne oz. »nebeške in zemeljske« strani v nas. Spravo Ezava in Jakoba, Lee in Rahele, Jožefa in njegovih bratov bomo okušali tudi v sebi. Lastno rast bomo doživljali kot integracijo celote in tako v procesu individualizacije postajali vse bolj celovita osebnost *(Kille 1995, 42)*.

4. Refleksija lastnega odraščanja in osebnostne rasti

Sveto pismo gleda na naše življenje pod različnimi zornimi koti in v različnih kontekstih. V knjigi *»Voices from Genesis« (Cohen 1998)* judovski profesor Norman J. Cohen v zanimivem pristopu ugotavlja, kako nas glasovi Geneze vodijo skozi različna življenjska obdobja oz. skozi stopnje odraščanja. Cohen reflektira življenje skozi Jakobove izkušnje, in sicer po shemi Eriksonove razvojne psihologije pod vidikom socialnega odraščanja.

Po Cohenovi interpretaciji nam o temeljnih doživljanjih dojenčka največ pove pripoved o Adamu in Evi ter o izgonu iz raja *(1 Mz 3,22-24)*. Tu se razodenejo dileme, povezane s temeljnim zaupanjem in nezaupanjem, ki jih rešuje dojenček v odnosu do staršev, zlasti matere. Prve omejitve namreč doživlja kot »katastrofo«, ki ga izžene iz dotedanjega raja zaupanja.

Na drugo stopnjo Eriksonove razvojne psihologije Cohen postavi brata Kajna in Abela *(1 Mz 4,1-8)*, ki ju interpretira v kontekstu napetosti med avtonomijo in sramom. Otrok v agresivnih reakcijah skuša »ubiti« vse, kar ga ogroža v avtonomiji, ki jo doživlja izrazito kot pravico do nedeljive egocentrične posesti staršev, zlasti matere.

Na tretji stopnji odraščanja najdemo doživetja Noetove graditve barke *(1 Mz 6,14 – 7,5)*. Otrok v napetosti med iniciativnostjo in občutki krivde spoznava prve moralne norme in vrednote ter spoznava prvinske strategije preživetja na podlagi odnosov.

Na četrti stopnji v skladu z značilnostmi predpubertete postavljamo »gradove v oblakih« ter tako razvijamo potrebno podjetnost, ob podiranju le-teh pa lahko zapademo v občutke nesposobnosti in manjvrednosti. Pripoved o babilonskem stolpu slikovito in prepričljivo razodeva tovrstno notranje dogajanje *(1 Mz 11,1-9)*.

V kontekst pete stopnje, kjer gre za oblikovanje identitete ob izzivih adolescentne zmešnjave vlog Cohen postavlja celotno pripoved o Abrahamu, začenši z odhodom od doma *(1 Mz 12,1-2)* do vključno njegovega »bojevanja z Bogom« v obliki daritve Izaka[7] in Izakove poroke, ko Abraham končno dojame tudi lastno sposobnost za oblikovanje trajnih odnosov.

Izak nas uči intimnih odnosov, kjer smo izpostavljeni tudi izzivom zlorabe. Tako se včasih intimni odnosi – kot posledica osebnostnih pomanjkljivosti – lahko sprevržejo v izoliranost in osamljenost. Izak torej izživi šesto stopnjo odraščanja.

Na sedmi stopnji najdemo Jakoba, ki zastopa občutke generativnosti in se v tem kontekstu pogumno ozira v prihodnjo generacijo. V trenutkih dvoma pa se skladno z Eriksonovo zasnovo strukture osebnosti tudi pri njem pojavljajo občutki nevarnosti pred stagnacijo.

Osmo stopnjo z vso dramatiko zastopa Jožef iz Egipta. Tu Jakob, ki Cohenu predstavlja izhodišče refleksije, v sinovem objemu *(1 Mz 46,29)* in blagoslavljanju vnukov *(1 Mz 48,1-20)* ponovno najde svojo identiteto, čeprav ga zlasti ob izgubi Rahele, nato Jožefa in končno še Benjamina spremljajo močni občutki obupa.

[7] V pripovedi o Abrahamovem darovanju Izaka prepoznamo klasičen konflikt med generacijama, kjer starši z vsemi sredstvi skušajo »obvladati« odraščajoče otroke in jih obdržati zase *(1 Mz 22,1-14)*.

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O čem govorimo,
ko obravnavamo fenomen religioznosti s stališča (kognitivnih) znanosti

Tomaž Strgar
Ljubljana, Slovenija
e-mail: strgart@hotmail.com

I. Namesto uvoda - beseda dve o pojmu

1. *Religija* kot pojem (beseda) vstopa v pojmovni aparat (besednjak) povprečnega pripadnika tako imenovane sodobne zahodne kulture praviloma nekje med 'ne', 'dobro' in 'hruška' na eni, ter denimo 'infinitezimalnim', 'visceralnim' ali 'morfološkim' na drugi strani.

Prvi vir 'religije' kot zgolj specifične kombinacije fonemov (zvočne slike), ki jo odraščajoči otrok (kognitivni subjekt) sprejema kot slušni dražljaj, je dandanes bržkone televizija. Kljub temu, da te zaznave v zaznavajočem navadno niti ne vzbudijo kakšnega posebnega *vsebinskega* zanimanja zanje, pa se sama beseda najverjetneje vpiše v nekakšen spominski katalog že slišanega.

Do tega uskladiščenja bržda pride celo povsem brez posredovanja zavestnega dela uma (v freudovskem smislu). Sama zavest (kot *ego cogito*) je namreč že zgolj glede na količino čutnih impulzov izrazito ozko grlo (v kognitivnem smislu). Poleg tega ima ta (t.j. *ego*) kar precej dela tudi s samim sabo, pač v sorazmerju s svojo lastno, s časom (praviloma) naraščajočo kompleksnostjo.

2. Ta 'religija' torej, ta zvočna slika, ki v začetku kot nekakšna prazna lupina leži nekje v območju (še vedno freudovsko) nezavednega, se tekom nadaljnjega razvoja otroka in s tem širjenjem njegove interesne sfere, postopoma polni. Dinamika tega polnjenja je zagotovo odvisna od cele vrste parametrov (okoliščin).

Precej pomembna je verjetno že frekvenca pojavitev posamezne besede, bržda še pomembnejši pa je odnos odraslih oseb (ki besedo že poznajo) do teh pojavitev. Če je okolica ob tem pretežno indiferentna, bo (pri otroku) zanimanje za *pomen* besede manjše; če reagira čustveno, burno, ali pač zgolj s povečano pozornostjo, bo le-to običajno sorazmerno večje.

V tesni povezavi z reakcijami okolice, nekakšen notranji odsev tega odnosa, pa je nek individualni občutek *pomena* besede za sam konkretni individuum. Gre za to, v kolikšni meri lahko ta nanjo navezuje svoja lastna izkustva, občutke, doživljanja. Pravilnost, oziroma, bolje rečeno, ustreznost teh navezav pa nato zopet vzvratno preverja z lastnim tvorjenjem in izrekanjem jezikovnih kontekstov za njeno uporabo.

3. Če povzamemo: pomen 'religije' se v kognitivnem subjektu tvori v prepletu dveh dinamik. Po eni strani je to sprejemanje zunanjih dražljajev skupaj z notranjim doživljanjem/izkušanjem le-teh, po drugi strani pa skozi jezikovno komunikacijo subjekta z okoljem prihaja do pretoka kompleksnih idej v jezikovni obliki. Razum ima pri tem vlogo nekakšnega 'koordinatorja', ki posameznikove (subjektivne) izkušnje povezuje z v že izdelani obliki pridobljenimi (objektivnimi) jezikovnimi strukturami.

Še vedno je seveda možno, da se zgoraj obravnavane zadeve v posameznih konkretnih primerih odvijajo povsem drugače. Ali, prosto po Humu in Popperju: še tako veliko število črnih kosov nam nikakor ne more jamčiti, da ne bomo nekoč naleteli še na belega. To pa ne spremeni dejstva (?), da samo besedo 'religija' vsakdo med nami bržkone pojmuje nekoliko po svoje.

II. Nekaj besed o pomenu

4. Za vsakršno, še posebej pa za znanstveno diskusijo pa je seveda precej pomembno, da imajo v njej uporabljane besede kar se le da natančno določen *pomen*. Glede na

zaključno misel prejšnjega odstavka zna biti to tudi vprašljivo, zato si najprej oglejmo slovarsko opredelitev ključne besede te razprave.

Takšen pristop se morda zdi nekako naiven, preveč neposreden, po drugi strani pa je hkrati kar se le da znanstveno-objektiven. Temelji namreč na strogo znanstvenem delu, ki o svojem predmetu (t.j. pomenu besed) poroča kolikor mogoče objektivno.

V SSKJ tako v okviru primarne definicije religije nahajamo najprej »zavest o obstoju boga, nadnaravnih sil; vera, verovanje«, v varianti s prilastkom (»islamska, krščanska…«) pa še »sistem naukov, norm, vrednot in dejanj, obredov, v katerih se ta zavest kaže; vera.« Sekundarna razlaga opredeli pomen 'religije' v ekspresivni rabi, z rodilnikom, kot »nazor, prepričanje, ki velja kot najvišja, najpomembnejša vrednota.«

5. Iz opisa lahko najprej izluščimo dve osnovni dimenziji pojma. Notranji, psihološki pomen prevladuje v prvem opisu, v preostalih dveh pa se le-ta navezuje na zunanje, sociološke vidike religije. Na prvi pogled torej nič novega, nič presenetljivega, prav tisto, kar smo imeli itak vsi že poprej nekako v mislih.

Definicijo torej pričenja »zavest...«, že sama eden izmed najkontroverznejših pojmov sodobnih kognitivnih znanosti, s pridanim »…ô…« pa dobimo naslednjega izmed 'vročih' pojmov, intencionalnost. V obravnavo le-teh se tu seveda ne moremo spuščati.

6. V korist možnosti nadaljevanja razprave smo tako prisiljeni sprejeti kar tisto nestrokovno, vsakdanje, neproblematizirano razumevanje zavesti (ô), kakor jo pač vsakdo od nas neposredno izkuša. Ker smo si ljudje med sabo seveda različni, so najbrž vsaj do neke mere različne tudi te izkušnje, a brez abstrakcije pač ni komunikacije, vsaj ne jezikovne.

S tem smo sicer izgubili nekaj znanstveno-objektivne ostrine, a drugače (zaenkrat ?) pač ne gre. Ko smo najtežavnejša pojma razlage gladko preskočili, lahko namreč pričakujemo hitrejše napredovanje. Definicija se nadaljuje z izrazi 'obstoj', 'bog' in 'nadnaravno'.

Sam goli 'obstoj' s stališča znanosti načeloma ni problematičen, filozofske dimenzije pojma pa (zaenkrat) pustimo ob strani. Navežimo ga torej na tisto, na kar se ta v našem primeru nanaša, to pa je najprej 'bog'.

7. V sodobni civilizirani družbi so dandanes debate »…o obstoju boga…« običajno kar hitro pri kraju – ali verjameš, ali pa pač ne verjameš. Iskanje (formalnega) dokaza božjega obstoja v zadnjih tisoč in nekaj letih ni prineslo želenega sadu, seveda pa je hkrati res, da v tem času ni nikomur uspelo (formalno) dokazati niti nasprotne trditve. A kaj je tisto, kar je *predmet* teh dokazovanj? Kaj se skriva za besedo?

Bog kot pojem …… vir 'boga' …… Ta 'bog' torej, ta zvočna slika …… pomen 'boga' se v kognitivnem subjektu …… besedo 'bog' tako vsakdo med nami bržkone pojmuje nekoliko po svoje, pač po mehanizmu, analognem usvajanju zgoraj (§1-3) obravnavanega pojma *religije*.

8. Naredimo še korak dva po tem začaranem krogu jezika. Po SSKJ je »v enoboštvu« bog pojmovan kot »nadnaravno bitje, ki je ustvarilo svet in ki posega v njegov razvoj«, medtem ko je »v mnogoboštvu« bog »vsako od človeku nadrejenih bitij.«

Obakrat gre, vidimo, predvsem za nek *presežek*; v prvem, nam večinoma bolj domačem primeru enoboštva (monoteizma), je ta presežek absoluten. Primarno, psihološko slovarsko opredelitev pojma smo s tem obdelali; v nadaljevanju lahko torej preidemo na bolj vsebinski (?), zgodovinski pristop.

III. Nekaj besed o poreklu pomena

9. Prehod od politeizma k monoteizmu je v sodobni zahodni kulturi običajno razumljen kot zgodovinski napredek, saj je za našo družbo politeistični koncept sveta stvar daljne preteklosti. Pri razumevanju tega prehoda pa običajno ostane nereflektirano neko *zelo* pomembno dejstvo.

Namreč: bogovi politeizma, denimo prebivalci starogrškega panteona, niso *ne stvarniki ne zakonodajalci* sveta, ki mu sicer (bolj ali manj uspešno) vladajo. Nasprotno: ti bogovi živijo *v svetu*, podrejeni pa so *istemu*, univerzalnemu, nespremenljivemu *kozmičnemu redu*, istim *naravnim zakonom* kot ljudje.

10. Skozi takšno optiko se nam tako ateistični pogled na svet kaže za bolj sorodnega poli- kakor pa mono-teizmu. Oba namreč praviloma ne priznavata »nadnaravnih sil«, ki so alternativa za »boga« tudi v slovarski definiciji religije. Bistvena razlika med poli- in a-teizmom je torej v tem, da prvi priznava *nad-človeške* sile, medtem ko drugi prevzame podobo človeka kot krone stvarstva (narave) iz mono-teističnega svetovnega nazora.

Tu pa je še en pomemben element, ki ga izrecno še nismo izpostavili. Ti bogovi *niso absolutni* vladarji sveta, imajo (nekatere) človeške lastnosti (slabosti), priložnostno pa jih lahko ukani (ali se jim pridruži) tudi kak (posebej spreten) smrtnik.

Če povzamemo: ateizem kot (za razliko od politeizma) precej aktualen svetovni nazor torej v prvi vrsti zavrača možnost obstoja boga/bogov, *običajno* pa tudi obstoj kakršnihkoli nadnaravnih sil; vse sile, ki vladajo svetu so (zgolj) naravne sile, brez presežka, t.j. nad-človeškega oz. nad-naravnega.

IV. O protislovnosti definicije

11. Na tem mestu pa se še za trenutek vrnimo k slovarju. Z zaključno mislijo tega izleta v zgodovino smo namreč zašli v hude težave jezikovno-logične narave, ali pa je v takšnih težavah naš vir. Slovarska definicija nam namreč ponuja opredelitev religije, ki je (s stališča zgoraj opredeljene oblike ateizma) *notranje protislovna*, namreč »zavest o obstoju…« - neobstoječega.

Kot vse kaže temeljno znanstveno delo nacionalnega pomena, torej SSKJ, (vsaj v primeru 'religije') ne izpolnjuje enega osnovnih kriterijev znanstvenosti nekega dela, da je namreč (v sebi) neprotislovno! Preden pa s to ugotovitvijo odhitimo k odgovornemu uredniku, si celo zadevo še nekoliko natančneje oglejmo.

12. Iskanje (in opisovanje) strogo *objektivnega* pomena posameznih besed, kar naj bi slovar bil, je pravzaprav precej kompliciran zadeva. V eno, čim krajšo definicijo je potrebno zajeti cel spekter razumevanj nekega pojma, kakor se ta pojavljajo pri posameznih pripadnikih aktualne družbe.

Leksikograf pa je dolžan hkrati zavzemati tudi konzervativno držo ter (vsaj do neke mere) vzdrževati tudi zgodovinsko dimenzijo pomena posameznih besed. V nasprotnem primeru bi leksikografija zašla v absurdno situacijo, ko bi pomen besed določalo zgolj nekakšno 'javno mnenje', neko povprečje subjektivnih pomenov, in bi bil torej najboljši slovar tisti z največjim in najreprezentativnejšim vzorcem anketirancev.

Človek je sicer v skušnjavi, da bi od slovarja zahteval kar opis, ki bi čim bolj adekvatno izražal bistvene značilnosti *stvari same* (pojava), ki jo posamezna beseda označuje, a je na podlagi 'Predavanj iz splošnega jezikoslovja' (Saussure, 1916) postalo jasno, da je to povsem zunaj dosega te znanosti. A pustimo zdaj okoliščine in se vrnimo h konkretnemu.

13. Kot smo že dejali, je definicija religije protislovna le s stališča ateista, ki hkrati zavrača tudi obstoj nadnaravnih sil. Zdi se, da je takšno stališče v sodobni zahodni kulturi kar precej razširjeno, tako da bi definicija nekako morala zadovoljiti tudi ta del populacije.

Prva ideja za adekvaten popravek bi bila, da besedici »vera, verovanje« iz nadaljevanja razlage gesla 'religija' postavimo na mesto »zavesti«. Razlaga bi se tako glasila »vera, verovanje v obstoj…«. Žal se sintagma »zavest o obstoju…« vztrajno ponavlja tako pri 'veri' kot pri 'verovanju'. Kritičnega pretresa ne zdrži niti pomislek, da lahko »zavest« tu pač razumemo tudi kot nekakšno napačno, pomotno zavest, kot zgolj neko prepričanje, ki ni nujno resnično. Če namreč po slovarju sledimo razlagi »zavesti«, nas ta preko »zavedanja« pripelje neposredno do »vedenja«.

Zdi pa se, da smo že povsem blizu rešitve. Z malenkostnim popravkom pridemo do neprotislovne formulacije, ki bi bila bržkone sprejemljiva za večino, tako za te-iste kot tudi za a-te-iste: »*verjetje* v obstoj…«.

14. To rešitev bi lahko zdaj kot (vse kaže) ustreznejšo, ponudili urednikom. Da pa se ne prenaglimo, si še enkrat poglejmo obstoječo formulacijo. To lahko namreč s pomočjo nekaterih posebnih prijemov razpoznamo kot neprotislovno *tudi* z ateistične, v zaključku §10 opredeljene pozicije. Kot taka se nam denimo kaže s stališča, da sploh nič ne *obstaja*; toda potem ne *obstaja* niti zavest, ne pot, ne protislovje; pravzaprav niti samega stališča ni.

Precej bolj obetavna se zdi (radikalno) skeptična pozicija; da namreč marsikaj sicer *lahko obstaja* in najbrž tudi *zares obstaja*, vendar pa o tem *obstoju* ni in ne more biti nikakršne *vednosti* (v strogem pomenu besede, če ta sploh *obstaja*). Ob takšni predpostavki tako »zavest o obstoju…« pomeni toliko kot »verjetje v obstoj…«. Takšno stališče je, vsaj zdi se tako (oz. vsaj na načelni ravni), dandanes kar precej razširjeno. Toda v tem primeru bi bila religija ravno tako adekvatno opredeljena kot »zavest o obstoju hrušk, morfologije ali česar-koli-že«, kar pa je najbrž nesprejemljivo tudi za večino (sodobnih) skeptikov.

V. O poreklu protislovja

15. Povzemimo zdaj stališče, s katerega se 'religija' kot »zavest o obstoju boga, nadnaravnih sil« kaže kot protislovna: boga/bogov ni, nadnaravnih sil ni, a vsaj nekatere stvari (denimo hruške, morfologija in še kaj) zagotovo obstajajo. Katere so zdaj te stvari, o katerih obstoju ni mogoče dvomiti?

16. Najslavnejša teoretska utemeljitev *razlike* med hruško in morfologijo, ki jo vsi občutimo, je Descartesov razrez celote (poprej hierarhično pojmovanega kontinuuma bitij in bivajočega) na *res cogitans* in *res extensa*. Pri tem je (po Descartesu) človek edino bitje, ki ima neposreden dostop do obeh področij stvarstva.

Čeravno je Descartesova metafizika v svojem (logično-filozofskem) jedru protislovna, pa se je (politično) izkazala za zadetek v polno. Odkritja naravoslovcev so tisti čas pogubno delovala na veljavnost verskih dogem, verske oblasti pa so pogubno delovale nazaj. Descartesovo metafiziko so tako oboji kaj hitro razumeli kot delitev interesnih sfer: stvari duha so stvar teologije, razsežne stvari pa stvar znanosti.

17. Ta poklop kartezijanskega dualizma s problemi takratne družbe je imel bržkone izredno pomembno vlogo pri kasnejši popularizaciji tega nauka, ki je dandanes vsajen globoko v podzavesti modernega zahodnega človeka. To se denimo kaže tudi skozi t.i. *mind-body problem*, problem odnosa med fizičnim in….. nekoliko smo zašli. Ostali smo torej pri iskanju stvari, ki zagotovo obstaja. Tudi pri tem vprašanju seveda ne moremo mimo Descartesa. Ta je poleg iznajdbe (kartezianskega) dualizma našel tudi točko *prve gotovosti* – in ta ni bila daleč.

18. Točka prve gotovosti je seveda lahko samo (gola) zavest (o predmetu) - Descartesov *cogito*. Slavni stavek, *cogito, ergo sum*, 'mislim, torej sem', pa je že precej vprašljiv...

Stavek, ki se neposredno nanaša na (goli) obstoj nečesa, pa je seveda nujno resničen zgolj in samo v primeru, da je tavtološki: *cogito ergo cogito*, *sum ergo sum* in podobno...

Namreč: *qui sum*, kaj torej sem? Misleča stvar, *ego cogito*, pravi Descartes. To pa je že izpeljano dejstvo, nujno veljavno le v primeru, da je *cogito ego* in *ego cogito*...

19. Descartes je predvsem (in dobesedno) znanstvenik; želi si predvsem *znanja*, in to *gotovega* znanja. A znanje je vedno le *znanje o*; znanja brez predmeta znanja pač ni...

Descartes ima sicer že s postavitvijo *cogita* predmet proučevanja, katerega obstoj mu je zagotovljen; namreč ravno sam *cogito*. A bolj ga zanima *narava*, vsaj zdi se tako...

Toda Descartes ni ne (ontološki) solipsist, niti mu ne zadostuje proučevanje *narave* (kot proizvoda) *lastnih misli*. Želi si področja, ki je od (njegovih) misli *a priori* neodvisno…

20. Vendar pa iz solipsističnega primeža ne more uiti sam. (Ontološki) solipsizem je namreč (logično) popoln sistem. Potrebno je le predpostaviti, da je sploh mogoč…

Lep primerek ontološkega solipsizma si lahko ogledamo v znanstveni podobi vesolja. Solipsist bi bil tu poosebljeni kozmos, ki ga zvedemo nazaj do Velikega Poka...

Toda v naši kartezijanski primeri je Pok pravzaprav že *ego cogito*. Ta *ego* sicer lahko stlačimo nazaj v tisti *cogito*, da pa je sploh prišel na plano, je bil potreben nek vzrok...

21. To bi sicer lahko bil sam *cogito* (točka singularnosti), a bi ta potem moral hkrati biti tudi vzrok samega sebe, *causa sui*. Toda *cogito* je le ena od obeh ustvarjenih substanc...

Šele *bog* je (pri Descartesu) vzrok samega sebe, torej *causa sui*. In tu se naša kozmična

analogija konča. Descartesov bog je namreč tudi večen, naš Pok pa je le otrok časa...

Tako smo ta kartezijanski univerzum odvrteli kraja; bolje rečeno, navili smo ga nazaj na začetek - na točko singularnosti. Ampak: *ta* univerzum je (le) *narava*, *res extensa*…

VI. *Causa sui* – logično posilstvo

22. Vrnimo se zdaj k vprašanju, zaradi katerega smo se na to kartezijansko-kozmično popotovanje pravzaprav odpravili: »Katere so zdaj te stvari, o katerih (objektivnem) obstoju ni mogoče dvomiti?«

Takšna reč (*res*) je pravzaprav samo ena – *cogito*. Zdi pa se, da poleg (subjektivne) zavesti, (objektivno) obstaja še marsikaj. Zdelo se je, da ima hruška (morda) nekoliko več biti kot morfologija, toda glede vprašanja obstoja velja Hamletova dialektika: »Biti ali ne biti.« Muha, ki (če) *je*, pravi nekje Kierkegaard, ima ravno toliko biti kot bog, ki (če) *je*.

23. Stopimo še korak nazaj; poskusimo v kontekstu povedanega obnoviti stališče, s katerega se slovarska opredelitev religije kaže kot protislovna. Osnovni predpostavki sta: boga ni, nadnaravnih sil ni.

Bog je, kot prvi vzrok *vsega* obstoječega, hkrati tudi vzrok samega sebe, *causa sui*. Kar je seveda (logično) nemogoče, absurdno, pravo posilstvo logike, kot se je izrazil Nietzsche.

24. Ključnega pomena je torej zdaj razumevanje samega pojma narave. Če je ta narava kartezijansko pojmovana, je njen obstoj popolnoma odvisen od boga. Če ni boga, niti (od zavesti neodvisno obstoječe) hruške ne more biti. A hruška (očitno) *je*…

Protislovno je torej samo stališče, s katerega se 'religija' kot »zavest o obstoju boga, nadnaravnih sil« kaže kot protislovna.

25. Če pa je ta narava pojmovana kot *res extensa* + *res cogitans* (duh in telo, mind & body), torej kot celota vsega, kar je, smo spet v težavah. Prva gotovost je namreč zdaj *zavest* o hruški, ne pa hruška sama.

Toda *zavest* o hruški je zgolj *subjektivna* zavest, s tem pa je zgolj subjektivna tudi sama hruška. (Razen v obskurnem primeru znane Berkleyeve metafizike, kjer hruška postane *objektivna* zgolj s tem, da je v zavesti boga.) Boga, ki bi nam torej jamčil objektivni obstoj česarkoli *zunaj zavesti* (subjekta), pa (po predpostavki) *ni*.

26. Preostane nam torej le, da v obstoj objektivne narave (hruške) zgolj verjamemo; dokazati tega *pač* ne moremo. *Verjetje* v obstoj (nečesa, kar nisem jaz sam) pa še ni *vedenje* o obstoju (tistega nečesa, kar nisem jaz sam). Smo pa prišli do neprotislovne definicije religije: »zavest o obstoju *nečesa, kar nisem jaz sam*«.

Kar pa zveni hudo banalno. Poleg tega je s tem zamegljena tista *notranja protislovnost*, ki je srčika (samega) *obstoja* (česarkoli).

Narava sama *je* namreč, če ni ničesar nad-naravnega, *logično absolutno nemogoča*. Z odpravo boga namreč nismo hkrati odpravili tudi njegovega bistvenega atributa, da je *causa sui*.

Predlagam, da razlaga 'religije' v SSKJ ostane nespremenjena kljub, oziroma, bolje rečeno, ravno *zaradi* svoje *notranje protislovnosti*.

27. *»Kaj je bilo prej: kura ali jajce?«*

Citirana literatura:

- *Slovar slovenskega knjižnega jezika*. Ljubljana: DZS, 2002.

Kocbekove ideje o vlogi krščanskih socialistov v OF in komunistični revoluciji

Doc. dr. Matjaž Ambrožič
Univerza v Ljubljani
Teološka fakulteta
Poljanska 4, 1000 Ljubljana, Slovenija
GSM: 040 244 339
matjaz.ambrozic1@guest.arnes.si

Za referat na konferenci *Kognitivno, znanstveno o verovanju* sem izbral temo, ki na kratko povzema osnovne ideje Edvarda Kocbeka za sodelovanje dveh nazorsko drugačnih, a v ciljih sorodnih skupin: krščanskih socialistov in komunistov. Šlo je za poizkus nekaterih katoličanov, kako bi s svojevrstno interpretacijo delovanja po evangeljskih načelih, pa čeprav mimo institucionalne Cerkve, zgradili pravičnejšo družbo. Žal se je odvijal v vojnih razmerah, ko so s svojo ekskluzivno revolucijo želeli preobraziti svet tudi komunisti.

Mlade generacije iz obdobja med obema vojnama so iskale različne odgovore na izzive, ki jim je botrovala preteklost. Pojav delavskega in kmečkega vprašanja na prelomu stoletij katoliške Cerkve na Slovenskem po zaslugi dr. Janeza Ev. Kreka in njegovih sodelavcev ni našel nepripravljene. Aktivno se je vključila v organiziranje delavcev in kmetov, v svoje vrste pa ji ni uspelo vključiti liberalnega meščanstva in izobraženstva.

Leta 1930 se je zaključila t. i. Jegličeva doba, ki ji je takoj sledila svetovna gospodarska kriza z vsemi posledicami. Potresno gibanje porajajočih se totalitarizmov je svoje odmeve našlo tudi pri nas. Papež Pij XI. je v 30-ih letih zaslutil njihovo nevarnost in zlaganost, zato jih je obsodil. Predvsem je izpostavil nevarnost »brezbožnega komunizma« in v tem mu je sledil tudi ljubljanski škof dr. Gregorij Rožman. V laiških vrstah so se razhajali pogledi glede reševanja socialnega vprašanja v duhu papeške okrožnice *Quadragesimo anno* (1931) in praktičnega krščanskega življenja, saj so nekateri imeli uradna cerkvena prizadevanja za preveč klerikalna.

Katoličanom je bilo leta 1937 z okrožnico *Divini Redemptoris* načelno prepovedano sodelovanje z »brezbožnim komunizmom«. Neenotnost v stališčih in boj med katoliškimi organizacijami ter skupinami (Katoliška akcija, stražarji, mladci, krščanski socialisti …) sta v kasnih 30-ih letih navznoter slabila njihove vrste, ki so jih pomagali hromiti tudi vrinjeni komunisti.

Razvojno pot krščanskih socialistov je pred leti preučil dr. Janko Prunk.[1] Zaostrili so idejno diferenciacijo med katoličani. Navznoter so želeli ostati verni, na zunaj pa so prelomili s katoliškimi skupinami, ki so ostale zveste cerkvenemu vodstvu. Gojili so simpatije do personalizma in socializma kot možne oblike njihovega udejstvovanja v družbi, ki naj bi potrebovala nov pravičnejši red. Seveda s komunisti niso nikdar popolnoma delili idej dialektičnega materializma, pač pa so se strinjali z nekaterimi njihovimi praktičnimi rešitvami, jim kasneje priznavali njihovo vodilno vlogo in verjeli v nujnost zgodovinskega razvoja. Tako so ob kolapsu stare Jugoslavije v dobri veri postali naivni revolucionarji, ki jih je KPS izrabila za maskoto pluralizma v OF.

Nujnost »revolucionarnega« sodelovanja katoličanov in komunistov je tedaj Kocbek utemeljeval v poglavju *O komunizmu*, ki je del neke njegove vsaj 45 strani obsegajoče razprave.[2] Takole pravi: *»Pri nas in po svetu se*

[1] Gl. J. Prunk, *Pot krščanskih socialistov v Osvobodilno fronto slovenskega naroda*, Ljubljana 1977.
[2] Ohranjene so samo strani 32, 33 in 44. Na 44. se začne *Skep*.

je vse zavrtelo okrog komunizma.[3] *[…] Zato se mu pridružujejo vsi tisti ljudje, ki sicer ne prisegajo na njegovo ideologijo, pa spoznavajo potrebo po »dopolnitvi časa« in potrebo izvršiti družbeno revolucijo. […] Tudi med evropskimi katoličani nastopa komunizem kot ločilo duhov. Ne deli jih v dogmatični sferi, pač pa na političnem in moralnem polju. […] Komunizem je po božji volji dosegel stopnjo najsilnejše sodobne zgodovinske sile. […] Tisti katoličani, ki hočejo iz Cerkve ustvariti trdnjavo obstoječega družbenega reda in v krščanstvu vidijo konservativen življenjski nazor, se obračajo proti komunizmu kot revolucionarni družbeni sili. Tisti katoličani pa, ki hočejo Cerkev osvoboditi družbenih vezi in ji omogočiti polno nadnaravno življenje na zdravih naravnih temeljih, gledajo na družbo svobodno ter zato sodelujejo v njej z vsemi naprednimi in pozitivnimi silami. […] Zato v komunizmu ne smemo videti le dialektičnega materializma, […], ampak moramo videti v njem predvsem tvorca nove družbe, razgibovalca zgodovine in osmišljevalca življenjskega smisla. […] Komunizem posredno torej očiščevalno vpliva na tako imenovani krščanski svet. […] Slovenski katoličan ni nič manj katoličan, če se je v usodni narodni ogroženosti postavil ob junaškega in drznega komunističnega tovariša ter se s tem oddaljil od meščanskega, sebičnega, bojazljivega in lažnjivega katoličana in z ustvaritvijo nove človeške tovarišije povzročil tudi ustvaritev novega krščanskega sveta.«*[4]

Izredne razmere okupacije in neenotnost katoličanov so KPS, ki ji je v resnici šlo za oblast, olajšale izvedbo revolucije pod etiketo narodnoosvobodilnega boja. Prav patriotizem in odločitev za takojšen odpor proti okupatorju sta krščanske socialiste približala komunistom, ki so revolucijo znali organizirati tudi vojaško. To je razvidno iz izhodišč KPS za OF z naslovom *Revolucionarni razvoj slovenskega narodnega osvobodilnega gibanja*, ki so verjetno nastala poleti 1942. V njih med drugim preberemo: *»Doseči osvoboditev, združitev in samoodločbo slovenskega naroda – to se pravi revolucionarno*[5] *zlomiti obstoječi sistem nacionalnega zatiranja slovenskega naroda in revolucionarno preprečiti vzpostavitev kateregakoli in kakršnegakoli starega ali novega sistema.«*[6]

In kako so svojo vlogo v OF in pri graditvi nove družbene ureditve razumeli krščanski socialisti? Kot odločitev in dejavno sodelovanje pravega slovenskega kristjana, ki se odpoveduje vsemu negativnemu v krščanstvu, vsemu zunanjemu hlastanju, vsemu računanju, vsemu opiranju na silo, skratka klerikalizmu.[7] Njihove poglede nam razkriva glavni ideolog Edvard Kocbek v svojih *Osvobodilnih spisih*[8] iz rokopisne zapuščine,[9] ki je nastala v tistih usodnih letih, ko je še tako dobra in plemenita ideja doživela drugačno praktično izvedbo. Pozornost posvečam nekaterim Kocbekovim dokumentom in spisom, na katerih je bila utemeljena drža krščanskih socialistov – krščanske skupine v OF. »*Krščanska skupina v OF predstavlja vse tiste slovenske kristjane, […] ki so takoj po okupaciji Slovenije kot ena izmed temeljnih skupin pomagali ustvariti OF na temelju takojšnjega odpora proti okupatorju in na temelju revolucionarne težnje po novem slovenskem redu. […] Njena naloga je, da združuje in moralno, versko, politično in kulturno preoblikuje krščanske delavce, krščansko kmetsko ljudstvo in krščansko izobraženstvo ter ga vključi v OF kot del skupne in enotne slovenske politične formacije. […] Omogočila je s sodelovanjem s komunisti edinstveno izkustvo, ki bo koristilo pri nastanku nove evropske družbe.«*[10]

[3] Poudaril M. Ambrožič.

[4] NUK/R, *Ms 1421*, m. 21, II.2.2.3.2. Fragmenti št. 3, poglavje *O komunizmu* (tipkopis), str. 32–33.

[5] Podčrtal verjetno E. Kocbek.

[6] NUK/R, *Ms 1421*, m. 21, II.2.2.3.1.3 Neobjavljeno v knjigah (1941–1945), *Revolucionarni razvoj slovenskega narodnega osvobodilnega gibanja* (izhodišča KPS za OF; verjetno poleti 1942, saj se sestavek začne: »Po enem letu množične …«).

[7] Prim. NUK/R, *Ms 1421*, m. 21, II.2.2.3.2 Fragmenti št. 2, *Ostanek nekega pisma*.

[8] Gl. E. Kocbek, *Osvobodilni spisi I*, ur. P. Kovačič-Peršin, Ljubljana 1991; isti, *Osvobodilni spisi II*, ur. P. Kovačič-Peršin, Ljubljana 1993.

[9] NUK/R, *Ms 1421*, m. 21, II.2.2.3.1.3 Neobjavljeno v knjigah (1941–1945); II.2.2.3.2 Fragmenti.

[10] NUK/R, *Ms 1421*, m. 21, II.2.2.3.1.3 Neobjavljeno v knjigah (1941–1945), *Krščanska skupina v OF* (rokopis);

Kocbek je v svojem spisu *Svetovni nazor in družbeno življenje* predhodne misli le še podkrepil in razložil: *»Slovenski kristjani v OF smo odločno stopili v zgodovinsko spreminjanje sveta in zavestno izbrali aktivistično vlogo v njem. O vseh posledicah svojega ravnanja poučeni vemo, da smo kot taki aktivisti danes nujno revolucionarji. […] Naša skupina kristjanov je pripravljena sodelovati do konca v sedanjem procesu.«* Ob koncu zaključi: *»Mi hočemo ustvariti v kristjanih prepričane revolucionarje. […] Kakor je naravno, da komunist ustvarja v sebi prepričanega revolucionarja s pomočjo dialektičnega materializma, tako je jasno, da more postati kristjan revolucionar le s pomočjo evangeljskega krščanstva.«*[11]

Krščanski socialisti so se torej zavestno odločili ubirati svoja pota mimo cerkvenega vodstva, to pa jih je še bolj pahnilo v odvisnost od komunistov. Ostro so se poleti 1943 odzvali tudi na suspenz dr. Metoda Mikuža in škofu Rožmanu očitali, da je na ta način partizane oropal duhovne oskrbe.[12]

Po *Dolomitski izjavi* so tudi sami občutili partijski diktat in svojo nemoč. Skoraj neverjetno pa se zdi, s kakšno lahkomiselnostjo so se odpovedovali lastnemu političnemu organiziranju – stranki, saj so ostali zgolj gibanje. Kocbek je zapisal: *»Vsak pošten kristjan mora priznati, da je Partija vodilna svetovna družbena sila. […] Da pa je nasprotna krščanstvu, ni slučajno, ampak nujna posledica zgodovinske krivde dosedanjega krščanstva. Iz vsega tega sledi, da nam niti družbeni niti nazorski razlogi ne dopuščajo osnovanja lastne stranke. […] Naš cilj je udeležba v OF, to se pravi bodoči svetovni demokraciji, ki bo razvijala pravo politično življenje, medtem, ko bo partija ostala garant pravilne smeri. […] Kaj je torej dolžnost Ks [krščansko-socialističnih] aktivistov? Ta, da opustijo vsako skupinsko množično organiziranje, pač pa da s svojim novim krščanskim in družbenim stališčem privedejo čim večje število slovenskih kristjanov na pozicije napredka.«*[13]

Na fragmentu nekega njegovega pisma anonimnemu tovarišu lahko preberemo že bolj kritična razmišljanja o komunistih, pa tudi tista o nujnosti čiščenja katoliških vrst, ki se je med vojno in po njej dogodilo na zelo brutalen način – povsem drugače od Kocbekovih predstav. *»Če se torej hočemo kot nazorsko od komunistov različno usmerjeni ljudje ob njih uveljaviti, […] potem moramo imeti možnost konfrontacije z njimi na ravnini, ki bo višja od nazorske. […] Komunizem je izrazit dialektični nazor, vendar je kot totalitarni nazor zapadel mehaničnemu gledanju, […] ko je kot organiziran del človeštva sklenil za vsako ceno*[14] *izbojevati zmago svoji vsebini: kdor hoče namreč v borbi uspeti, mora njegova doktrina zmagati v vsej polnosti in popolnosti, to se pravi, da mora biti pripravljen na krivičen postopek, do življenja in do človeka samega. Organiziran nazor hoče doseči enotnost gledanja in pri tem ne gleda niti na človeške niti na vrednostne žrtve. […] Skušali bomo komunistom dopovedati, da se s silo lahko uničujejo samo tiste sile, ki so naprednemu razvoju nasprotne, ne pa tudi tiste, ki ta razvoj pospešujejo, /čeprav so nasprotne dialektičnemu materializmu./*[15] *[…] V tem smislu pa se moramo kristjani zavedati, da mora krščanska družba v Evropi doživeti tako čiščenje, da bo odpravilo vse napake, ki so se v teku dolgih desetletij nakopičile. […] Obračuna nad kristjani in čiščenje krščanske družbe v nobenem smislu ne smemo preprečevati, kajti s tem bi najbolj škodovali sebi in pravemu razvoju. […] Gre le za to, da bo to čiščenje silovito, ne pa nasilno, da bo podvrženo predvsem vsem potrebam etičnega*

objava: E. Kocbek, *Osvobodilni spisi I*, ur. P. Kovačič-Peršin, Ljubljana 1991, str. 20.

[11] NUK/R, *Ms 1421*, m. 21, II.2.2.3.1.3 Neobjavljeno v knjigah (1941–1945), *Svetovni nazor in družbeno življenje* (tipkopis), str. 1, 6–7.

[12] Peticijo so »Na položaju 19. junija 1943« za vodstvo kristjanov v OF podpisali: dr. Bogdan Brecelj, dr. Marjan Brecelj, Tone Fajfar, Franc Klešnik, Edvard Kocbek, Štefan Pavšič, Helena Puhar, Janez Stanovnik, in dr. France Škerlj. Gl. NUK/R, *Ms 1421*, m. 21, II.2.2.3.2 Fragmenti št. 6, *Protest kristjanov v OF zaradi suspenza dr. Metoda Mikuža* (rokopis).

[13] NUK/R, *Ms 1421*, m. 21, II.2.2.3.2 Fragmenti št. 2, *Ostanek nekega pisma.*

[14] Podčrtal E. Kocbek.

[15] Dopisano s peresom.

samospoznavanja in obžalovanja, ne pa procesom političnega terorja./«[16]

Kakorkoli že skušamo razumeti »verska« prizadevanja Kocbeka in njegovih tovarišev, pa se vendarle ne moremo izogniti tragični resnici, da je med 2. svetovno vojno partija z njihovo pomočjo napadla ostale katoličane, ko je instrumentalizirala, monopolizirala in sankcionirala osvobodilni boj proti okupatorju. Ne smemo pozabiti, da so bili v partizanih večinoma povprečni katoličani – domoljubi; žal pod taktirko politkomisarjev.

Krščanski socialisti so si prizadevali za uresničitev svojih idealov. Ker pri cerkvenem vodstvu niso našli razumevanja, so se obrnili drugam. Čutili so nezadostnost cerkvenih prizadevanj za pravičnejšo družbo v duhu evangeljskih vrednot. Vsekakor je šlo za ponesrečen poizkus aplikacije pravičnejše družbe na temelju krščanstva in socializma, saj je bil ateistično-marksistični rival v vojnih razmerah preveč močan in hkrati nepripravljen deliti oblast, s katero je kasneje dolga desetletja pokoril kristjane in ostale drugače misleče. Danes nam je na te dogodke že dano gledati iz zgodovinske perspektive in si želeti, da se kaj takega ne bi nikoli več ponovilo.

Viri in literatura

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Doc. dr. Matjaž Ambrožič, docent za zgodovino Cerkve in patrologijo na Teološki fakulteti Univerze v Ljubljani.

SUMMARY

The author of the paper delivered at the conference *Kognitivno, Znanstveno o verovanju* has chosen the topic which in short gathers the basic ideas why the part of the catholic people – the so called Christian Socialists – cooperated with the Osvobodilna fronta (Liberation front). They used a unique way of activity under the gospel principle, even though without the institutional Church, and tried to build a more righteous society. Unforunatelly, their attempt took place during the war time when also the comunists tried to transfigure the world with their exclusive revolution.

Thanks to dr. Janez Evangelist Krek and his associates the appearance of the labour and peasants question at the end of the 19th century did not find the Catholic Church in Slovenia unprepared. In 1930 different views on how to solve the social questions and the practical christianity started to part the laity. Some of them thought the Church's effords were too clerical. The time during and after the Spanish Civil War was a very frutile foundation for the Kocbek's socialists to take an active part in. They strained the ideal differentiation among the catholics. They wanted to stay religious from the inside, but from the outside they broke with the catholic groups which stayed loyal to the Church's leadership. They symphatised with the personalism in socialism as the possible way of their activity in the society which needed new order. Of course they never agreed in full with the communists on the idea of practical materialism, but they agreed with some of their practical solutions, later on acknowledged them their leading role and also believed in the necessity of the historical progress. So at the end of the old Yugoslavia they became naive revolutionaries who were used by the KPS (Communist Party of Slovenia) as a mascot of pluralism in the Osvobodilna fronta.

[16] NUK/R, *Ms 1421*, m. 21, II.2.2.3.2 Fragmenti št. 1, *Ostanek nekega pisma.*

ZNANOST O VEROVANJU

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 je podan znanstven pogled na verovanje kot na enega najbolj pogostih kognitivnih dogajanj. Po kratkem pregledu se prispevek ukvarja z evolucijo, obsmrtnimi doživetji, kognitivnim pogledom na verovanje, na Jezusa Kristusa in krščanstvo in na koncu prikaže avtorjevo mnenje o evolucijski (ne)koristnosti verovanja in sistemov vrednot slovenske družbe.

1 UVOD

Večina ljudi se proglaša za vernike enega izmed 6 svetovnih religij (opomba: v tem prispevku ni razlikovanja npr. med verstvom, religijo in drugimi termini; dostikrat so te besede uporabljene kot sinomnimi – v tem prispevku je poudarek na principih in naukih), trenutno okoli 5 milijonov, od tega večina za kristjane in muslimane (internet – Google najde 1.800.000 strani z vsebovanim dobesednim nizom "science and religion"). Skupaj z islamom tvorijo eno skupino verovanj, kjer obstaja mesija v človeški podobi, nebesa in pekel. Druga velika skupine svetovnih verstev je locirana pretežno v Aziji, tu obstaja božji nauk, iskanje modrosti in sreče, ter nek osnovatelj, ki je ponesel nauk med svoje učence. Vse pomembnejše religije pa vernikom dajejo smernice, nauk, navodila, upanje v odrešitev na tem in onem svetu. Verovanje je torej eden najpogostejših kognitivih pojavov, po pogostosti primerljiv recimo s sanjami (Hameroff idr. 1997; LaBerge 1998).

Prve religiozne pojave opazimo pri najmodernejšem človeku, ki se je pojavil kakšnih 200.000 let nazaj. Najpomembnejša verstva so stara približno 2000 let, recimo krščanstvo in islam. Pri živalih in nižjih podvrstah (starejših kot 200.000 let) ljudi religioznih pojavov ne poznamo. Pač pa večina mladih bitij intenzivno raziskuje in se uči. To je podobno znanosti, saj gre v vseh primerih za zajemanje novega znanja. Ko se mlada mucka podi za klopko volne, se uči dinamike svojega telesa in lova. Raziskovanje je torej staro skoraj toliko kot življenje samo. Znanost kot veda se pojavi bistveno kasneje, je pa verjetno najbolj zaslužna za razvoj modernega človeštva.

Znanost in vera sta si bila v zgodovini pogosto antipoda. Nekateri kot Karl Marx so verovanje proglašali za lažni opij človeštva, torej za duševno skodljivo omamo, ki ne prinaša nobenih koristi, torej nekaj podobnega kot kajenje. Sigmund Freud je religijo iznačeval za prisilno duševno motnjo. Nekaj časa se je zdelo, da bo znanost spodrinila vero, ki je vztrajala na starih dogmah (Spiegel, Newsweek). Najbolj znan primer nesmiselnega vztrajanje religije v nasprotju z znanstvenimi dejstvi je trditev, da se sonce vrti okoli zemlje in ne obratno. **Ali bo torej znanost spodrinila vero?**

Nekateri najvidnejši znanstveniki pa so imeli do religije zelo odprt odnos, recimo Newton. Albert Einstein je bil podobno kot prenekateri znanstvenik mnenja, da v našem vesolju velja nek višji red, brez katerega sam obstoj ne bi bil mogoč. Za Stephena Hawkinga je bog utelešenje fizikalnih zakonov.

Kljub temu, da se je marksizem bolj ali manj izpel, pa se zdi, da religija v razvitem svetu nima več toliko gorečih privržencev kot pred stoletji ali celo desetletji. 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. V Nemčiji se z osnovnimi cerkvenimi koncepti, recimo Bogom, strinja le še med 10 in 20%. Večina ljudi pa je naklonjena neki obliki verovanja, pri čemer je to dostikrat konstrukt posameznika, ne pa dosledno sprejemanje obstoječega verovanja.

Kaj se torej dogaja z znanostjo in vero? V tem sestavku se bomo ukvarjali predvsem z znanstvenim pogledom na verovanje kot kognitivni proces in analizirali nekaj razlik v pogledih znanosti in krščanstva.

2 ZNANOST ODKRIVA KORISTNOST VERE

Znanost kot osnovna veda za ugotavljanje resnice ima tradicionalno težave pri preučevanju in razlaganju tako zapletenih dogodkov, kot so verovanje ali drugi kognitivni pojavi. En razlog je v zapletenosti dogodkov, ki se dogajajo v možganih kot najbolj zapletenem samostojnem sistemu v vesolju. Drug razlog je v tem, da smo vsi tako ali drugače opredeljeni do teh vprašanj in neradi sprejemamo drugačne, čeprav dokazane resnice. Pa vendar korektnim znanstvenim spoznanjem težko dalj časa oporekamo.

Znanost je o verovanju v zadnjem desetletju odkrila marsikaj novega. Najpomembnejše spoznanje glede vere je, da imajo ljudje (tudi ateisti) del možganov vnaprej specializiraniih za verovanje/vero in da imajo postopki verovanja celo svojo kemijo, svoje kemično-biološke procese. Od tod sledi kar nekaj zanimivih izpeljav in analiz. Kot prvo – danes na splošno velja, da so določeni deli možganov vnaprej pripravljeni za svojo funkcijo, recimo za vid ali govor. Med

prvimi, ki je za lingvistiko to tezo postavil na abstraktnem nivoju na osnovi eksperimentov, je dr. Chomsky, znanstvenik, ki je leta 2005 dobil častni doktorat ljubljanske univerze. Torej ljudje nismo nepopisan list, ki ga v celoti oblikuje okolje. Seveda je končna izvedba človeka/možganov sestavljena iz prirojenih in pridobljenih lastnosti, vendar zadnja desetletja poudarjajo pomen genetike in predispozicij človeških možganov.

Pri teh razmišljanjih velja ostati previden. Npr. človeški možgani so neverjetno prilagodljivi, tako da se novorojenčki, ki jim pri porodu odmre pol poloble (grobo rečeno – pol možganov), večinoma razvijejo v normalne ljudi. S tem odpade tudi klasična asimetrija možganov – komunikacija med levo in desno poloblo, ki naj bi bila najpomembnejša za vrhunsko človeško razmišljanje (Gams 2001). Okrnjeni možgani se neverjetno prilagodijo in praktično v celoti izvajajo iste operacije kot normalni z dvakrat večjo količino nevronov v najbolj razvitem delu. Očitno pri možganih ni nič enostavnega, hkrati pa so nekatere lastnosti morda celo v celoti teoretično nepojasnljive ali zaradi kompleksnosti ali problemov samoreference.

Kljub temu pa je ugotovitev o specializiranih možganih za verovanja presenetljiva in prinaša nekaj pomembnih in nespornih zaključkov. Ker so sposobnosti možganov ključnega pomena za uspeh človeštva in ker je del možganov speciliziran za vero in ne za – recimo – še boljšo matematiko, je očitno **verovanje 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). Pri tem je potrebno upoštevati, da možgani porabijo približno 20% energije, torej je verujoči del možganov velika dodatna obremenitev. Pa se je očitno izplačala.

Od te znanstvene ugotovitve o koristnosti verovanja lahko postavimo morebitne razlage (bolj ugibanja), zakaj je temu tako. Morda neverujoči ljudje nimajo notranje sile, ki jih žene v produciranje otrok, morda pa gre za premalo strpno in predano delo v skupnosti. Različne znanstvene študije, ki modelirajo delovanje skupin (avtorju najbližje so s področja računalništva in informatike, recimo združb inteligentnih agentov) kažejo, da je za evolucijsko uspešnost najpomembnejša skupnost povezanih sodelujočih posameznikov, ki se občasno žrtvujejo za skupno dobro. V nekem smislu so to lokalno altruistični sposobni egoisti, ki kombinirajo lastne motive s skupinskimi. Skupne oz. skupinske motive morebiti predpisuje verovanje, večinoma v obliki verstev, delno pa tudi z drugimi ideologijami, morda tudi lokalnimi načeli. To so kljub vsemu ugibanja, **trditev o koristnosti verovanja pa je zgodovinsko in evolucijsko dejstvo**.

Drugo vprašanje je, ali mora biti verovanje v obliki obstoječih religij, ali pa je lahko tudi kakšno novo, morda celo nereligiozno, samo sistem vrednot? In še drugače - zakaj recimo ne bi za verovanje namenjenega dela možganov uporabili raje za kaj bolj konkretnega, dobili boljšo službo in zaslužili več denarja? Tu nam znanost ne pomaga kaj dosti, razen v obliki statističnih podatkov za nazaj. Ve pa se, da so verujoči ljudje v splošnem bolj zdravi kot ljudje, ki v nič ne verjamejo. Razlaga je preprosta – sodobni svet je izrazito stresen in kot tak škodljiv, vse vrste mentalne sprostitve pa so izrazito koristne pri hitrejšem okrevanju in preventivnem delovanju. Statistično sicer niso ugotovili kakšne posebne razlike med verovanjem (vnetim ali blagim), jogami, avtogenimi treningi ali celo tehnikami dihanja (Newsweek, internet).

Drugo področje, kjer se je moderni pogled, delno temelječ na znanstvenih spoznanjih modernega sveta, izkazal za vsaj vprašljivega, je sistem vrednot, recimo družina ali enakopravnost spolov. V današnji kapitalistični družbi je najpomembnejša celica družbe posameznik in ne družina kot v religioznem pogledu. Razviti svet skuša na vse načine vpeljati potrošniški pogled, kjer sta denar in kariera pomembnejša kot recimo poroka ali otroci. Zato tudi uvajanje istospolne poroke. Posledično se zmanjšuje tudi število rojstev in število bodočih potrošnikov, toda kapitalizem se v svoji optimizaciji srednje in kratkoročnih rešitev s tovrstnimi problemi ne ukvarja. Za Slovenijo lahko ugotovimo, da bi se moralo število rojstev povečati za 100 % (z besedo sto), da bi se obdržalo reprodukcijsko ravnotežje z 2.1 otroka na žensko. Kljub temu ta problem zavzema zanemarljivo prostora v medijih in v političnih ali strokovnih debatah tako v svetu kot v Sloveniji.

Še jasneje se zmote moderne sociološke znanosti, pomešane s političnimi nazori, kažejo pri enakosti spolov. Medtem ko so v 19. stoletju ženske smatrali za nesposobne vrhunskih miselnih procesov, je v današnjih srednjih šolah v razvitem svetu le okoli 45% dijakov, v Sloveniji pa le 40%. Raznovrstne študije (prava, resnična kognitivna znanost) odkrivajo poglavitni razlog za to – moški in ženske so si različni, imajo različne fizične in mentalne lastnosti. Ker v osnovnih in srednjih šolah daleč prevladujejo učiteljice, ki poučujejo in ocenjujejo "ženski" pogled, so fantje prikrajšani (Newswek, internet, BBC) . Drugi pomembni razlog je v tem, da fantje zaostajajo v razvoju, težina in zahtevnost ocenjevanja pa se prenaša v nižje šolstvo. Pri tem se dela trojna škoda: zaradi povečanih kriterijev je življenje za učence in starše postalo bolj zahtevno; rezultati zaradi preobremenjenosti upadajo; **država izvaja masovno spolno zatiranje na sistematičen način.** V Sloveniji so rezultati še slabši kot v razvitem svetu, saj je med diplomanti le približno tretjina študentov.

Dasiravno ne bi mogli reči, da je spolno zatiranje učencev rezultat znanosti, pa vseeno v javnost in v odločanje teh ugotovitev ni ponesla dovolj hrabro. Podobno kot je bilo v medijih dolgo časa trdeno, da med otroci v družini in izven ni nobene razlike, pa je statistika pokazala, da so otroci samohranilk signifikantno manj zdravi kot v celih družinah.

3 PRED- IN OBSMRTNA DOŽIVETJA

Pred nekaj desetletji so nekateri znanstveniki gledali na pred in obsmrtne pojave kot na še eno reklamo religij, ki izkoriščajo duševno stisko v težkih trenutkih za pridobivanje vernikov. Vendar se je število registriranih pojavov večalo in kmalu zraslo v desettisoče (Moody 2001; Kubler-Ross 1991). Čeprav so bile prve študije običajno tudi religiozno obarvane, znanstveno korektni bralec ni mogel prezreti empiričnih dejstev, čeprav si je znanost dolgo zatiskala oči.

Pred smrtjo se ljudje pogosto zavejo, kaj jih kmalu čaka. Stisko in strah zamenja pomiritev in duševni mir, pogosto sprejemajo tudi ljudi, s katerimi se prej niso razumeli. Pogosto poročajo o sanjah o optimistični odpravi, recimo z jadrnico na s soncem obsijano morje. V prehodu med življenjem in smrtjo se ljudem hitro zavrtijo spomini na najlepša doživetja, sledi približevanje z lučjo, srečanje z najdražjimi umrlimi osebami, recimo nekateri umrli sorodniki umirajočega včasih pošljejo nazaj v življenje, drugi doživijo srečanje s svetlobo in svetlobnim bitjem. Manjši odstotek pa doživi postopek spuščanja v temo kot v hudobijo, pekel.

Avtor tega prispevka je doživel obsmrtni dogodek in o tem tudi poročal na konferencah kognitivnih znanosti na multikonferenci Informacijska družba (Gams 2002, 2003). Nekaj izsekov doživetja:
… kot bi se približeval svetlobi ali svetloba meni … je bilo to podobno dogodkom v filmu "Ghost", ampak tudi tu je bila bistvena razlika v tem, da je bila svetloba povezana z občutjem, s čustvi. Svetleje ko je postajalo, močnejše je postajalo čustvo oz. doživljanje. To čustvo je bilo nekaj neponovljivega. … Le redki najboljši občutki se lahko primerjajo s tem, pa še drugačni so. Morda bi se dalo to opisati z besedami kot "nebeško, božansko", vendar je problem v tem, da ta čustva težko opišemo. … Čustvo ob prihajanju svetlobe pa je bilo nekaj enkratnega, nikoli ponovljivega. Kvalitetno gledano je bilo to nekaj drugega, ne različica ljubezni, zmagoslavja ali zadovoljstva. …
… prihajam do osnov bistva mene kot človeka in tudi človeštva. Da je tisto osnovno tam doli nekaj takega, do česar nikoli ne moreš priti pri popolni zavesti. Da je to nekaj izjemnega, enkratnega. … gre za neko obliko zelo osnovne modrosti, zavesti oz. človečnosti. Izraz "človečnosti" mi je nekoliko bolj všeč kot izraz "božanstva", čeprav bi kdo drug morda uporabil drugačne termine…

Pred desetletjem si avtor tega dogodka gotovo ne bi upal poročati o osebnem doživetju, saj ga ne bi več obravnavali kot resnega znanstvenika. Danes pa so znanstvena spoznanja o pred in obsmrtnih doživetjih že toliko sprejeta, da o njih lahko mirno govorimo in jih analiziramo. Po nekaterih študijah je recimo kar 10% pacientov ob srčnem zastoju in ponovni obuditvi poročalo o podobnih doživetjih. V Sloveniji orjemo ledino v kognitivnih konferencah predvsem trije soorganizatorji-profesorji in doktorji znanosti: prof. Musek in prof. Kononenko in dasiravno so tako obsmrtna doživetja kot znanstveno o verovanju provokativne teme, so doslej avtorji uspeli vpeljati znanstvene in strokovne analize v omenjene teme (Kononenko 2004; Musek 1995). Kljub vsemu precejšen odstotek slovenskih znanstvenikov absolutno dvomi npr. o pred in obsmrtnih dogodkih, pa čeprav jih je **večji del npr. ameriških znanstvenikov sprejel**.

Čeprav je znanost potrebovala kar nekaj časa, da se je objektivno lotila tovrstnih doživetij in v veliki meri potrdila pred in obsmrtna doživetja, pa se je pokazalo dvoje razlik v primerjavi s splošnim mnenjem:
- nekaterih trditev in občutkov ni mogoče znanstveno potrditi, recimo dokaj pogost občutek izventelesnih opazovanj samega sebe npr. na postelji se je najverjetneje izkazal kot izpad možganskega centra za telesno lociranje
- znanost pri razlagi dogodkov pride do neke meje, recimo do srečanja s svetlobo, potem pa trenutno ni znanstvenih mehanizmov, s katerimi bi lahko ugotovili kaj več in obstajajo le možne hipoteze o nadaljnjih postopkih. Znanost sicer nesporno ugotovi smrt telesa in odsotnost mentalnih pojavov v možganih.

4 RELIGIJA O EVOLUCIJI

V prejšnjih sekcijah smo analizirali nekaj trenutnih slabosti znanosti. Kljub temu je znanost sinonim za resnico, religija pa sinonim za obravnavanje duševnih pojavov verovanja. Religija je v očeh nekaterih znanstvenikov bliže politiki, kjer so resnica in dejstva manj pomembna kot namen, ki posvečuje sredstva. Značilen je odnos do evolucije.

V ZDA še danes skoraj pol ljudi ne verjame, da je človek nastal iz opicam podobnih prednikov na osnovi naravnih (evolucijskih) zakonov, ampak naj bi človek nastal po božji želji (National Geographic). Verski fundamentalisti zahtevajo, da se tovrstna razlaga vključi v šolski pouk. Trenutno pa znanost take možnosti praktično ne dopušča. **Neoporečnih znanstvenih dokazov o veljavnosti evolucije je enostavno preveč.**

V zgodovini se je pogosto dogajalo, da so bile nekatere verske trditve v nasprotju z ugotovitvami znanosti. Ampak z razvojem znanosti se je v veliki meri prilagajala tudi vera. Danes nobena vera oz. duhovstvo ne trdi, da je zemlja ploščata, kot so zapovedali Koperniku okoli leta 1550, ali pa da so nebesa nad oblaki. Danes lahko vsakdo med pogledom z aviona opazi rahlo ukrivljenost obzorja. Čemu vztrajanje, da evolucija ne drži?

Evolucija pravi, da v boju za obstenek le najbolj okolju prilagojeni prenesejo svoje gene na potomce. Zato se živalske vrste prilagajajo okolju in so čedalje sposobnejše. Zato recimo so sloni na izoliranih otokih postali pritlikavi. Darwin je leta 1859 predstavil svoje delo "Izvor vrst" in skupaj z nekaj sodobniki vpeljal evolucijo kot naravni zakon. Dokazi so predvsem s štirih področij (National Geographic):

- biogeografija (v sorodnih nekoliko drugačnih okoljih so sorodne nekoliko drugačne vrste, recimo podobne vrste ščinkavcev na Galapaških otokih),
- paleontologija (fosilni ostanki kažejo razvoj vrst in zakonitosti razvoja od začetka življenja do danes),
- embriologija (človeški zarodek gre skozi različne faze podobnosti nižjim bitjem, recimo podobnosti s plazilcem, kot posledica milijonov let razvoja živih bitij in skupnih prednikov)
- morfologija (zakaj so si vse mačke podobne in vsi psi med seboj – brez poznavanja DNA je Darwin opazil in razložil podobnost – sorodne prednike).

Evolucije običajno ne moremo sproti opazovati, ker so genetske spremembe opazne pri potomcih na daljši čas. Lahko pa jo v živo opazujemo in merimo v laboratorijih in v naravi. Tako lahko opazujemo, kako se bakterije prilagajajo antibiotikom (najsposobnejši preživi), kako se virusi AIDS prilagodijo posameznemu zdravilu, težje pa najdejo rešitev proti koktejlu zdravil, v laboratorijih pa so merili npr. spremembe vinske mušice na spremembe laboratorijskega okolja. Evolucijski zakoni so tako osnovni kot Newtonovi fizikalni in tudi približno tako trdno dokazani.

Moderne pripombe na evolucijo so drugačne - kakor ne moremo razložiti, zakaj veljajo v našem vesolju ravno Newtonovi fizikalni zakoni, tudi ne moremo razložiti, zakaj veljajo evolucijski zakoni. Veljajo pa. Celo Janez Pavel II je priznal evolucijo kot veljavno zakonitost, po kateri se razvijajo živa bitja, pa vendar zakonitost, ki je nastala kot rezultat božjega dela, torej božja zakonitost.

Po mnenju dr. Osredkarja (2005) "evolucijska teorija ni del katoliškega nauka, vendar mu tudi ne nasprotuje. V 19 stoletju, ko sta Lamarck in potem Darwin postavila to teorijo, je le-ta navidezno res zanikala kreacionizem. Ampak od takrat je katoliška teologija naredila velik napredek na področju eksegeze. Danes v svetopisemskem tekstu razlikujemo različne literarne vrste; predvsem pa ločimo znanstveni jezik od simbolnega jezika, v katerem se izražajo verske resnice. Zato je papež Pij XII leta 1950 v encikliki Humani generis lahko napisal, da med verskim naukom in evolucijsko teorijo ni nasprotij. Poudaril pa je, da vsekakor Bog je stvarnik vsega in ustvarja tisto, kar je v človeku duhovnega, pa če to imenujete duša, ali kako drugače.
Papež Janez Pavel II je 24. oktobra 1996 leta o tej temi spregovoril članom Pontifikalne Akademije Znanosti in dejal, da je evolucijska teorija več kakor hipoteza.
Skratka, kristjani verujemo, da je Bog Stvarnik, to je verska resnica. Kako pa je to stvarjenje potekalo, s tem se ukvarja znanost. In evolucijska teorija nam ponuja enega od možnih odgovorov."

Morda je tu priložnost, da se spomnimo dejstva, da odstotek registriranih kristjanov po posameznih državah niha, različni pa so tudi npr. pogledi posameznih vej krščanstva na evolucijo, pri čemer se zdi ameriška varianta dokaj ortodoksna, zgornje slovensko mnenje pa bolj argumentirano. Hkrati pa velja, da je v dobršnem delu najbolj razvitih držav sveta precejšen odstotek kristjanov.

5 ZNANOST O ZGODOVINI KRŠČANSTVA

V zadnjih desetletjih se je znanost intenzivno ukvarjala s študijem krščanskih besedil in naukov, predvsem z iskanjem zgodovinskih potrditev dogajanj. Tu se bomo omejili predvsem na dogodke v zvezi z Jezusom Kristusom, kjer je danes bolj ali manj potrjen bistveni del zemeljskih dogodkov. Recimo, leta 1961 so našli kamnite zapiske in z datiranjem ugotovili, da so pristni in potrdili zgodovinsko verodostojnost Poncija Pilata. Zadnja leta se lahko vsak turist v Izraelu (tudi avtor) udeleži ogleda kraja poslednjega maziljenja, lokacije zadnjega dneva pred prijetjem, v roke lahko vzame leseni križ, posnetek tedanjega, se udeleži kraja križanja na Golgoti in ogleda kraj, kjer je ležalo truplo.

Zgodovina je nekatere stvari potrdila dokaj natančno, nekatere pa z določenim intervalom nejasnosti. Recimo datum križanja je okoli leta 30. Približna zgodba pa je takale: Žid Jezus je bil eden izmed potencialnih voditeljev upora proti Rimljanom v uporni židovski provinci Judeji, ki ji je vladal Poncij Pilat v prisilnem sodelovanju z lokalnimi židovskimi duhovni. Podobno kot mnogi drugi uporniki (recimo Baraba) je tudi Kristus končal tragično. Zgodbe o njem so pisali pretežno ljudje kakšnih 30-50 let kasneje in preko evangelijev in nove zaveze uveljavili osnovni krščanski nauk, ki je pripeljal do najpomembnejše svetovne religije. Seveda je potrebno upoštevati, da je bilo krščanstvo tako tedaj kot danes sestavljeno iz mnogo podvej in podsmeri, ki so imele vsaka svoja tolmačenja in poglede. Z enotnimi zapisi, čeprav morda nekoliko privlačneje opisanimi kot dejanski dogodki, so tedanji Židje začeli še bolj masovno sprejemati krščanske nauke.

Kaj je bilo torej posebnega na Jezusu, ki je svojo mladost preživel kot uboren tesarski pomočnik svojemu očetu? Približno je znana njegova velikost, teža, izgled, ni pa znana njegova DNK, čeprav je bilo kar nekaj poskusov v tej smeri. Nesporno je bil Kristus človek v biološkem smislu, tudi njegova mati je nesporna. Glede očetovstva ima zgodovina nekaj variant, pri čemer se uradna cerkvena z duhom zdi z znanstvenega stališča manj verjetna. Omenja se kasnejšega uradnega očeta, ki je bil torej aktiven pred poroko, pa celo nekega rimljanskega vojaka. Kristus je torej svojo pot začel z roba družbene lestvice. Nesporno pa je znal s svojimi nastopi, nauki in mislimi pritegniti ljudske množice. Tudi redki zgodovinski viri nasprotnikov, recimo židovskih duhovnov, mu priznavajo "mistične" ali "ranocelniške" sposobnosti. Tudi ni sporno, da je Kristus imel sorodnike vsaj po materini strani, katerih potomci najverjetneje živijo še danes. Kljub temu si je zgodovina kot znanstvena veda enotna, da je recimo zgodba v "Da Vincijevi kodi" npr. o Kristusovih otrocih in nadaljnjih potomcih brez realnih osnov, sicer zanimiva kot domišlijska zgodba (uspešnica), vendar brez pomembnejše povezave z zgodovinskimi dejstvi skoraj v vseh komponentah.

Na vprašanje, kaj je bilo torej tako posebnega v življenju in delu Jezusa iz Nazareta, ki ga je Poncij Pilat posmehljivo imenoval "Židovski kralj", znanost o tem ne ve povedati kaj konkretnega, razen nekaj potencialnih razlag o privlačnosti nauka strpnosti, potrpežljivosti in trdi realnosti na robu človeške družbe, o svetosti življenja in o obljubljenem posmrtnem nebovzetju. Znanost o duši in dogajanjih v njej ne ve povedati kaj posebno veliko, čeprav čedalje več. Napredek tu prihaja z majhnimi koraki.

6 ZAKLJUČEK - DISKUSIJA

Strpna, moderna in kognitivna znanost v marsičem potrjuje nekatere trditve religij in ugotavlja evolucijsko in konkretno koristnost verovanja oz. duševnih procesov. Potrebno pa se je zavedati omejitev našega znanja – tako recimo bodočnost ostaja popolnoma odprta. Morda bo naslednja verzija človeka, ki se bo slej ko prej pojavila kot nova mutacija v neskončni evoluciji, drugačna. Marsikateri pojavi tako v bodočnosti in tudi v sedanjosti, predvsem v smislu npr. duše, so trenutno nad našim razumevanjem in nad našimi najboljšimi znanstvenimi sposobnostmi. Več vemo povedati o zgodovini in sedanjosti, predvsem o materialnem svetu.

Zdi se, da so spori med znanostjo in vero povezani s političnimi družboslovnimi pojavi, ne pa z nauki ene in druge struje. Morda bi bilo smotrno, da bi cerkveni predstavniki fleksibilno sprejemali nova znanstvena spoznanja predvsem v materialnem svetu, kjer znanost nesporno vlada, in se ukvarjali s pojavom verovanja v duševni obliki, kjer znanost sicer spoznava kemijo in lokacijo verovanja v človeških možganih, o najpomembnejših duševnih postopkih in naukih pa praktično ne zna ničesar povedati. Hkrati bi bilo lepo, če bi se znanost nehala izkoriščati v politične namene v pogosto zgrešenih interpretacijah, recimo pri poučevanju v osnovnih in srednjih šolah, kjer smo si sami zakomplicirali življenje.

Nesporno je znanost v povezavi s tehnologijo in modernim kapitalizmom najbolj zaslužna za bistvena povečanja dolgosti življenja, bistveno večji standard in tehnološke zmogljivosti ljudi v materialnem smislu. Hkrati pa je moderni kapitalizem, ki je nastal na osnovi znanosti, nesporno negativen v odnosu do tradicionalnih bioloških in socioloških vrednot kot družina, poroka, svetost življenja, odnosi med spoloma. Npr. v Sloveniji se pogosto ne splača poročiti, ker je ekonomsko učinkoviteje, če je mati prijavljena kot samohranilka. Omenjeni problem spolnega zatiranja osnošolcev in sednješolcev je tudi eden značilnih pojavov. Prava znanost na to opozori, reakcije v politiki in zakonodaji pa so zanemarljive oz. se celo v imenu izmišljene družboslovne znanosti narobe interpretirajo. Kot tehnični znanstvenik lahko le ponovim, da so učinkovitejši računalniški modeli, ki temelje na sodelovanju in sistemu vrednot, kot pa variante s poudarkom na posameznikih.

Zakaj in kako skoraj vsi ljudje verujejo v taka ali drugačna načela/ideologije/verovanje, je težko pojasniti. Znanstveno dokazano pa je, da so te sposobnosti globoko povezane z bistvom človeka, z njegovo evolucijsko uspešnostjo. Hkrati ko je danes nesporno, da v ekonomskem in razvojnem smislu tržno na znanstvenih dosežkih temelječe privatno podjetništvo ekonomsko uspešno, cerkev pa podobno kot državne inštitucije v gospodarskem smislu ne, in kot je splošno sprejeta ločitev med cerkvijo in državo, pa je v duševnem smislu jasno, da mora nek sistem vzdrževati neke duševne odnose in norme.

Kakor preganjanje znanosti ni ustavilo njenega razvoja, tako tudi znanost ni uničila verovanja. V določenem smislu je znanost v nasprotju s pričakovanji celo podprla verovanja oz. sorodne mentalne aktivnosti kot verodostojna in koristna.

V današnjem času ni razloga za nasprotja med znanostjo in religijo, saj se obadve prilagajata novim razmeram in iščeta pot do ljudi. In v nekem smislu znanost in vera izgubljata, ko vsake deset minut v nas butne taka ali drugačna reklama, ki nam prefinjeno vsiljuje nek drugačen način življenja.

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PSIHOLOŠKI, NEVROZNANSTVENI IN EVOLUCIJSKI VIDIKI VERSKEGA DOŽIVLJANJA

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

Duhovno doživljanje in doživljanje transcendentnega je univerzalni pojav. V znanstveni psihologiji je versko doživljanje vzbudilo zanimanje že v samih začetkih, vendar ni veliko napredovalo. Šele v novejšem času so se pojavile resnejše empirično raziskovanje verskega doživljanja v psihologiji, svoj odmev pa je dobilo celo v nevroznanosti in evolucijski teorij. V psihologiji sta versko in duhovno doživljanje predvsem predmet humanistične, eksistencialne, transpersonalne in v najnovejšem času tudi ti. pozitivne psihologije. S tem razvojem sovpada tudi konstrukt duhovne inteligentnosti. Versko in duhovno doživljanje je tudi v našem času možno povezati z značilnostmi psihičnega blagostanja.

1 UVOD

Človek se po vsej verjetnosti ukvarja s transcendentnim in duhovnim, odkar obstaja. Iz arheoloških ostankov se da celo sklepati, da to najbrž ne velja samo za naš ožji rod (homo sapiens sapiens), temveč tudi za naše izumrle bratrance Neandertalce (homo sapiens neanderthalensis). Brez človekove zmožnosti, da na nek način dojema in doživlja transcendentno, si vsekakor ne moremo predstavljati religioznosti, ki je univerzalni pojav. Prav religiozno občutje in mišljenje je bilo zato razumljivo že od začetkov tudi predmet znanstvene psihologije. Izjemno delo s tega področja je napisal že eden očetov psihologije, William James (1982, izvirnik 1902). Mnogi poznavalci menijo, da je to Jamesovo delo tudi doslej najboljša psihologija religije. Vendar se je psihologija šele v najnovejšem času začela resneje ukvarjati z vprašanjem, ali obstaja posebna sposobnost oziroma skupina sposobnosti za duhovno doživljanje in razumevanje.

2 RAZISKOVANJE VERSKEGA IN DUHOVNEGA DOŽIVLJANJA V PSIHOLOGIJI

Religiozno in duhovno doživljanje je značilno za človeka in je izjemo pomembno v vseh obdobjih in kulturah. Mnogi, tudi nekateri najprominentnejši psihologi, npr. Adler (Adler in Jahn, 1933), Erikson (1958), Freud (1928a, 1928b, 1939), Fromm (1950) so se ukvarjali s psihološkimi vidiki religije in religioznosti, a razen častnih izjem (kot npr. Bucke, 1923, in že omenjeni James, 1982/1902) je psihologija do nedavnega presenetljivo malo raziskovala samo naravo duhovnega in religioznega dojemanja sveta. Ključni postavki duhovnosti sta smisel in transcendenca, ki se seveda krepko izmikata operativnemu definiranju, s tem pa tudi znanstvenemu raziskovanju (Coles, 1999). Tej tematiki 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).

Dodatno so raziskovanje duhovnosti spodbudila nevropsihološka odkritja, da se določeni možganski predeli bolj kot drugi odzivajo 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, kot že rečeno, vključil v svoj razširjeni, »preokvirjeni« model multiple inteligentnosti, potem ko je že našel svoje mesto v modelu Buzana in Keena (1997). Zohar in Marshall (2000) sta nato postala zaslužna za pravcato popularizacijo tega pojma. 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/Spirituality, Idler in sod., 1999).

3 NEVROZNANSTVENI VIDIKI VERSKEGA IN DUHOVNEGA IZKUSTVA

Čeprav najdemo pri sodobnih protagonistih duhovne inteligentnosti (Zohar in Marhall, 2000) veliko referenc na nevrološko delovanje, gre večkrat za ohlapne in spekulativne hipoteze, ki nimajo prepričljive veljavnosti. Vzemimo npr. tezo, da je umska inteligentnost povezana z zaporednim, emocionalna s povezovalnim in duhovna s spajajočim procesiranjem informacij. Podobno moramo za sedaj reči tudi za številne raziskave, ki povezujejo zavestno delovanje z magnetoencefalografsko analiziraimi oscilacijami vzburjenih nevronov v razponu 35-45 Hz. Čeprav se zdi smiselna povezava med omenjenimi oscilacijami in zavestnim doživljanjem (npr. predmetov, na katere smo pozorni) in bi lahko imele te ugotovitve znaten pomen za nevroznanstveno pojasnjevanje zavesti, pa nam golo ugotavljanje da so te oscilacije osnova duhovnosti pravzaprav skoraj nič ne pove. Od zavestnega delovanja, ki je samo zase največja uganka nevroznanosti, kar jih obstaja, do duhovnosti in duhovne inteligentnosti je še dolga in neraziskana pot.

Podobno velja za spekulacije o vlogi desne hemisfere pri verskem in duhovnem doživljanju. Relativno stopnjevano delovanje desne hemisfere najdemo pri vrsti aktivnosti ali doživljanja, npr. pri glasbi, prostorski imaginaciji, plesu, tudi z intuicijo, nezavednimi procesi in emocionalnostjo jo do neke mere upravičeno povezujemo (simptomatično pri tem je, da je leva hemisfera po vsej verjetnosti tista resnično „zavedajoča se“ hemisfera). Duhovno delovanje je z nevroznanstvenega vidika verjetno v kompleksnih odnosih z zavestjo in zavestnostjo in enačenje duhovnosti s hemisfernostjo je groba, zavajajoča in informacijsko revna poenostavitev.

Že dolgo je znano, da se pri epilepsiji (npr. pri doživljanju avre pred velikim napadom) pojavljajo doživatja in izkustva, ki spominjajo na mistična in njim podobna doživetja z versko in duhovno vsebino. Po drugi strani je že dolgo znano, da se z epilepsijo pogosto povezuje možganska aktivnost z žarišči v temporalnem režnju. Nekatere novejše raziskave na tem področju so pokazale, da lahko z elektromagnetno stimulacijo določenih temporalnih predelov izzovemo doživljanje, podobno duhovnim in verskim mističnim doživetjem. Eden od teh raziskovalcev, kanadski nevropsiholog Persinger (1987), je takšno doživetje opisal kot neposredno izkušnjo Boga in s tem spodbudil novi val razmišljanj o „božjem predelu v možganih“ (Ramachandran in Blakeslee, 1998). D’Aquili in Newberg (1998) se prav tako sklicujeta na nevrološke podatke, ko razlagata, zakaj se Bog kljub vsej rigorozni racionalnosti, kljub vsej detranscendentalizaciji in sekularizaciji sveta noče kar tako posloviti od nas. Pozneje je Newberg (2004) potrdil ugotovitve, da se med verskim ali duhovnim meditiranjem in molitvijo po pravilu aktivirajo določeni možganski predeli, poleg tistih v temporalnem režnju tudi nekateri deli frontalnega in parietalnega režnja. Prav nič ni torej izključeno, da se le približujemo neki začetni podobi nevroznanstvenih vidikov duhovnega, verskega oziroma transcendentnega doživljanja. Vsekakor pa na rojstvo nevroteologije gleda marsikdo z mešanimi občutki in to iz obeh strani, nevzroznanstvene in teološke.

4 POSKUSI EVOLUCIJSKIH RAZLAGA VERSKEGA IN DUHOVNEGA IZKUSTVA

Einstein, sam nedvomno duhovna in verna osebnost, je nekoč dejal, da izvira religija iz izkustva skrivnosti, pa čeprav povezanega s strahom. Nekateri evolucionisti danes poudarjajo, da je nevropsihični razvoj homo sapiensa že zgodaj postavil pred takšne skrivnosti. Eno najglobljih mu je porajalo soočanje zavesti o samem sebi z zavestjo o smrti in smrtnosti. Po mnenju Conrada Montella (2002) so se religijske predstave razvile kot poskus odgovora na to skrivnost; Montell med drugim meni, da bi lahko religija tako odrešila človeka hudih emocionalnih in eksistenčnih napetosti in bojazni, ki bi ovirale njegovo evolucijsko uspešnost. Religija in versko obnašanje naj bi tako – ne glede na to, ali je stvarnost, o kateri govori resnična ali ne - prispevala k uspehu naravne selekcije človeka.

Že prej je ameriški psiholog Jaynes (1976) razburil znanstveno javnost s tezo, da je človek šele pred razmeroma kratkim časom (kakih 3500 let nazaj) doživel pomembno transformacijo iz mentalne “dvodomnosti” (bicameral mind) v enotno zavestnost. V času dvodomnosti je s pomočjo relativno samostojnega delovanja desne hemisfere lahko neposredno komuniciral z duhovnim svetom, npr. z bogovi, tako da je sllišal njihove ukaze. Okrog leta 1500 pred našim štetjem imamo obilo pričevanj iz tedanjih civilizacij, ko se ljudje pritožujejo, da novi svet nima več stika z bogovi, da jih ne vidi več, ne sliši in s tem izgublja svojo glavno oporo. Ostali so le še ostanki dvodomnosti, s katerimi večinsko zavestno poenoteno človeštvo na kratko opravi kot z eksotičnimi izjemami, ki jih klasificira kot mistike, shizofrenike ali kako drugače.

5 VERNOST IN DUHOVNOST V ODNOSU DO PSIHIČNEGA BLAGOSTANJA IN ZDRAVJA

Čeprav so vernost in duhovnost že zelo zgodaj povezovali s predstavami o psihičnem blagostanju in zdravju (kakršne so pač bile, odvisno od kulturnega in obdobnega konteksta), so bila mnenja in pojmovanja o tem odnosu zelo različna. Raztezajo se od nedvoumnega prepričanja, da sta vernost in duhovnost nujni sestavini psihične stabilnosti, prilagojenosti in zdravja, do nasprotnih prepričanj, da sta vernost in

duhovnost povezana s psihično labilnostjo, če ne kar s psihičnimi motnjami.

Sodobne raziskave psihičnega blagostanja vendarle prepričljivo kažejo na nizko, vendar statistično signifikantno pozitivno korelacijo med vernostjo in merami psihičnega blagostanja kot so zadovoljstvo z življenjem, sreča, optimizem, pozitivni afekt in občutje smiselnosti (Ellison, 1991; Myers, 1992; Myers in Diener, 1995; Pollner, 1989). Bolj kot nasprotno bo torej držalo, da je psihičnih težav, problemov in motenj pri osebah z globljim verskim in duhovnim prepričanjem manj; vendar je povezanost tako nizka, da nas ne sme presenetiti, da se pri precejšnjem številu ljudi lahko vernost povezuje tudi s psihično labilnostjo in drugim znaki nižjega psihičnega blagostanja in zdravja.

6 ZAKLJUČEK

Raziskovanje verskega in duhovnega doživljanja je vsaj v psihologiji očitno preseglo začetno, še povsem spekulativno in teoretsko fazo in prešlo v fazo empiričnega raziskovanja. Pokazalo se je, da se dajo pomembni vidiki tega doživljanja operacionalizirati in postaviti v psihometrične okvirje (tako npr. koncept duhovne inteligentnosti). To je omogočilo razmah psiholoških, nevropsiholoških in celo evolucijsko psiholoških raziskovanja na eni strani, na drugi strani pa integracijo raziskovanja duhovnosti in vernosti v tok pozitivne psihologije, ene trenutno najbolj propulzivnih psiholoških usmeritev. Zavedati pa se moramo, da gre za raziskovanje ene izmed najpomembnejših in tudi najkompleksnejših tematik človeštva in brez tveganja lahko ocenimo, da se dolgoročno vzeto nahajamo šele na dobrih začetkih znanstvenega raziskovanja te tematike.

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Religijskost v antropološki strukturi in njenem oblikovanju

Dr. Drago K. Ocvirk

Univerza v Ljubljani
Teološka fakulteta
Poljanska 4, 1000 Ljubljana, Slovenija
Tel: +386 1 434 58 46; fax: +386 1 434 58 54
drago.ocvirk@guest.arnes.si

ABSTRACT:
Povzetek Religijskost v antropološki strukturi in njenem oblikovanju

Razprava predstavi v osrednjem delu vlogo in mesto religijskosti v antropološki strukturi in njenem oblikovanju. Pri tem predstavi antropologa R. Girarda in filozofa D.-R. Dufoura ter ju kritično sooči. Oba se v svojih raziskavah religijskega pojava opirata na antropološko danost neotenije, človekove nedokončanosti, zaradi katere je izumil/izmislil simbolni red ali drugo naravo (kulturo), da more preživeti v prvi (naturi). Za oba avtorja ima religijskost bistveno vlogo pri ustvarjanju simbolnega reda in njegovega ohranjanja. Ta osrednji del je vpet med prvi del, kjer je nakazano, zakaj je prišlo do nasprotij med znanostjo in religijo, in zadnji del, kjer je nakazano, da prehajamo v novo obdobje vključevalnih in kooperativnih odnosov med znanostjo in religijo,

> »Včasih se ljudje sprašujejo, če si vera in znanost ne nasprotujeta. Si, tako kot so nasprotni palec in drugi prsti na moji roki. To je takšno nasprotje, ki omogoča, da lahko zgrabimo kar koli.«
> William Henry Bragg, Nobelov nagrajenec za fiziko (1915).[1]

1. Znanost: otok v oceanu

Ko pogledamo v ozadje tako razvidnih kategorij, kot so znanost, religija in njuni odnosi, kaj hitro ugotovimo, da se je potrebno za kakršno koli razumevanje sploh dogovoriti, kaj imamo v mislih. To soglasje v razumevanju vsebin kategorij znanosti in religije je pogojeno civilizacijsko tako v času, zgodovinsko, kot v prostoru, družbeno.
Naj spomnim, da so splošni pogledi na znanost in religijo v Evropi še vedno močno obremenjeni z zgodovino emancipacije posameznih družbenih področij izpod vseobsegajočega krščanskega vpliva. V te politične in ideološke boje je bila hočeš nočeš potegnjena tudi znanost, s katero so v 19. stoletju hoteli nadomesti religijo.[2] Znanost kot religija, scientizem, podaja smisel vsega, predpisuje moralna pravila in se razglaša za edino odrešiteljico. E. Renan je v *L'Avenir de la Scince* (1849) jasen: »Moderen projekt ne bo dokončan, dokler ne bo verovanje v nadnaravno, v kakršni koli obliki že, uničeno … Po tistem, ko bo razum organiziral človeštvo, bo organiziral še Boga … Ne pretiravamo torej, ko pravimo, da znanost vsebuje prihodnost človeštva, le ona mu more nakazati njegovo usodo in ga poučiti, kako naj doseže svoj cilj.«[3]
V svojem scientističnem verovanju je Renan med drugim pozabil, da se sodobna znanost ne pojavi neodvisno od religijsko-civilizacijskega okolja, ampak da mora prav to okolje ustvariti pogoje za njen začetek in razvoj. Zato niso dovolj ustrezne strukture, kakor jih je v 15. stoletju imela npr. Kitajska, marveč tudi življenjski polet: tega pa je imela tedaj krščanska Evropa. Ta resničen *élan vital* jo je popeljal najprej v osvajanje sveta zemljepisno, nato še znanstveno. Verjela je, da je Stvarnik svet uredil racionalno in inteligentno tako, da ga je mogoče razumeti, razbrati in obvladati. Medtem ko za kitajska verstva ni končne resnice, krščanski Evropejci verjamejo, da je, le poiskati jo je treba; Kitajci so imeli svojo družbo za popolno, zato jo je treba le ohranjevati, za kristjane je njihova nepopolna, a se jo da izboljšati.[4] »Galilej (…) kakor njegova sodobnika Kopernik ali Newton so jasno povedali, da hočejo s svojimi znanstvenimi deli proslaviti Boga in s tem tudi krščansko vero.«[5]
Eksperimentalna znanost se je pojavila samo enkrat v zgodovini človeštva in to v eni sami civilizaciji. Če ji ne pripisujemo spontanega nastanka, potem pač moramo priznati, da je povezana z (religijskim) okoljem, v katerem se pojavi. Ta razmerja so zapletena, nikakor pa ne izključujoča, kot so verjeli scientisti. Še več, kar pravi W. Heisenberg ne velja le za atomiste, marveč za sleherno znanstveno teorijo: »Zagovorniki atomizma so morali uvideti, da je njihova znanost le člen v neskončni verigi pogovorov med človekom in naravo in da človek ne more več govoriti preprosto o naravi 'sami na sebi'. Znanosti o naravi vedno predpostavljajo

[1] Navajata D. Wilinson, R. Frost**,** *Thinking clearly about God and Science*, Crowborough, Monarch, 1996, 204.

[2] Prim. D. Alexander, *Rebuilding the Matrix. Science and Faith in the 21st Century*, Zondervan, Grand Rapids, 2001. Glej 6. poglavje.

[3] Navaja J.-P. Lonchamp, *Science et Croyance*, DDB, Pariz, 1992, 147-148.

[4] Prim. X. Le Pichon, *Science et christianisme*, v: R. Rémond, dir., *Les grandes inventions du christianisme*, Bayard, Pariz, 1999, 133-148.

[5] P. Valadier, *Un philosophe peut-il croire?*, Ed. C. Defaut, Nantes, 2005, 10.

človeka in, kakor je rekel Bohr, priti nam mora v zavest, da nismo gledalci na odru življenja, ampak igralci.«[6]

To spoznanje postavlja pod vprašanj naivno in strogo ločevanje med objektom in subjektom, ko v racionalistični maniri postavljamo znanost na stran objektivnega, religijo pa subjektivnega, kakor da ne bi bil odnos objekt - subjekt vpet v neskončno mrežo odnosov, ki ji pravimo simbolni red ali kultura. Čeprav se zdi, da je znanost povsem izpodrinila prav ta simbolni red in ga bo po prepričanju nekaterih celo presegla in ukinila, pa zagovarja J. Lacan v delu *Le triomphe de la religion* nasprotno tezo. Po njegovem bo prav silen razmah znanosti povzročil zmagoslavje religije, posebej prave, kot imenuje katoličtvo. Znanost namreč širi področje stvarnosti in »zaradi tega bo imela religija veliko več razlogov, da pomiri srca. (…) Potrebno bo vsem pretresom, ki jih povzroča znanost, dati neki smisel. In na smisel se predstavniki religije razumejo. Resnično so ga sposobni dati čemur koli, na primer človekovemu življenju. Za to so izurjeni. Vse to, kar je religija, je od začetka v dajanju smisla stvarem, ki so bile prej naravne. Ljudje ne bodo prenehali ustvarjati smisla zato, ker bodo stvari postale po zaslugi stvarnega manj naravne. Religija bo dala smisel najbolj nenavadnim preizkušnjam, tistim, ki se jih znanstveniki sami komajda začenjajo nekoliko bati. Za to bo religija našla slikovite smisle. Kar poglejte, kaj se dogaja sedaj, kako se predstavnike religije posodabljajo.«[7] L. Wittgenstein, genialen matematik, inženir in filozof, je opustil verovanje v edino veljavnost znanstvene vednosti in se preusmeril v tisto, kar jo obdaja: »Področje znanstvene vednosti je podobno otoku, ki ga obdaja ogromen ocean. Ocean je iz tega, kar znanost ne more spoznati, toda resnično me zanima le ocean.«[8]

2. Neotenija - topla greda religijskosti

Če sta znanost in religija dve od številnih oblik človekovega delovanja in pridobivanja vednosti, pa se naše spraševanje o razmerju med znanostjo in religijo ne more zaustaviti pri tem, ampak mora iti dalje, kolikor je le mogoče k izvorom kulture in njene vpetosti v naturo, naravo. Tu se bolj kakor koli drugod pokaže prvenstvo religije, kajti ta je pravzaprav omogočila prehod od človečnjakov k človeku, od živali torej k *homo sapiens* in je odločilnega pomena za izoblikovanje in ohranjanje antropološke strukture. Med vse bolj številnimi antropologi, ki razmišljajo v to smer, sodita René Girard in Dany-Robert Dufour.

2.1. Teorija posnemovalne želje in grešnega kozla

»Človeška kultura in samo človeštvo sta otroka religijskosti,«[9] pravi Girard v svojem delu *Izvori kulture*. Ta antropolog je razvil hipotezi - o posnemovalni želji in o grešnem kozlu - ki ju je povezal v enotno teorijo razvoja kulture in človeštva iz naravnih živalskih danosti.

Posnemanje je razširjeno v živalskem svetu, bilo pa je tudi med predniki *homo sapiensa*. Zaradi posnemanja drugega si posnemovalec zaželi isto stvar, kot jo želi vzornik. Posnemanje povzroča dvojno reakcijo: vzornik prebudi željo po nečem/nekom, hkrati pa je ovira, da bi želeno dosegli, ker ga hoče zase. Med vzornikom in posnemovalcem se lahko razvije ali sodelovanje ali tekmovanje. Logika posnemanja ne strukturira le odnosov med posamezniki, ampak tudi skupinske odnose, in pripelje v različne oblike nasilje, ko se boj za zaželeno stvar spremeni v boj proti tekmecu. Izvor nasilja je v tem posnemovalem prisvajanju stvari.

Kako zajeziti in omejiti to posnemovalno nasilje, ki ogroža obstoj posameznikov in vrste?

Mehanizem, ki nasilje kanalizira in odvrača od skupnosti, je pri izvoru pojava in razvoja kulture. Poznan je pod imenom grešni kozel, moremo pa ga ponazoriti še z drugimi prispodobami: dežurni krivec, trn v peti, črna ovca, garjava ovca, bela vrana … Vse te prispodobe označujejo človeka, ki se razlikuje od drugih in mu skupnost, ki ji grozi razdejanje zaradi posnemovalnega nasilja, pripiše krivdo za kaos in ogroženost. Vso mimetično sovraštvo se prenese na grešnega kozla, ki je v očeh vseh kriv za nasilje v skupnosti. Ta ga zato odstrani iz svoje srede, ga umori, in v njo se povrne red. To je dokaz, da je žrtev imela res silno škodljivo moč, ki pa se je z njenim umorom spremenila v izjemno blagodejno moč. »Grešni kozel postane božanstvo v arhaičnem pomenu, se pravi je hkrati vsemogočno za storiti in dobro in hudo. (…) Predpostavljati moremo, da nekatere arhaične skupine niso preživele zato, ker njihova posnemovalna rivalstva niso nikoli določila takšne žrtve, proti kateri bi bili vsi, in bi jih zato obvarovala pred samouničenjem. Drugim morda ni nikoli uspelo tega pojava spremeniti v obredje in tako ustvariti trajen religijski sistem. (…) Kultura izvira iz mehanizmu grešnega kozla in prve resnično človeške ustanove so iz njegovega namernega, načrtnega ponavljanja.«[10]

Pot človeštva iz biologije v kulturo se tako začne z smrtonosnim posnemovalnim nasiljem, ki se ga začasno zaustavi z mehanizmom grešnega kozla. Če se iz tega mehanizma razvije ponavljajoče se obredje in z njim religija, smo prestopili iz biologije v kulturo. »Obredje se tako spremeni v ustanovo, ki pomiri sleherno obliko krize: npr. krizo odraščanja z obredi prehoda, krizo smrti s pogrebnimi obredi, na krizo bolezni odgovarja obredna medicina.«[11] Vse to se dogaja med predhodniki homo sapiensa in dolgo pred pojavom jezika, kajti upoštevati je treba neotenijo, pomembno biološko danost, ki se kaže že pri človekovih predhodnikih. Neotenija[12] je, kot je znano, podaljšana mladost, nezrelost mladiča, ki se med drugim kaže v njegovi odvisnosti od drugih in v dolgem dvostopnem spolnem razvoju. Pri človeku kot najbolj izrazitem neotenu pa so s

[6] W. Heisenberg, *La nature dans la physique contemporaine*, Gallimard, Pariz, 1962, 19.

[7] J. Lacan, *Le triomphe de la religion précédé de Discours aux catholiques*, Seuil, Pariz, 2005, 79-80.

[8] Navaja J.-P. Lonchamp, n. d., 227.

[9] R. Girard, *Les origines de la culture*, DDB, Pariz, 2004, 172.

[10] R. Girard, n. d., 78-79.

[11] R. Girard, n. d., 83.

[12] Pojem neotenija je skovanka iz grščine: *neo* = nov in *ten* (od *teinein*) = raztegniti, podaljšati.

podaljšano nezrelostjo povezane še z druge značilnosti.[13] Vse te so »hkrati fizične in kulturne,« pravi Girard, »in znanstveniki se še vedno sprašujejo, kako se je vse to zgodilo. Mislim, da omogoča to na predjezikovni ravni sistem okrivljene žrtve. Na določeni stopnji evolucije, ki je spremenila primate v ljudi, je neka vrsta religijskih prepovedi ali nepopisnega bivanjskega strahu pred ogromno in nevidno močjo povzročila prepovedi proti nasilju. Te vrste prepovedi so ščitile samico in njeno potomstvo in tako omogočile preživetje otrok, ki sami tega niso zmogli in ki bi jih samci sicer požrli. Pogosto pravijo, da je človek žival, ki 'se je sama udomačila'. Toda ni se udomačil sam: *zanj je to storilo žrtvovanje*. Religija je struktura brez subjekta, ker je subjekt načelo posnemanja. Prepričan sem, da si lahko o tem izdelamo realistično predstavo, ki razloži veliko tega, česar se brez nje ne bi dalo razložiti.«[14]

2.2. Potreba po velikem Subjektu

Drugi avtor, Dany-Robert Dufour, filozof, opre svojo raziskavo »o nekaterih sedanjih in prihodnjih posledicah smrti Boga« prav na neotenijo. Delo z dvoumnim naslovom: *On achève bien les hommes*[15] nakazuje dvojno možnost, ki je danes pred človeštvom: ali se človeka izpopolnjuje tako, kakor se ga je doslej, ali pa se ga s pomočjo tehnoznanosti pokonča in zamenja z nečem novim. Avtor se predstavi kot prepričan ateist, vendar je enako trdno prepričan, »da ni mogoče odpraviti vprašanja Boga brez velike škode«.[16]

Če so misleci, ki so dokazovali božji obstoj, umestili Boga v svet ali ga z njim enačili (Spinoza), ga postavili na začetek sveta (Aristotel, Akvinec) ali njegov konec (Hegel), ga Dufour odkriva v glavi ljudi. Vendar - pozor! - ne gre za relativizem: tega avtor odločno zavrača, kajti nikakor ne misli, da si sleherni ustvari svojo podobo Boga ali celo Boga po lastni podobi. »Upam, da bom pokazal,« pravi, »da je obstoj Boga v glavi ljudi strukturno nujen. Ker izhaja človeštvo iz ene same skupnosti, velja ta identična struktura za slehernega človeka. Kljub temu pa se izraža v izjemno različnih oblikah, ki so zelo odvisne od časov in krajev, v katere so ti ali oni ljudje vrženi. Povedano na kratko, te oblike gredo od Totema do Proletariata prek grške *Physis* in Boga enoboštev.«[17]

Dufour se ujema z Girardom, ko na podlagi človekove neotenije pokaže, kako je verovanje v kakšno božanstvo objektivna danost, ker izvira iz evolucije človeške vrste. Človekova prva - biološka - narava, mu še ne omogoča človeškega življenja, ki ga doseže samo s stalnim rojevanjem (uvajanjem, vzgojo) v drugo naravo - kulturo. »Neoten ne more živeti v svetu drugače, kakor da ga denaturalizira. Ker ga svet ne sprejema, ga mora spremeniti. Razumemo, čemu hoče ta nedokončana žival postati 'gospodar in posestnik narave' (Descartes): nima druge rešitve, kakor da spremeni naravo, da bi jo mogel v njej prebivati.«[18] Možna nevarnost tega pa je, da spremeni svet v Disneyland, oziroma v miniaturo, kot pravi Nietzsche.[19] Neoten, ki mora zaradi svojega obstanka napolniti zemljo in si jo podvreči, »ribam v morju in pticam na nebu ter vsem živalim, ki se gibljejo po zemlji,« pa gospodovati (prim. 1Mz 1,28), je zaradi neotenije čredno bitje. Brez drugih, zunaj črede, ne bi mogel preživeti biološko in se roditi v drugo naravo, kulturo. Medtem ko se morajo v živalski čredi vsi posamezniki podvreči najmočnejšemu vrstniku, pa »so vsi posamezniki v vrsti *homo sapiens sapiens* postali enako nesposobni za gospodovanje zaradi neotenije, ki določa njihovo vrsto. Ni ga, ki bi razkazoval kaj podobnega jelenjemu rogovju ali levji grivi ali puranjemu podbradku in golši! Gotovo, veliko jih je, ki se šopirijo s pavjim perjem, toda niti enega samega ni, ki bi imel njegovo opravo. Niti enega samega, da bi rešil druge!«[20]

Kdo naj gospoduje skupini človeških neotenov in jo drži skupaj, da morejo posamezniki živeti, če so vsi neoteni za to enako nedokončani? »Človek se podreja bitjem, ki pripadajo izmišljeni vrsti. V bistvu ustvarja Boga beseda - in umetnost v vseh svojih oblikah - in s tem daje nadomestek za tisto, kar neotenu manjka: gospodovalni samec.«[21] Tu se Dufour razlikuje od Girarda in je v primerjavi z njim prekratek, ker začenja z besedo, medtem ko Girardova teorija razloži tudi nastanek jezika. Neoten je za Dufoura »nedokončano telo, ki ni cepljeno na nič, na nič drugega kakor izmišljije. Izmišljije izumlja, da bi mogel živeti.«[22] Človeka, to žival na poti pogube, sta udomačila in počlovečila, odrešila torej, iznajdba Boga in nevednost, da gre za iznajdbo. Bog je z iskrivo francosko skovanko predstavljen kot *grand d'hommesticateur*, počlovečevalec-udomačevalec. »Skratka, če je človekov dom hkrati kraj udomačevanja, je to zato, ker deluje kot svetišče, v katerem človek časti *grand d'hommesticateura*, ki si ga je moral dati kot nadomestek za gospodarja, ki je izginil zaradi neotenizacije. Dejansko ni doma brez dajanja, brez prve daritve temu *grand d'hommesticateuru* … Ta je v ozadju vseh tehničnih, obrednih in drugih organizacij, ki si jih človek postavlja.«[23]

Toda ko človek enkrat »ve«, da ni več ne »Boga« ne njegovih avatarjev kot npr. Kralj, Ljudstvo, Proletariat … ker jih je umoril, in da je odslej sam s seboj v svetu množične demokracije, ne ve, ne kaj bi s samim seboj, ne kod ne kam. Vse bolj sanja, da bo s tehnoznanostmi (genetske biotehnologije, umetno oplojevanje, umetna inteligenca, informatika ipd.) končno le presegel svojo konstitutivno neotenijo. S tem bi bilo konec človeštva, meni Dufour in to bi bila najbolj katastrofalna posledica umora »Boga« in njegovih avatarjev. »Kaj bi nastalo iz protetične dejavnosti,

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[13] Prim. D.-R. Dufour, *On achève bien les hommes. De quelques conséquences actuelles et futures de la mort de Dieu*, Denoel, Pariz, 2005, 40-41.

[14] R. Girard, n. d., 180-181. Prim. M. Bertocl, *Abrahamovo darovanje Izaka v 1Mz 22,1-19 in v judovskem izročilu v luči Girardove teorije*, v: *Bogoslovni vestnik*, let. 65 (2005), št. 4.

[15] Glej opombo št. 13. Naslov *On achève bien les hommes* lahko prevedemo bodisi *Ljudi res dokončujemo*, bodisi *Ljudi res pokončujemo*.

[16] D.-R. Dufour, n. d., 9.

[17] D.-R. Dufour, n. d., 15.

[18] D.-R. Dufour, n. d., 77.

[19] F. Nietzsche, *Tako je govoril Zaratustra*, § 5.

[20] D.-R. Dufour, n. d., 79.

[21] D.-R. Dufour, n. d., 89.

[22] D.-R. Dufour, n. d., 90.

[23] D.-R. Dufour, n. d., 98-99.

ko bi se tako spremenila, da bi začela tudi iz človeka delati super-protezo? Skušnjava po uživanju je toliko večja, ker bi ta največja nesreča dokončno odpravila vse druge oblike nesreče in nezadovoljstva neotenskega človeštva, ker bi se končala v nekem drugem človeštvu. V postčloveštvu! (…) Nekateri bi radi verjeli, da uničenje simbolnega balona nima drugih posledic kakor odprtje oči, boleče sicer, a odrešilno za človeka, ki tako hipoma preide iz podložnosti v samostojnost. Vendar glede na to, da je neotenova samostojnost v odnosu do velikega Subjekta vse do danes nerešeno vprašanje, je njegova zdajšnja osvoboditev od simbolnosti verjetno le prvi korak pri dejanski prekoračitvi simbolnosti. Z drugimi besedami, prestop simbolnih pregraj se lahko konča le s preoblikovanjem človeštva, ki ga stori samo. (…) Po takšnem koraku vrnitve nazaj, kar zadeva zgradbo simbolnega sveta, ne bi bilo: dati življenje sam, izogniti se sinovstvu in zaporedju generacij, skrčiti drugačnost na istost …«[24] Govoreče se dviga nad živeče, druga narava more sedaj temeljito spremeniti prvo. »Z umanjkanjem Drugega se pokaže, da se stara stvarnost, stvarnost prve narave, izgublja z vidika. Zato se lahko obenem vprašamo, kaj neki more biti iz simbolnega sistema, ki ni več zasidran v tej stvarnosti? Subjekt, ki je prisiljen v samoutemeljitev, izgubi določeno umestitev v odnosu do teh zvezd, ki so se rade vračale na vedno isto mesto, da so mu dajale nekaj stvarnih opor v svetu, v katerem se vse giblje: dan/noč, očetje/sinovi, moški/ženske, živali/ljudje, življenje/smrt … Na kratko, zdaj vidimo, kako se razvezuje trojka Lacanovih kategorij stvarnega, imaginarnega in simbolnega. Resnično je videti, kot je pokazal Lacan s svojim boromejskim vozlom, da ni mogoče onesposobiti eno od teh kategorij, ne da bi izgubili vse tri hkrati. Če razvežemo eno, smo razvezali vse.«[25]

Med neoteni v simbolnem svetu sta bila vedno tudi nasilje in krutost, ki so ju včasih z »Bogom« preprečevali, včasih pa podžigali. Zato se zastavlja vprašanje: ali bi izhod iz neotenije odpravil nasilje in vzpostavil mir? Dufour misli prav nasprotno in opozarja, da je človeštvo pred izbiro: »Ali ostanemo v navadni krutosti nedokončanih teles, ki niso cepljena na nič, na nič drugega kot izmišljije - in v tem primeru si moramo nemudoma dati, če že ne nove bogove, pa vsaj nova verovanja. Ali pa stopamo v neznano nasilje, ki je v hotenju, da dejansko spremenimo to telo, ki je staro sto tisoč let«.[26] Čeprav ateist, se Dufour odloči za religijo, ker zunaj nje ni človeštva. Ta religija ni nova in še ena več poleg že obstoječih, ampak je vzpostavitev tretjega, ki je potreben, da med nami (s)teče pogovor, dialog.

2.3. Skrb za žrtve

Na tej točki je koristno primerjati Dufoura in Girarda. Ta postavi, za razliko od Dufoura, religijskost pred jezik in jo ima za izvir kulture z jezikom vred. Obenem pa Girard s svojo teorija posnemovalne želje pokaže na izvir nasilja, s teorijo grešnega kozla pa, kako družba nasilje regulira oziroma odganja iz svoje srede. Oba mehanizma, posnemovalne želje in grešnega kozla, delujeta dokler zanju ne vemo. Po Girardu je delovanje teh mehanizmov razkrilo judovsko-krščansko izročilo.

V zadnji zapovedi Dekaloga je prepovedano poželeti dobrine bližnjega in če bi to uspelo, človek ne bi moril, prešuštvoval, kradel in pričal po krivem, kar prepovedujejo zapovedi, ki so pred zadnjo.[27] Evangeliji pa dajejo Boga za vzornika, v posnemanje ljudem, kajti Bog ljubi človeka in človeštvo. To je pokazal Jezus iz Nazareta, ki je sprejel nase vlogo grešnega kozla. Če evangeliji sledijo do tod delovanju mehanizma grešnega kozla, pa na tej točki prekinejo z njim. Zavrnejo namreč uveljavljeno prepričanje, da je žrtev krivec, ki je res povzročil nasilje v družbi, saj se je to z njegovim umorom ustavilo. Zaradi tega so miti tega »povzročitelja« zla, kasneje predstavljali kot dobrotnika, božanstvo: dvoumnost grešnega kozla (vzrok nasilja/pomiritve) je stalnica mitov. Evangeliji pa nasprotno razkrijejo, da je Jezus nedolžen in da je Bog na strani nedolžne žrtve, ne pa skupnosti, ki se je ob njegovem križanju spravila med seboj.

Judovsko-krščansko izročilo je razkrilo izvor nasilja in nedolžnost žrtve, žrtvovane zaradi »ljubega« miru. Prav to antropološko razodetje v pripovedih o Jezusovem trpljenju je bistveno vplivalo na spremembo miselnosti in odnosa do nedolžne žrtve. Skrb zanjo je postala skupni imenovalec sodobnega sveta: »Resnična gibalna sila je konec žrtvovanjskih zapiranj, to je sila, ki zatem, ko je uničila arhaične družbe, sedaj razgrajuje njihove naslednike, nacije, ki se imenujejo moderne.«[28] Zanimivo je, da je ta skrb pripeljala do absurdnih situacij, ko prihaja do posnemanj in tekmovanj, kdo bo več storil za žrtve ali odkril nove. »So žrtve na splošno, a najbolj zanimive so tiste, zaradi katerih moremo obsoditi svoje sosede. In ti nam vračajo z enako mero. Mislijo predvsem na žrtve, za katere nas imajo za odgovorne. (…) V našem svetu si nazadnje vsi očitajo žrtve in končni rezultat je to, kar je Kristus napovedal v misli, ki jo sodobna skrb za žrtve osvetli prvič: 'Od tega rodu se bo terjala kri vseh prerokov, ki je bila prelita od stvarjenja sveta: od Abelove krvi …' (Lk 11,50-51). (…) Odslej imamo svoje žrtvene protižrtvovanjske obrede, ki se odvijajo v enakem nespremenljivem redu kot pravi religijski obredi.«[29]

3. Veje vednosti

Doba, ko je znanost dajala videz naprednosti in je bila vpeta v oblastne in ideološke boje z družbenimi in političnimi silami, ki jih je menda podpirala religija, je za nami. Šest milijard ljudi, če hoče živeti in preživeti, si ne more več privoščiti, da bi imelo ali religijo ali znanost za grešnega kozla in izključevalo iz družbe ali misli. Dežurni krivec - ali religija ali znanost - more odpreti nova obzorja in ustvarjati pogoje za bolj kakovostno sožitje, če mu ponudimo gostoljubje in smo mu pripravljeni prisluhniti. Takšen odnos do religije kažeta med drugim znanstvenika R. Girard in D.-R. Dufour, številni verski misleci gojijo podoben odnos do znanosti.

[24] D.-R. Dufour, n. d., 330-331.
[25] D.-R. Dufour, n. d., 333.
[26] D.-R. Dufour, n. d., 344.
[27] Prim. R. Girard, *Je vois Satan tomber comme l'éclaire*, Grasset, Pariz, 27-30.
[28] Prim. R. Girard, n. d., 257.
[29] R. Girard, n. d., 253-254.

M. Serres, filozof in zgodovinar znanosti, pokaže v delu *Veje*, kako se v zgodovini misli stekajo znanosti, kulture, umetnosti in religije. Zase priznava, da ni nikoli ničesar razumel v Apostolskih delih in Evangelijih, ker so v šoli njega in druge posvetili grškemu maliku in vzgajali v grški misli. Sveto pismo je zato razumel le z grškimi izrazi. Zdaj si zastavlja vprašanje: »Mar se klavir igra z boksarskimi rokavicami?« in razloži: »Dejansko prihaja sedanji prezir do religij, ki na Zahodu na splošno izhajajo iz semitskih izročil, manj iz kritične razumnosti ali ateizma, kakor iz običajne zaslepljenosti ene od kultur za drugo. (…) Sodobna vednost lahko, ko briše prezir, ki ga goji ena kultura do svoje sosede, sedaj prvič misli skupaj pojem in pripoved, logiko in literaturo, znanost in religijo.«[30]

[30] M. Serres, *Rameaux*, Le Pommier, Pariz, 2004, 223.

Srečanje z bogom kot kognitivni problem
Encountering god - a cognitive problem

Primož Škoberne
Center za duhovno kulturo, Duhovna unvierza
Ruska 13, SI-1000 Ljubljana
e-mail: primoz.skoberne@cdk.si

Abstract
Article presumes that religious beliefs are basicaly true. The bipolar model based on dynamics of invocation-evocation and two definitions of god (transcendental and antropomorfic) are proposed. Notion 'present or absent god' is also introduced. The encounter is defined as meeting with an antropomorfic form of god.
From a human point of view absence of personal god is a cognitive problem, problem of intuition or lack of recognition, which inhibits invocation-evocation dynamics. Thereafter antropomorfic god has also a problem, i.e. which form is suitable for him to be recognised. E.g. if we met Jesus on a street, wouldn't we take him for a lunatic? But if he presented himself in modern clothes, would he be recognised? Examples from Old and New testament and above all the testimonies from present times are analysed. A conclusion is derived, that we are confronted with inverse situation: evocational pole is invocative. Does god look for an open gate in our preconceived opinions about him? Does he invoke a rather intuitional recogniton instead of a formal one?

UVODNA POJASNILA

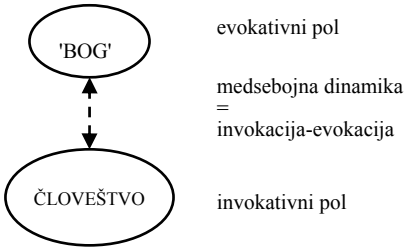
Namen tega prispevka ni primerjati ali vrednotiti posameznih religij, niti dokazovati njihovo verodostojnost. Prav tako ni namen dokazovati obstoj boga, torej obravnava resničnosti ali neresničnosti nekega nedoumljivega, presežnega principa.

Izhajali bomo iz predpostavke, da je to, v kar verjamejo religije (torej bog), načelno resnično, čeprav ne nujno v podrobnostih in izpeljavah.

Ob tej postavki bomo obravnavali, kakšna je dinamika približevanja dveh polov religij, to je človeštva in boga, oziroma kako je odvisna od kognitivnih sposobnosti človeka.

MODEL RELIGIJE

Religijo bomo ponazorili z bipolarnim modelom, kjer en pol ('spodnji') predstavlja človeštvo (konkretna družbena skupnost), drug pol ('zgornji') predstavlja 'boga' in z invokativno-evokativno dinamika med tema poloma.



Slika 1: Bipolarni invokativno-evokativni model religije

Definicija boga

Kaj je bog in kakšna je njegova narava, ne vemo. Vendar bom glede na religiozne izkušnje (1) postavili, da ima bog transcendentno in osebno naravo, ter na tej osnovi podali dve definiciji boga, ena je transcendentna (onkrajni bog), druga pa antropomorfna (osebni bog).

Transcendentna definicija

To lahko postavimo na osnovi opisov, kot jih navajajo n.pr. avtorji F. Capra (2), Jogananda (3), Upanišadi (4) in drugi. V teh primerih je bog nekaj, kar je vsota vseh energij, zavesti in inteligenc, ki pa je hkrati nekaj več, neka nova, emergentna entiteta, podobno kot je voda emergentna glede na vodik in kisik, ki jo sestavljata. Ta je nadrejena posamičnim naravnim pojavom (kot jih konkretna družba pozna) morda v smislu implikatnega reda (5). Bog, ki ga opisuje takšna definicija, je univerzalni bog in je prej načelo (eno, dao, brahman, alah, ...) kot nekaj osebnega.

Antropomorfna definicija

V antropomorfni definiciji boga je to oseba, ki je dosegla tako stanje zavesti, da trajno in povsem jasno odseva gornjo transcendentno resničnost ter jo polno izraža v svojem življenju. Takšna oseba izraža oziroma uteleša transcendentni princip (ali kako njegovo lastnost) in ga predstavlja v tem pogledu.

Takšno zavedanje transcendentne resničnosti bi moralo povsem preglasiti osebnosto (samo)zavedanje; moralo bi biti trajno in brez prekinitev. Tem zahtevam ustreza stanje, ki ga jogijska tradicija imenuje 'sahadža nir-vikalpa samadhi' ali trajno zlitje s transcendentno resničnostjo ob hkratnem normalnem življenju osebe navzven. Fiziologija tega stanja zavesti ni raziskana. (Pojmi, ki jih uporabljajo druge tradicije za spremenjena stanja zavesti in zavedanja, kot so sveta poroka ali sveta združitev, unio mistica, razsvetljenje, satori, so premalo definirana, da bi jih lahko uporabili na tem mestu.)

Invokativno-evokativni odnos

Na osnovi transcendentne definicije privzemimo, da pola nista enakovredna, marveč je človeštvo šibkejši, t.j. sprejemni pol, bog pa je superioren, presežen, oddajni pol. Ta superiornost nad človeštvom se ne kaže le v nadmoči, marveč tudi v presežnosti modrosti, etike, razumevanja.

Komunikacija med poloma poteka po principu invokacija-evokacija. Človeštvo je kot šibkejši pol invokativno: to pomeni, da kliče, prosi, se obrača na boga. Bog kot močnejši, mogočnejši, pa je evokativni pol, ki se odziva, daje, usmerja, nadzira, razodeva.

Specifičnost invokativno-evokativnega odnosa v religiji:

1. gre za izrazito zavesten in oseben, torej čustven, intimen odnos. Osebni stik je bistvo invokacije-evokacije v religijah.
2. utemeljen je na svobodni volji. To pomeni, da je invokativni pol, ne glede na inferiornost, samostojen in neodvisen. Religija potemtakem implicira svobodno voljo, oziroma, kjer te ni, se religija konča in se začne indoktrinacija in prisila.

DVA TIPA RELIGIJ

V bipolarnem modelu religije ločimo dva možna odnosa med poloma. Glede na to, ali je evokativni pol prisoten znotraj invokativnega pola v svoji antropomorfni podobi ali ne, lahko govorimo o prisotnem ali odsotnem bogu. (Boga v transcendentni obliki tu pojumujemo kot vedno prisotnega.)

Prisotni bog

V hinduizmu je navzočnost osebnega boga na Zemlji poznana kot avatarstvo. Avatar je določen vidik transcendentne narave boga, ki se izrazi v podobi človeka in predstavlja osebnega boga po antropomorfni definiciji. Tako je lahko bog hkrati abstrakten, nadoseben kot načelo in konkreten, oseben, utelešen kot človek.

Tradicija kot avatarje med drugim navaja Krišno, Kristusa, Budo; danes marsikdo v to kategorijo uvršča osebe kot sta Sai Baba (6) ali Šri Muktešvar (7).

Odsotni bog

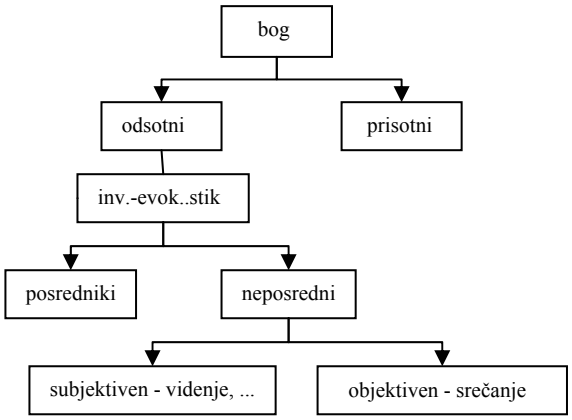
Sem spadajo vse tri monoteistične religije, judovstvo, krščanstvo in islam.

V judovstvu je bog abstrakten stvarnik. Judovstvo ne pozna osebnega boga, boga kot osebe, ki bi bila fizično prisotna med ljudmi. Bog nastopa in govori preko prerokov in svetih ljudi ali pa sam, vendar v nedefinirani podobi le kot božji glas. Podobno velja za islam.

Krščanstvo pozna obe božji plati, nadosebno kot boga očeta (ali morda sveto trojico skupaj) in osebno plat, ki jo vidi v božjem sinu, v Kristusu. Le da je za krščanstvo konkretizacija (avatarstvo) božjega sina Kristusa enkratna v podobi Jezusa iz Palestine.

V religijah odsotnega boga se stik med poloma vzpostavlja po posrednikih (preroki, sveti ljudje, duhovniki) ali neposredno. Neposredno je na subjektiven način (mistiki - videnja, v sanjah, ...) ali na objektiven način (srečanja).

Srečanje tukaj definiramo kot srečanje z osebnim bogom. (Slika 2.)



Slika 2: Povezava med poloma

SREČANJA KOT PROBLEM KOGNICIJE

Obstoj transcendentnega boga je povezan z zaznavo (percepcijo) in vprašanji: kje je prag človeških čutil? Ali ima človek še kakšne čute, ki jih še ni razvil? Kakšna je fiziologija 'nadčutne' percepcije? ...

Obstoj osebnega boga je povezan s prepoznavanjem in s problemom intuicije. Tu se srečamo s vprašanji kot so: Razbiranje informacij v signalih in vpliv predstav na to. Intuicija kot 'neposredna notranja zaznava'. Kaj sproži intuicijo (pomen sprožilcev v obliki nenavadnih, izstopajočih in paradoksnih podrobnosti)? ...

Zavedanje transcendentnega boga je potemtakem težje dosegljiva in redka izkušnja, ker zahteva od posameznika specifično aktivnost (n.pr. meditacija), ki bo spremenila njegovo zaznavo. Pri osebnem bogu po definiciji te omejitve ni in bi lahko vsakdo imel stik z njim ter ga doživel. Postavi se vprašanje, zakaj je torej odsoten?

Domneva, ki jo tukaj podajamo je, da lahko odsotnost (v okviru tega modela religije) tolmačimo drugače in sicer kot problem intuicije in (ne)prepoznavanja. Ne gre torej za odsotnost, marveč za neprepoznavanje prisotnosti antropomorfnega boga.

Znano je, da izkušnje in na njih zgrajene predstave vplivajo na kasnejšo zaznavo. Miselne predstave delujejo kot modeli, po katerih subjekt selektivno izlušči informacijo iz signalov, oziroma identificira ali prepozna tisto, za kar ima že izkušnje.

Izkušnja, da je Kristus živel kot Jezus v Palestini, se je utrdila v predstavo o enkratnosti (neponovljivosti) tega dogodka. Zaradi tega koncepta (predstave o enkratnem avatarstvu) bog ne more biti več fizično, živo prisoten skozi konkretno osebo, ki bi živela z ljudmi, kot je svoj čas Jezus. Na primer, Apolonij iz Tijane (8) je bil v marsikaterem pogledu podoben Jezusu (po moralni in duhovni veličini, po nenavadnih sposobnostih in čudežih, po modrosti) in bi ga lahko mirno imeli za ponovno avatarstvo njegovega 'duha in sporočila'. Tako pa je to, kar naj bi se enkrat že udejanjilo v nekdanji Palestini, v drugo odmaknjeno nekam v nedefinirano prihodnost - teorija drugega prihoda.

Domneva neprepoznavanja torej implicira, da se bog ne more približati ljudem, ne da bi upošteval njihovih miselnih predstav. Če je večji del človeštva tradicionalno veren, potem s svojimi predstavami določa način, kako se jim lahko bog približa. Tip predstav o bogu in način orientiranosti k njemu, ki ju neka kultura goji, določa okvir invokacije-evokacije. Podobno velja za ateiste. Tudi ti, ne glede na to, da se deklarirajo za neverne, poznajo enake tradicionalne

predstave, le da menijo, da niso resnične. Človek s tem določa drugemu polu, kako se mu lahko približa.

Ker se osebni bog lahko približa človeku samo skozi človeku znane in domače podobe, se srečamo z nenavadno in malce komično situacijo. Kaj bi si ljudje mislili, če bi na ulici, na primer na Miklošičevi v Ljubljani, srečali prepasanega človeka v beli halji in s trnovo krono na glavi? Bi ga poslali k psihiatru? Če pa bi bil oblečen, kot se oblačijo ljudje danes, na primer v jeans in bombažno majico ali pa v poslovno obleko, se bi to ujemalo z ustaljenimi predstavami ali bi ostal neopažen?

Če se hoče izogniti tem nesporazumom, se lahko antropomorfni bog približa človeku samo tako, da se skuša zmuzniti okvirjem miselnih predstav in prebuditi intuitivno prepoznanje. Na osnovi obravnave konkretnih primerov srečanj zato lahko domnevamo, da so srečanja način, kako se bog skuša približati ljudem, tako da se zmuzne med okvirji človeških predstav in da možnost intuiciji, da ga prepozna mimo ustaljenih predstav o njem.

PRIMERI SREČANJ IN OBRAVNAVE

1. primer iz Stare zaveze: Bog v gosteh pri Abrahamu

Abraham na ravnici Mamre sedi pred šotorom nekega vročega dne. Dvigne pogled in pred njim so trije možje. V njih (enem izmed njih?) prepozna boga. Jih pogosti. Bog mu napove, da bo priletna Sara rodila otroka. (1. Mojzesova knjiga 18,1-15)

Obravnava

To je edini primer neposrednega srečanja z bogom kot človeško osebo v Stari zavezi. Iz besedila je razbrati, da tri osebe ne izstopajo od običajev po oblačenju. Ni jasno, po kakšnih znakih je Abraham prepoznal njihovo božansko naravo - intuitivno? Kasnje se izkaže, da ima oseba, na katero se obrača Abraham kot na boga, sposobnosti vnaprejšnjega videnja, ko napove, da bo Abrahamova žena Sara rodila, oziroma ima sposobnost povzročanja dogodkov, glede na to, da je Sara že nekaj časa v meni. Izkaže se tudi, da ima oseba sposobnost branja misli, ker je vedela, da se je Sara v sebi zasmejala ob tej napovedi.

2. primer iz Evangelijev: Pot v Emavs

Jezus naj bi se že po vstajenju iz groba prikazal dvema izmed svojih učencev, onadva pa ga nista prepoznala. Pridružil se jima je na poti, skupaj so hodili in se pogovarjali o aktualnih dogodkih (Jezusovi smrti in dogodkih po njej). Nazadnje sta ga povabila k sebi v hišo. Ob večerji, ko je neznanec blagoslovil in prelomil kruh ter jima ga dal, sta pa načinu, kako je to naredil, prepoznala v njem Jezusa. Nato naj bi pred njunimi očmi izginil. (Luka, 24.13-32)

Obravnava

Evangeliji navajajo šest primerov srečanj z Jezusom po njegovem vstajenju. Tu so našteti: Marija Magdalena ga sreča pri praznem grobu in misli, da je vrtnar. To je zjutraj in ni ravno verjetno, da bi se zmotila zaradi slabe svetlobe. Enkrat se pokaže sedmerim učencem, ki lovijo ribe, ki ga ne prepoznajo takoj. Tudi tukaj ga vidijo zjutraj, vendar ker je on na obali in oni v čolnu na morju, je to lahko zaradi razdalje. Dvakrat se pojavi v zaprti sobi, kjer so bili zbrani učenci, ki najprej mislijo, da vidijo duha. Pokazal se je Simonu.

Vsaj v dveh primerih ga njegovi ne prepoznajo, dokler se jim ne da prepoznati z nekim znamenjem. To neprepoznavanje je pravzaprav nerazumljivo. Ti ljudje so živeli tesno skupaj nekaj let. Par dni po smrti, ko naj bi se Jezus znova pojavil, pa ga niso prepoznali? To je možno edino, če se je pojavil v drugačni podobi, kar navaja tudi Evangelij: "Nato se je v drugi obliki prikazal dvema izmed njih med potjo ..." (Marko, 16.12). Ta vzorec, da se je Jezus po vstajenju očitno pojavljal v različnih podobah, je tu še posebej zanimiv, kot bo razvidno v nadaljevanju.

3. primer iz današnjega časa (9): Jezusu je bil podoben

Sodelavci Centra za duhovno kulturo smo v letih 1999 do 2003 zbirali podatke o srečanjih v današnjem času (10). V obdobju leta in pol (začetek 2000 - sredina 2001) smo zbrali samo za Slovenijo 90 pričevanj, ki jih uvrščamo v to kategorijo. Na temelju zbranega gradiva ocenjujemo, da je teh pojavov dosti več, kot smo jih evidentirali.

V prvi fazi zbiranja smo na ilustrativnem vzorcu srečanj v Sloveniji naredili naslednjo statistiko (N=24). Vsak četrti je izjavil, da je oseba podobna Jezusu (N=6). V nekaj manj kot tričetrt primerih (N=17) je oseba na koncu izginila in to v 13 primerih pred očmi, v 4 primerih pa pogojno (ni je bilo več, a se ni dalo ugotoviti, kam je odšla).

Tukaj navajamo primer takšnega srečanja.

Jože G., uslužbenec hotela Union v Ljubljani, je zvečer spomladi 1993 po službi odklepal kolo in se zmotil pri kombinaciji številk. Takrat je prišel mimo visok, vitek moški, petdesetih let, preprosto oblečen, ki se je začel sproščeno pogovarjati z njim. Povedal mu je pravilno kombinacijo ključavnice; vedel je, da ima bolnega očeta v kliničnem centru; napovedal je, da bo operacijo dobro prestal; poznal je sleherno podrobnost iz njegovega življenja; opozoril ga je na nekatere dogodke, ki so se kasneje uresničili.

Nekaj dni kasneje, ko je Jože zjutraj preslišal budilko za službo, ga je nekdo prijel za ramo in stresel: "Vstani, službo boš zamudil!" Ko je odprl oči, je zagledal obraz tistega človeka. V hipu je vstal, a v sobi ni bilo nikogar. Na vprašanje, kakšen je bil ta človek, je odgovoril: "Jezusu je bil podoben."

Obravnava

Dogodek je zanimiv iz večih razlogov. (i) Oseba je izražala nenavadne sposobnosti: vpogled v osebno zgodovino posameznika, napovedovanje dogodkov, izginjanje in pojavljanja. (ii) Jože G. je doživel po srečanju čustveni pretres. Več ur se ni mogel pomiriti in je intenzivno jokal, kar je bilo zanj neznačilno. (iii) Vsaj nekaj tednov po dogodku je bil osebno spremenjen: ni kadil, ni bil vzkipljiv, v družini je zavladala harmonija.

ZAKLJUČEK

V bipolarnem modelu religije z invokativno-evokativno dinamiko je pri religijah odsotnega boga videti, da je situacija invokacije-evokacije obrnjena, in je antropomorfni bog tisti, ki invocira ljudi, vzbuja njihovo pozornost, da bi se lahko razkril. Torej ne drži povsem, da samo 'človek išče boga', marveč tudi 'bog išče ljudi'.

Domnevamo lahko, da je razlog za obrnjeno dinamiko po eni plati kognitivne narave, povezana z ustaljeno formalno podobo antropomorfne oblike boga in s pomanjkanjem intuicije. Drug razlog pa je lahko tudi osebni ali monopolistični (znanstveno in verski). Prisotnost osebnega boga lahko namreč pomeni korenit preobrat v verskih in znanstvenih predstavah.

Sklep, ki ga lahko damo za konec je: 'bog' išče odprta vrata in invocira intuitivno prepoznanje svoje prisotnosti; ljudje se držimo formalnih predstav in težko sprejememo

nekaj, kar ni v skladu z njimi, ne glede na to, ali smo verni ali ne.

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Objektivna znanost in subjektivna duhovnost sta komplementarni

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: Objective Science and Subjective Spirituality are Complementary

Both, science and spirituality are looking for the truth, but with completely different basic principles and methodologies. Science insists on objective descriptions of the world. This limits its scope to measurable, describable material world. Science deals with question "HOW universe operates" and develops various scientific theories that try to EXPLAIN. On the other hand spirituality, stemming from various eastern and western traditions, deals with question: WHY universe exists and what is the purpose of life. It 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 spiritual seekers practice spiritual virtues like love, compassion, humility, faith, modesty, patience, courage and sincerity. Mathematics defines strict boundaries for describable, rational (scientifically observable) world - corresponding to discrete world of natural numbers, while irrational world (subjectively observable) corresponds to the continuous world of real numbers. However, for creative development both in material and spiritual world we need both: science and spirituality - they complement each other. In the words of Dalai Lama: mind and heart have to go together.

1 Uvod

"Science without faith is lame, religion without science is blind. "

Albert Einstein

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.

Duhovni pogled na svet je temelj vseh učenj velikih modrecev, pomembnih filozofskih in religioznih šol ter svetih tekstov vzhoda in zahoda. 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.

Na drugi strani pa znanost temelji samo na merljivih in s tem opisljivih in ponovljivih pojavih. Kar je objektivno merljivo in opisljivo, je za znanost zanimivo, subjektivna doživetja in čutenja so pri strogi znanstveni obravnavi nedopustna in zavajajoča. Vsaka znanstvena teorija mora biti objektivno preverljiva, vsak poskus ponovljiv. Pri tem se eksplicitno zahteva, da se loči eksperiment od eksperimentatorja - od njegovih čustev in namenov. Torej subjektivne izkušnje so za znanost nedosegljive - nemerljive in s tem neopisljive in nezanimive.

Znanost in duhovnost sta torej na prvi pogled nezdružljivi in ena z drugo nimata kaj početi. Pa vendar nas veliki misleci in znanstveniki opozarjajo, da ni tako. Sam Albert Einstein je bil zelo duhoven človek, o čemer nam v šolah seveda ničesar ne povedo. Namen tega članka je potrditi Einsteinovo izjavo: »Znanost brez vere je hroma, vera brez znanosti je slepa.« (Einstein, 1940). Z osvetlitvijo relacije med znanostjo in duhovnostjo lahko pokažemo, da sta si znanost in duhovnost dejansko komplementarni in ne nasprotujoči - druga drugo lahko usmerjata, nadzirata in dopolnjujeta.

V naslednjem razdelku najprej prikažemo matematične meje opisljivosti in s tem meje, ki jih znanost v principu ne more preseči. Zatem v 3. razdelku osvetlimo relacijo med znanostjo in duhovnostjo - med objektivnostjo in subjektivnostjo. 4. razdelek na kratko povzame znanstvene potrditve pojavov, ki so najverjetneje povezani z duhovnostjo. Zaključimo z diskusijo o potrebni harmoniji med duhovnostjo in znanostjo, med srcem in razumom.

2 Meje znanosti so meje objektivne opisljivosti

Teorija izračunljivosti (Hopcroft in Ullman, 1979) opozarja, da je skoraj zanemarljiv delež problemov, ki si jih lahko formalno zastavimo, rešljiv algoritmično. Turingovih strojev (algoritmov) je številno neskončno mnogo, problemov pa je neštevno neskončno mnogo, kar ustreza moči potenčne množice prejšnje veličine. Prva veličina je enaka moči

množice naravnih oziroma racionalnih števil (diskretni svet), druga pa moči množice realnih števil (zvezni svet).

Danes uporablja znanost naslednje formalne simbolične jezike za opisovanje (modeliranje) realnosti:

- matematična logika,
- računalniški programski jeziki,
- rekurzivne funkcije in
- formalne gramatike.

Vsi ti formalizmi so po izrazni moči med seboj enakovredni in vsi imajo enake omejitve (Manna, 1974; Hopcroft in Ullman, 1979): lahko (delno) opišejo pojave znotraj diskretnega sveta, medtem ko lahko opišejo samo tako rekoč zanemarljivo majhen del zveznega sveta

Že sama imena množic so zgovorna:

- racionalna števila: tista, ki so dosegljiva, doumljiva z razumom (racio);
- iracionalna so nedosegljiva razumu, neopisljiva, nedoumljiva;
- realna števila: predstavljajo realnost, resnico, zveznost, continuum.

Torej, če je svet dejansko zvezen, potem je najverjetneje **neopisljiv** s katerimkoli formalizmom, ki ga znanost danes uporablja. To bi dejansko pomenilo, da znanje, ki nam ga lahko dajo znanost, knjige, učitelji, ni nikoli dokončno, saj je **vedno** samo približek in ne more popolnoma opisati realnosti, kot v simboličnem jeziku ni možno opisati vseh realnih števil. To seveda ne pomeni, da realnost ne obstaja, in da je ni mogoče subjektivno začutiti - le objektivni opis ni mogoč. To je matematično dokazano dejstvo!

3 Relacija med znanostjo in duhovnostjo

Tabela 1 povzema relacijo med znanostjo in duhovnostjo. Znanstveniki pri svojem delu uporabljajo razum. Pri tem se omejijo na objektivno merljive in opisljive pojave. Namen znanosti je opisovati realnost, in pri tem uporabljati logični, racionalni um. Znanost zanima, KAKO deluje vesolje, in želi delovanje opisati. Pri tem preučuje materialni, merljivi vidik sveta. Po drugi strani mistiki za dojemanje realnosti uporabljajo notranji čut, srce. Njihov namen je začutiti in se zavedati realnosti. Pri tem uporabljajo intuitivni um. Zanima jih, ZAKAJ obstaja vesolje, in iščejo smisel življenja. Pri tem se osredotočajo na subjektivno (nemerljivo) zavest.

Znanost modelira empirične podatke: postavlja model (hipotezo, teorijo), ki opisuje meritve, ki se, če dovolj natančno opisuje podatke, sčasoma privzame kot (naravni) zakon. V sako stvar je treba dvomiti in vse preveriti. Če sčasoma pride do drugačnih (bolj natančnih, pod drugačnimi pogoji itd.) meritev, ki se ne skladajo z zakoni, se obstoječi zakoni spremenijo/razširijo, tako da pokrivajo tudi nove meritve. Znanost se pri opisovanju realnosti omeji na razum, ki je omejen s simbolično reprezentacijo/opisljivostjo, čeprav seveda znanstveniki pri ustvarjalnem raziskovanju uporabljajo (najverjetneje neopisljivo) intuicijo. Znanost je omejena na opisovanje racionalnega - diskretnega sveta. Pri tem velja samo posredna, objektivna izkušnja, dobljena z meritvijo. Rezultat znanosti je znanje, ki je namenjeno praktični uporabnosti ter aktivnemu poseganju v naravo in njenemu podrejanju in nadzoru.

Tabela 1: Relacija med znanostjo in duhovnostjo

ZNANOST	**DUHOVNOST**
znanstveniki	mistiki
razum	čut, srce
objektivnost, opisljivost	subjektivnost, neopisljivost
opisovanje realnosti	čutenje, zavedanje realnosti
logični, racionalni um	intuitivni um
KAKO? opisovanje	ZAKAJ? iskanje smisla
preučuje materijo	preučuje zavest
NAKLJUČJE	»NA KLJUČ«
dvom, preverjanje	zaupanje
logika, eksperimenti, statistika	sprostitev uma, meditacija, obredi
razumska členitev, specifični zakoni	povezovanje v enost, splošno načelo
diskretni svet (N), racionalni svet (Q)	zvezni, realni svet (R), iracionalnost, transcendentnost
objektivna, posredna izkušnja	subjektivna, neposredna izkušnja
aktivna, nasilna svobodna volja	pasivna, ubrana svobodna volja
podrejanje, nadzor	sodelovanje
praktična (sebična) korist	vse je eno
znanje	modrost
znanstvene teorije (matematični modeli): - kvantna fizika - teorija relativnosti - termodinamika - teorija evolucije ...	duhovne vrednote: - ljubezen, sočutje - potrpežljivost,strpnost - ponižnost, skromnost - iskrenost, spontanost - zaupanje, pogum ...
znanstvene vede in discipline: - matematika - naravoslovne vede (fizika, kemija, biologija,...) - družboslovne vede, filozofija - tehnične vede ...	duhovna gibanja: - joga, tantra - tao, zen - alkimija, kabala, teozofija, sufizem - institucionalizirane religije - novodobna gibanja (New Age) ...

Po drugi strani pa duhovnost goji duhovne vrednote, kot so ljubezen in sočutje, ponižnost in strpnost, preprostost in

skromnost, sprejemanje in odpuščanje, iskrenost, zaupanje in pogum. Na osnovi vere in zaupanja, ki presega strahove in meje ega, duhovni iskalec uporablja sproščanje uma, meditacijo in razne obrede, z namenom doseči neposredno izkušnjo realnega sveta - razširiti svojo zavest na vse, kar obstaja, in neposredno spoznati resnico, enost vsega kar obstaja. Rezultat duhovnosti je modrost, ki se zaveda realnosti, je ubrana z vesoljem in sodeluje z naravo.

Znanost se ne sprašuje: ***zakaj vesolje obstaja in čemu je življenje namenjeno***. Zaradi ignoriranja teh dveh vprašanj mnogi privzamejo kot temeljni princip, da je vesolje in življenje nastalo po naključju in da sama po sebi nimata nobenega globjega smisla (pa vendar že sama beseda namiguje, da naključja ne obstajajo - vse se dogaja NA KLJUČ...). Seveda materialistična predpostavka, da je vesolje nastalo po naključju in da življenje nima globjega smisla in namena, nima nobene znanstvene osnove.

Filozofija (v prvotnem pomenu besede) poskuša odgovoriti na obe vprašanji, vendar pri tem potrebuje **razum in srce**. O tem govorijo vsi veliki modreci, duhovni učitelji in filozofi vzhoda in zahoda: Sokrat, Platon, Plotin, Lao Ce, Buda, Jezus, Zaratustra itd. Današnja filozofija poskuša posnemati znanost in izključuje srce (um, etiko). Iz učenj velikih modrecev bi lahko sklepali, da sta tako razum kot srce nujna za harmoničen razvoj zavesti.

4. Znanost potrjuje duhovnost

Z duhovnim pogledom na življenje so najverjetneje povezani pojavi, ki jih današnja znanost ne priznava, jih pa lahko vključimo v širši (zaenkrat neznanstven) model, ki vključuje materijo (fizično telo) na svojem najnižjem nivoju in je seveda nujno potrebna za uresničevanje smotrov in ciljev višjih nivojev (energijskega, čustvenega, mentalnega in duhovnega nivoja). Seveda znanost ne prehiteva in poskuša korak za korakom pojasnevati posamezne fenomene. Danes je verjetno energijski nivo najbližje temu, da ga znanost prizna oziroma vključi v svojo paradigmo. Vse več raziskovalcev se ukvarja z raziskavo energijskega biopolja okoli živih objektov (Detela, 2002, Korotkov, 2002), ki mu popularno rečejo aura (Brennan, 1995).

V članku (Kononenko, 2003) smo opisali več pojavov, ki jih je znanost opazila, vendar jih ni moč razložiti s trenutnim poznavanjem naravnih zakonov:

1. *Vpliv molitve zdravilcev na zdravje pacientov:*

V zadnjih nekaj letih pa je bilo objavljeno že več znanstvenih raziskav vpliva molitve na daljavo na zdravje ljudi, ki so bile narejene v strogo znanstvenih scenarijih z dvojno slepimi poskusi, ki izključujejo sugestijo in placebo (Byrd, 1988; Harris in sod., 1999; Cha in sod., 2001; Lebovici, 2001). V teh študijah so bili pacienti naključno razdeljeni v eksperimentalno in kontrolno skupino, poklicni zdravilci ali »običajni« verniki so molili za zdravje ljudi v eksperimentalni skupini, ne da bi prišli osebno v stik s temi ljudmi. Za vsakega od pacientov v obeh skupinah so pred in po terapiji z molitvijo zabeležili vrednosti parametrov, ki kažejo na zdravstveno stanje pacientov. V vseh štirih študijah so bile razlike statistično signifikantne v prid učinkovitosti molitve za zdravje na daljavo.

2. *Obsmrtna doživetja*

Obsmrtna doživetja se v Sloveniji in po svetu še vedno pri mnogih uvrščajo med tabu teme (Harpur in sod., 1997; Kubler-Ross, 1991; Moody in Kubler-Ross, 2001; Moody, 1975). Vendar se vse več znanstvenikov ukvarja z obsmrtnimi doživetji in objavljene so že resne študije. Na kognitivnih konferencah v Ljubljani (Detela in sod., 2002; Kononenko in Jerman, 2003) smo obravnavali to tematiko in končni zaključek je bil enak tistemu, ki je naveden v resni znanstveni študiji (van Lommel in sod., 2001): Treba je upoštevati tudi teorijo o transcendenci zavesti, kjer v spremenjenem stanju zavesti identiteta, kognicija in čustva delujejo neodvisno od nezavestnega telesa, vendar zadržijo sposobnost nesenzorne percepcije.

3. *Predvidevanje bližnje prihodnosti*

V raziskavah (Bierman in Radin,1998) in (Bierman, 2002) rezultati nakazujejo na nenavadno sposobnost ljudi, da njihovo telo (merjeno preko prevodnosti kože) lahko predvideva prihodnost vsaj za nekaj sekund vnaprej.

4. *Telepatija in telekineza*

Mnogo ljudi ima občasno telepatsko doživetje, kar povečuje zaupanje v to, da je telepatija možna. Hkrati s prenosom informacije pa velja, da ta miselna informacija lahko vpliva tudi na fizični svet - na materijo. Raziskave telepatije in telekineze to tudi potrjujejo (Jahn in sod., 1997; Dunne in Jahn, 1995; Wackerman in sod., 2003).

5. *Neposredno gledanje*

V Rusiji je skupina pod vodstvom g. Bronnikovega in dr. Lognikove razvila metodo mentalnega treninga, namenjeno slepim in slabovidnim otrokom, da bi se lahko znašli v prostoru brez uporabe običajnega vida (Korotkov in Bundzen, 2002; Korotkov in sod., 2002). Intenzivni mentalni trening poteka več let in nekateri otroci so po tem sposobni izvensenzorne percepcije – neposredni vid, ki, ne uporablja fizične oči. Skupina ima velike uspehe pri rehabilitaciji slepih in slabovidnih otrok. Pri raziskavah neposrednega vida uporabljajo Kirlianovo kamero, ki pokaže specifičen vzorec korone prstanca, ki je značilen za t.i. spremenjeno stanje zavesti (Korotkov, 2002).

Poleg zgoraj omenjenih fenomenov zavesti lahko med področji raziskav, ki potrjujejo mejne pojave zavesti, navedemo še: preučevanje učinkov meditacije, raziskave spomina vode, ki je osnova homeopatskega zdravljenja, preverjanje radiestezije, preverjanje astrologije ter preverjanje učinkov alternativnega in komplementarnega zdravilstva: akupunkture, homeopatije, preverjanje energijskega stanja pacientov s Kirlianovo kamero itd.

5 Harmonija srca in razuma

Razum uporablja logiko, algoritme, simbolične formalizme. Zavest pa ima najverjetneje globji pomen in namen, zato je zavest nujno povezana z etiko življenja. Razum brez srca je nezavedna inteligenca, sposobna uničevati in uničiti okolje in sebe. *Razum* je inteligenca brez *uma*. Lahko bi poenostavljeno rekli *srce* = *um* = *etika* ter *razum*+*srce* =

zavest. To potrjuje Einsteinov citat: »Znanost brez vere je hroma, vera brez znanosti je slepa.« Kot je dejal Dalaj Lama v Ljubljani: ***Potrebujemo izobrazbo in čut moralne etike - to dvoje mora iti skupaj.***

Vpliv molitve na zdravje, telepatija, telekineza, predvidevanje bližnje prihodnosti in neposredni vid so si med seboj podobni in mogoče bo v bližnji prihodnosti znanosti uspelo postaviti model, ki bi bil konsistenten s temi pojavi, in bo mogoče obsegal tudi energijski (eterični) nivo realnosti. Obsmrtna doživetja pa posegajo na višje nivoje realnosti in nas spominjajo, da ima življenje globji smisel in namen, kot samo golo preživetje fizičnega telesa (do njegove smrti).

Telepatski poskusi na Princetonski univerzi nakazujejo, da je potrebno v opis sveta vključiti opazovalca – njegovo zavest oziroma svobodno voljo (Kononenko, 2002). Razlago za te pojave dobimo s pomočjo kvantne fizike. Kvantni princip nedoločenosti stanja »vse do meritve« najverjetneje pomeni »*vse do meritve, ki jo izvrši zavestno bitje*«. Ta princip srečamo v različnih duhovnih učenjih, hkrati pa ga zagovarjajo tudi mnogi vrhunski fiziki. Veliki matematik John Von Neumann, ki je razvil rigorozno matematično osnovo kvantne mehanike, je verjel, da edino človeška zavest lahko zruši valovno funkcijo. Dobitnik Nobelove nagrade, fizik Eugene Wigner, je zapisal: »… (Iz povedanega) sledi, da je kvantni opis objektov pod vplivom vtisov, ki vstopajo v mojo zavest… Sledi, da ima zavest drugačno vlogo v kvantni mehaniki kot nezavedna merilna naprava.« Slavni fizik John Wheeler je naredil še korak naprej. Po njegovem se lahko vesolje pojavi v fizični realnosti samo skozi opazovanje zavesti. Opazovalec je nujen za ustvarjanje vesolja, saj je vesolje stvaritev opazovalca.

Veliki modreci nas učijo, da se mora vsak soočiti sam s seboj in sebe spoznati. Vsak ima pri tem sam odločilno vlogo. Vsak je pomemben, enkraten, drugačen od ostalih (po zunanjem in po notranjem). Duhovni pogled na svet izvira iz starodavnih tradicij in je plod notranjega uvida mnogih velikih mislecev in filozofov. Veliki učitelji samo spodbujajo, vendar ne morejo storiti ničesar namesto nas. Zato je filozofija (v prvotnem pomenu te besede) nujnost – vedno in prav zdaj, za vsakega človeka, da lahko začne odkrivati stvari z razumom in s srcem, z znanostjo in z duhovnostjo. Duhovni pogled na svet je konsistenten z znanstvenimi dejstvi, vendar, vsaj zaenkrat, mogoče pa tudi v principu, nedokazljiv, kot je neopisljivo vse kar presega razum in na prvem mestu sta to gotovo intuicija in smisel življenja, ki ju čutiš v srcu.

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Ko objekt več ne vznemirja

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:
When the Object Does Not Excite Any More

We live in two worlds at the same time: in the material world, which can be called the world of objects, and in the spiritual world, which will be called the world of relations. The dimensions of the physical world differ from the dimensions of the spiritual one, where only closeness and distance can be distinguished.
Any science tries to organize the knowledge, which is the aim of its endeavours. Empirical science gains knowledge on the basis of repeated experiments, theological cognition is only based on logical reasoning and arguments of faith. Thus, the understanding of faith is unattainable for exact science. When moving from the area of science to the area of faith, the aim is not knowledge any more, but the preservation of the relation we have found ourselves in. Some axioms derived from the thought of the French philosopher Guy Lafon reveal the laws of the world of relations. We do not enter it, but find ourselves in it because it is the relation that makes subjects possible and keeps them alive. Each relation works on the basis of a simultaneous alternation of a presence and an absence of subjects, at the same time it consists of two inseparable components, an ethical and a theological one. When the opposition between the presence and the absence of subjects moves apart to the extreme, one can speak about faith, which is present (together with hope and love) in every relation. The latter is endangered by death and saved by the theological component. Christians bear witness to their relation to God *via* the relation to any other person. To have a scientific discussion of faith means to speak about a relation we have found ourselves in. To believe, however, means to speak with a partner we do not know. Knowledge does not enable us to live. It is the relation that generates "me", "you", "him", "her", "us", and "them". And faith makes "me" and "you" a believer.

Uvod

"Dieu, s'il est, est entre nous!"[1]
Guy Lafon

Da bi v tem prispevku opravičili delovni naslov podkonference *Znanstveno o verovanju*, bomo v prvem delu nekoliko opredelili osnovne pojme, ki jih bomo uporabljali: znanost, empirična znanost, teologija in verovanje. Hkrati z opredelitvijo pojmov pa bomo predstavili tezo, ki jo postavljamo: *Verovanje je znanosti nedosegljivo, lahko pa ta o njem nekaj spozna.* Naša trditev temelji na epistemoloških razlogih. Najprej pokažemo dve različni področji življenja: materialni svet in duhovni svet. Če nam je tvarni svet dosegljiv preko spoznanja, to ne velja za duhovni svet. Znanstvenik, ki se ukvarja s tvarnim svetom, se namreč uresničuje preko spoznavanja, to pa ni mogoče na področju verovanja. Na mesto logike spoznavoslovja stopi neka druga logika, ki temelji na aksiomih, ki jih bomo v drugem delu predstavili in z njimi opravičili zgoraj omenjeno tezo. Izpeljali smo jih iz misli francoskega teologa Guya Lafona. V zaključku pa, s pomočjo teh aksiomov, nakažemo en možen odgovor na vprašanje: *Kaj pomeni znanstveno razpravljati o verovanju?*

1. Človek živi istočasno v dveh svetovih

Znanstvenemu delu je lastno, da si prizadeva metodično priti do sistematično izpeljanih in urejenih spoznanj. Glede na delitev znanosti na empirično in humanistično, med katerimi ima teologija posebno mesto, se razlikuje tudi metodologija spoznavanja. Medtem ko empirične znanosti resničnost svojih spoznanj dokazujejo s ponavljanjem poizkusov in z meritvami le-teh, teologija za utemeljevanje svojih povedi uporablja le razumske in verske argumente. Teologija te zadnje imenuje vsebina razodetja[2]. Teologija kot vedenje o veri lahko sistematično uredi svoja spoznanja in o njih resničnosti z razumskimi argumenti prepriča poslušalca. Ker pa njena spoznanja temeljijo tudi na verskih argumentih, so osebi, ki je zgolj znanstvenik materialnega sveta in ne hkrati preučevalec tega, »kar se ne vidi«, pogosto nesprejemljiva, ker vera spada na področje, s katerim se eksaktna znanost ne ukvarja. Dejavnost empiričnih znanosti je namreč omejena na svet objektov v materialnem ali fizičnem svetu, kar pa še zdaleč ni popolno stvarstvo. Filozofija v zadnjih desetletjih govori o svetu odnosov (E. Levinas, M. Buber, Wittgenstein), ki ga religijska tradicija že dolgo imenuje tudi »duhovni svet«. Na tem področju veljajo drugačne zakonitosti kot v tvarni naravi.

[1] Bog, če je, je med nami!

[2] Razodetje je zapisano v Svetem pismu.

Teologija kot znanost lahko torej nekaj spozna o verovanju, eksaktni znanosti pa je razumevanje verovanja nedosegljivo, ker njen način spoznavanja ne dosega sveta odnosov. Kadar govorimo o teoloških spoznanjih, namreč ne mislimo zgolj na Boga in na transcendenco, temveč mislimo predvsem na vero, ki je po svoji naravi odnos. Zato je »konflikt argumentov« eksaktnih znanosti in tistih s področja sveta, ki obstaja »med nami«, podoben nerazumevanju Kitajca in Slovenca, ki se ne moreta sporazumeti, ker pač govorita različna jezika oz. ker sta njuna jezika osnovana na popolnoma različnih pravilih. Vsi sicer hkrati živimo tako v materialnem kakor tudi v duhovnem svetu. Toda nekateri včasih razmišljajo samo z logiko zakonitosti materialnega sveta in se ne zavedajo pomembnosti nadfizičnega oz. omalovažujejo zakonitosti sveta odnosov in aksiomov »metafizičnega« sveta. Morda bi bilo primerno reči, da človek, ki verjame in se ravna le po spoznanjih eksaktnih znanosti, še ni odkril sveta v polnosti. Ukvarja se le z materialnim svetom in njegovimi razsežnostmi. V nevidnem svetu odnosov ali duhovnem svetu pa ni višine, dolžine in širine, temveč obstajata samo dve dimenziji: prisotnost in odsotnost. Od tu tudi izvira ločitev na sveto in posvetno. To, kar izvira iz spoznanja sveta objektov, je profano, to, kar izvira iz sveta odnosov pa je sveto. Čeprav duhovni svet ni področje eksaktnih znanosti, smo prepričani, da je poznanje sveta odnosov za uresničitev posameznikovega življenja nujno dopolnilo poznanju fizičnega sveta.

Razumevanje verovanja je torej eksaktni znanosti nedosegljivo, teologiji pa ne. Toda ker tema naše konference ni le spoznavanje verovanja, temveč tudi verovanje samo, naredimo še korak naprej z naslednjo trditvijo: *Verovanje samo je kakršnemu koli znanstveniku, če je zgolj znanstvenik, pa četudi teolog, nedosegljivo.* Zakaj? Srčika odgovora je naslednja: bistvo znanosti je vedno spoznanje, materialnega ali duhovnega sveta. Vse prizadevanje in vsa znanstvena sredstva so usmerjena k temu cilju. Tudi teologije. Znanstvenik je namreč opazovalec, ki objekt postavi predse in spoznava, da bi »o njem« čim več vedel oz. da bi o njem lahko čim več povedal. Uspešen je takrat, ko »spozna« opazovani objekt. V dvatisočletni zgodovini krščanske teologije so tudi o Bogu poskusili marsikaj napisati. In tudi so. O Božjem bistvu in njegovih lastnostih. Toda ker Bog ni objekt, ki bi ga lahko postavili predse in ga opazovali, spoznavali in o njem govorili, o njem praktično nič ne moremo vedeti. Če damo vsa spoznanja o Bogu na skupni imenovalec, lahko postavimo tri Božje lastnosti, ki pa so končno le človeške lastnosti: Bog je vsemogočen, vseveden in človeškemu razumu nedosegljiv. Zato je logični zaključek vsega tega prizadevanja »spoznanje«, da o Bogu samem ne vemo praktično nič. Oziroma, kar o njem povemo, je bolj kot govorjenje o Božjem bistvu opisovanje njegove podobe, ki jo nosimo v sebi. Ker je Bog človekov »ideal«, ga spoznava takega, kot bi sam rad bil: vsemogočen in vseveden! In ker o Bogu samem ne moremo nič kaj bolj konkretnega povedati, zaključujemo, da je Bog čisto drugačen, kot si ga mi predstavljamo. S tem »spoznanjem« lahko človek preneha »spoznavati Boga«.

Moderni teologiji je jasno, da njen cilj nikakor ni spoznanje Boga. Bolj kot z Bogom se ukvarja z vero. Njen objekt obravnavanja je torej verovanje. Zaustavila se je ob tretji Božji lastnosti: nedosegljivost. Če sta bili prvi dve na nek način kreposti, je tretja lastnost pomanjkljivost, vsaj na prvi pogled. Biti nedosegljiv najprej pomeni biti daleč, kjer je spoznanje onemogočeno. Toda če rečemo, da me od njega loči neka razdalja, lahko prav tako rečemo, da me z njim povezuje neka razdalja. To dejstvo, da je med menoj in njim neka razdalja, pa dokazuje preprosto dejstvo, da on ni jaz oz. da se imenuje »Drugi«[3]. Bog je »Drugi«, je drugačen, je popolnoma drugačen. Ker se je teologija v preteklosti ukvarjala s spoznavanjem Boga in ker »oddaljenost« otežuje spoznanje, je bila ta nekaj negativnega. Danes pa se teologija ukvarja z odnosom, ki veže človeka z Bogom. Ta vez se imenuje verovanje, ki si ga postavlja predse kot objekt opazovanja in o njem govori. Vendar ta vez sama po sebi sploh ni objekt. Teologija verovanje sprejema kot objekt samo zato, da lahko o njem govori, da ga lahko spoznava. Ker je spoznanje tisto, ki človeku približa objekt. Toda če si teologija kot znanost prizadeva spoznavati vero, potem si vera, ki je sama po sebi odnos, prizadeva ta odnos ohraniti. Cilj verovanja torej ni neko spoznanje, niti spoznanje Boga, temveč ohranitev odnosa, ki vernika povezuje z »Nespoznavnim«. V ta odnos pa vernik ne more vstopiti, temveč se v njem znajde. Vera je absoluten nezaslužen dar. V teološkem jeziku bi dejali, da je vera milost. Čeprav teologija kot znanost torej o verovanju govori, vernik s spoznanjem še ni dosegel cilja verovanja, ki je ohranjevanje odnosa z Nespoznavnim.

Področje verovanja torej ni svet objektov, temveč svet odnosov, kjer ne govoriš »o Bogu«, temveč Boga »srečaš«, ko se z-najdeš v svetu odnosov. Ker torej cilj verovanja ni spoznanje, je verovanje zunaj konteksta znanstvenega udejstvovanja, ki je spoznavanje. Bogu nas ne približa spoznanje ali neko védenje, temveč vera. Verovati pa ne pomeni tudi razumeti. Zato torej Bog »uhaja« znanosti, ker je bistvo njenega poslanstva spoznavanje. Spoznavamo namreč tisto, kar nam je enako ali podobno. Bog pa je drugačen. Tako zelo drugačen, da ga ne moremo spoznavati. Zahvaljujoč se temu dejstvu, da je »Drugi«, pa lahko z njim komuniciramo. Vera je dejansko odnos s partnerjem, ki ga ne poznamo. In niti ni potrebe po tem. Če smo zgoraj zapisali, da je cilj verovanja ohranjevanje odnosa z Nespoznavnim, se lahko sedaj vprašamo: Ali verovati pomeni ohranjati odnos samo z Njim? In odgovorimo: Ne samo z Njim, temveč verovati pomeni ohranjati odnos s »slehernim drugim«.

Prav gotovo lahko rečemo, da je tudi verovanje iskanje resnice, toda ta resnica še zdaleč ni omejena na védenje. Spoznanje namreč ni edina pot do resnice, ki ni le to, kar je dokazljivo in empirično preverljivo. Obstaja še druga pot do resnice: odnos s slehernim drugim. Ker človek živi v materialnem in duhovnem svetu hkrati, je vera zanj nujno dopolnilo znanosti, če hoče doseči polnost življenja, torej če hoče resnično živeti v duhovnem in materialnem svetu. Če namreč fizični zakoni človeka ohranjajo v tvarnem svetu, potem je zagotovo vera tista, ki človeka ohranja v svetu

[3] Kadar se beseda »Drugi« nanaša na Boga, ki ga v krščanski tradiciji pišemo z veliko začetnico, bomo tudi besedo »Drugi« pisali z veliko začetnico.

odnosov. Vsakdo pa je že v svetu odnosov. Zato vsak tudi veruje, čeprav nezavedno. To bomo razložili v nadaljevanju.

V naslednjem poglavju najprej prikažemo aksiome, ki smo jih izpeljali iz spisov francoskega teologa Guya Lafona in opisujejo zakonitosti duhovnega sveta. Ključna beseda v francoskem tekstu je »l'entretien«, ki je v slovenščino neprevedljiva. Vsebuje tako širok pomen kot nobena slovenska beseda.[4]

2. Aksiomi Guya Lafona

1. Odnos je transcendentno stanje, v katerem se (z)najde vsak človek, da lahko obstaja

Odnos je stanje. Torej ni objekt, ki bi ga prvenstveno postavili predse in o njem govorili, ali ga celo posedovali, temveč je transcendentno stanje v Kantovem pomenu. V smislu, da ga ne moremo spoznati samega po sebi. Ne mislimo na stanje nekega konkretnega človeka, temveč na stanje v katerem se (z)najdemo vsi ljudje, da lahko smo. Ni bivanja izven odnosa. Preprosto se znajdemo v odnosu - v življenju. Nobene zasluge nimamo za to, da živimo. Nihče me ni vprašal za mnenje ali dovoljenje, pa tudi odločil se nisem, da bi »bil«. V življenju sem se znašel! Bilo mi je podarjeno. Zato živeti pomeni (z)najti se, biti v odnosu.

Razlika med stanjem in objektom je enaka razliki med razdaljo in dvema objektoma, ki ju ta razdalja loči. Odnos in objekt nista primerljiva. Lahko pa rečemo, da je razdalja tisto, kar dva objekta ali subjekta povezuje. Ali še drugače povedano, razdalja je tisto, kar dva subjekta omogoča in hkrati osmišlja.

2. Subjekti se rodijo v odnosu.

Če med subjekti ne bi bilo oddaljenosti, tudi subjektov ne bi bilo. Toda subjekti so, ker med njimi je neka razdalja, ki pa je ne ustvarijo in vanjo ne vstopajo, temveč se v njej rodijo. Jaz kot subjekt sem se nenadoma zavedel, da sem. In to, »da jaz sem«, bolje rečeno, »da sem jaz«, sem spoznal takrat, ko sem nekoga naslovil s »ti«. Tisti trenutek, ko sem nekomu rekel »ti«, sem postal »jaz«, sem se rodil kot subjekt. Tebe pa sem lahko naslovil s »ti«, ker ti nisi bil jaz, ker si bil »drugi«, ker si nisva identična oz. ker je bila med nama neka razlika – razdalja, skratka, ker sva se znašla v odnosu, zato sem lahko izrekel besedo »ti«. Brez »odnosa do tebe« me ne bi bilo. In obstajal bom toliko časa, dokler te bom lahko klical s »ti« - dokler bom v odnosu s teboj. Odnos torej rodi in ohranja pri življenju tebe in mene.

Lahko rečemo, da se »jaz«, »ti«, »on«, »ona«, »mi«, »vi«, »oni« in »one« rodijo v odnosu. V svetu odnosov zaživimo kot subjekti. Odnos se ne pojavi pred ali za subjekti. On je. Omogoča nas in osmišlja naše bivanje. V njem smo, toda v njem nismo izgubljeni. Nasprotno, v njem se najdemo, ker smo v njem rešeni nebivanja. Svet odnosov je prostor našega bivanja. Skratka, odnos je pogoj, smisel in cilj naše eksistence.

3. Odnos »deluje« na osnovi istočasne izmenjave prisotnosti in odsotnosti subjektov.

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. Vsak odnos istočasno vsebuje prisotnost in odsotnost. Jaz sem tebi istočasno prisoten in odsoten. Ta istočasna izmenjava je pogoj, ki omogoča obstoj odnosa in njegovo delovanje. Istočasna izmenjava prisotnosti in odsotnosti zagotavlja odnos do drugega. Kdor želi ostati v odnosu, mora sprejeti to izmenjavo. Tako lahko rečemo, da smo istočasno skupaj in tudi narazen. V nasprotnem primeru si ne bi mogli ne govoriti in se ne poslušati. Bili bi istovetni drug z drugim ali, v nasprotnem primeru, drug od drugega do skrajnosti oddaljeni. Toda nihče izmed nas ni ujetnik te vezi odnosa. Bolj ga osvobaja kot usužnjuje, da je lahko z drugimi, da z drugimi komunicira. Iz tega osvobajajočega odnosa, pa čeprav je včasih boleč v konfliktih, ne bo izšel vse do smrti. Kolikor časa živimo, živimo v komunikaciji igre odsotnosti in prisotnosti.

4. Vsak odnos je sestavljen iz teološke in etične komponente. Toda ne moremo ju zliti v eno.

Odnos, ki porodi subjekte, jih tudi ohranja s tem, da jim omogoča komuniciranje. Vsa dejavnost subjektov se odvija v svetu odnosov, tako komuniciranje s prisotnimi, kakor z odsotnimi subjekti. Čim bliže sta si prisotnost in odsotnost (pogosta izmenjava), tem bolj v odnosu prevladuje etična komponenta. Čim bolj sta si prisotnost in odsotnost oddaljeni (redka izmenjava), tem bolj pride do izraza teološka komponenta odnosa.

Ker vse subjekte med seboj povezuje prisotnost in odsotnost hkrati, teološko in etično brez mešanja in brez ločitve sestavljata vsak odnos v katerem se znajdemo. Ne moreta se ločiti, kakor se ne more ločiti ena stran od druge istega lista papirja. Prav tako se ne moreta zliti v eno. Alternanca prisotnosti in odsotnosti omogoča etično in teološko komponento odnosa in hkrati onemogoča njuno ločitev ali zlitje. Dokler so subjekti v odnosu, odnos deluje z obema komponentama.

Prisotnost ali odsotnost med subjekti ne more biti nikoli absolutna. Absolutnost ene bi namreč pomenila izničenje druge. Želja, da bi prisotnost ali odsotnost »potegnili« do skrajnosti, ni uresničljiva, vse dokler živimo. Če bi se teoretično uresničila, bi to pomenilo konec etičnega in teološkega in s tem konec človekovega življenja, našega skupnega življenja.

5. Ko se nasprotje med prisotnostjo in odsotnostjo razmakne do skrajnosti, se znajdemo v veri.

Toda nasprotje prisotnosti in odsotnosti med subjekti se paradoksalno vendarle razmakne do skrajnosti, ne da bi izničili eno izmed njiju. Takrat v odnosu nad etično

[4] Beseda »l'entretien« v sebi nosi naslednje pomene: odnos, komuniciranje, srečevanje, vzdrževanje stanja, predvsem pa tisto, kar omogoča subjekte.

komponento prevlada teološka komponenta. To se zgodi takrat, ko nam je nekdo neskončno blizu in istočasno neskončno daleč. Pravzaprav sta skrajna bližina in oddaljenost sinonima: istovetnost je popolna drugačnost. To se zgodi, ko drugega imenujemo »ti« v njegovi odsotnosti (nepoznanju) ali ko v drugem prepoznamo samega sebe. Prisotnost in odsotnost med subjekti se razmakneta do skrajnosti, ko drugi iz končnosti pobegne v neskončnost, da se zdi, da se je izničil, a vendar se odnos med nama ne prekine. Še vedno ga lahko pokličem s »ti«. Drugi se oddalji do take mere, da se moj 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 - vera, ki je odnos do partnerja, ki »ga ne poznamo«.

Vere ne moremo razumeti drugače kot v primeru, ko je drugi odsoten do skrajnosti in vendar ne izgine in ko je istočasno prisoten do skrajnosti in vendar ne postane »jaz«. Tako je v veri drugi prisoten tudi v svoji odsotnosti.

6. Ker je vera sestavni del vsakega odnosa, odnos do slehernega drugega postane možen prostor odnosa do Popolnoma drugega – Boga.

Ker je drugi v prisotnosti vedno tudi odsoten, je vera sestavni del vsakega odnosa. Skrajna odsotnost, ki hkrati zahteva tudi skrajno prisotnost, pa »gledanje« drugega popolnoma podredi veri. Oziroma vera (teološka komponenta) postane nosilka odnosa, ne da bi ukinila etično komponento. Nasprotno, prisotnost, ki omogoča etično komponento odnosa, je v hkratni skrajni odsotnosti drugega spremenjena v skrajno prisotnost. Takrat »drugi« postane "Popolnoma drugi". Popolna različnost pa je tudi sleherna različnost. Zato je »Popolnoma drugi« hkrati »sleherni drugi«.

7. Teološka komponenta reši etično, ko smrt ogrozi odnos.

Smrt ogroža človekovo eksistenco. Gledano z materialističnega stališča s smrtjo oseba preneha obstajati, ker se 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.

Vsi smo se znašli v igri prisotnosti in odsotnosti. Med nami se izmenjujeta prisotnost in odsotnost, bližini sledi oddaljenost, nato zopet bližina itd. Vsakdo pa lahko izbira, ali to izmenjavo sprejme ali pa jo zavrže. Sprejetje pomeni nadaljevanje komuniciranja, odklonitev pa pomeni prekinitev izmenjave prisotnosti in odsotnosti. Ko z biološko smrtjo odsotnost prevlada nad prisotnostjo, sprejetje te odsotnosti kot dela alternance pomeni nadaljevanje komuniciranja z drugim v njegovi odsotnosti (v veri drugega še vedno lahko kličemo »ti«). Nesprejetje te odsotnosti drugega kot dela alternance pa pomeni konec komuniciranja ali konec odnosa.

V svetu odnosov torej ne govorimo več o bivanju in nebivanju, temveč o komunikaciji med subjekti. Udejstvovanje v njej pomeni ostajanje v skupnosti. Ker tebe lahko pokličem s »ti« tudi po tvojem fizičnem odhodu, je to dokaz, da se odnos s smrtjo ne prekine, temveč se spremeni. Zato lahko rečem, da s tvojim odhodom vez med nama ne bo prekinjena. Skrajna odsotnost te hkrati naredi skrajno prisotnega.

Zvestoba komunikaciji s tistimi, ki so odšli, pa hkrati pomeni tudi okrepitev odnosa do živečih. Vera rešuje odnos do drugega tudi tako, da se odnos do odsotnega drugega izraža v odnosu do slehernega drugega. Skratka, teološka komponenta rešuje etično, ker je prva skrita v drugem. Kdor v odnosu do drugega živi odnos do Boga, lahko v življenju z nekom ali za nekoga živi s celotnim človeštvom in zanj. Neizključevanje katerega koli drugega pa gradi univerzalno bratstvo.

8. Odnos se izraža preko vere, upanja in ljubezni.

V krščanski tradiciji se vsak odnos izraža preko vere, upanja in ljubezni. Te tri kreposti vplivajo druga na drugo, se dopolnjujejo in omogočajo delovanje odnosa. Ko nasprotje med prisotnostjo in odsotnostjo doseže svojo skrajnost, torej ko človek veruje, upa in ljubi drugega v njegovi skrajni odsotnosti, te kreposti postanejo teološke kreposti.

Vera ni identična védenju, ki z določanjem njegove vsebine drugega približuje. Nasprotno, verovanje odločno ohranja razdaljo. Vera ne gleda na objekt in ne določa nobene vednosti o drugem, niti o Bogu ne. Vera ni neka določena predstava[5] Boga, čeprav jo ta vedno spremlja. Védenje in vera nista identična, čeprav sta "zaveznika". Če prvo preveč vztraja pri prisotnosti, druga opozarja vernika, da bi izključujoča prisotnost onemogočila skupno bivanje ljudi. Če védenje teži, da bi odsotnost nadomestilo s prisotnostjo, vera počne ravno nasprotno. Guy Lafon misli na tako vez med vero in vedenjem, ko pravi: « *les fidèles d'une religion se donnent, souvent sans les choisir, des représentations particulières, à commencer par celle de Dieu »*[6].

Vera je neločljivo povezana z upanjem. Vera namreč ni v polnosti sinonim za izraz »teološka komponenta odnosa«. Njen »zaveznik« vedenje namreč želi odpraviti odsotnost, upanje pa, ki je popolnoma tuje védenju, izhaja iz želje, ki predpostavlja ohranitev odmika, ker drugače ne želja ne upanje nimata moči.[7] Zato se teološka komponenta predstavlja tudi kot upanje. Ker pa je upanje iz reda želja, njegova izpolnitev pomeni konec upanja. Zato vera in upanje ne zadoščata. Teološka komponenta poleg vere in upanja potrebuje še ljubezen.

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[5] Ko si verniki ustvarijo o Bogu čisto določeno predstavo, preidejo iz področja vere na področje védenja.

[6] Lafon G, *Le Dieu commun*, Paris, Seuil, 1982, 85. (»Verniki neke religije si pogosto postavljajo, ne da bi to želeli, konkretne predstave, začenši s predstavljanjem Boga.)

[7] Prav tam, 88.

Ljubezen kot že prej upanje ne pozna posedovanja. To je obema sovražno. Oba živita iz pričakovanja in pomanjkanja.[8] Ljubezen pa, drugače kot upanje, dovoljuje srečanje : *« Dans l'amour, la rencontre est cette atteinte qui, loin de réduire le désir, l'entretient plutôt, le fait lever sans cesse. »*[9]

Guy Lafon spregovori o tretji teološki kreposti takole: « *L'amour suppose la différence, l'écart, la séparation et il est, dans le même temps, effort pour les supprimer, mais un effort assorti de la joie de n'y pas parvenir. Du fait qu'il n'existe que si la distance est maintenue, l'amour est de l'ordre du désir* »[10]. Guy Lafon poveličuje in poje slavo ljubezni, ki v srečanju omogoča srečo v pričakovanju, ki se ne iztroši. Zato je ljubezen « odnos par excellence ». Za dobro ima, da se nikoli ne pride do cilja, ki bi ljubezen pokončal.[11]

9. Po zaslugi nekega dogodka, katerega znamenje je pričevanje neke ustanove, je etični odnos postal izraz odnosa do Boga.

Kristjani v veri izpovedujemo učlovečenje Boga. Izpoved te vere povezuje vernike v občestvo vernih. Povezanost pa se ne konča v institucionalnih mejah Cerkve, temveč vera spodbuja kristjana, da gradi univerzalno bratstvo vsega človeštva.

Da bi spoznali pomen, ki ga ta misel nosi v sebi, zadostuje, da se zaustavimo pri 25. poglavju Matejevega evangelija, kjer Kristus pravi : »Karkoli ste storili kateremu izmed mojih najmanjših bratov, ste meni storili!« Bog, ki je »popolnoma Drugi«, se identificira s »slehernim drugim«. Tako se v človekovem odnosu do katerega koli drugega izraža odnos do Boga. Živeti odnos z drugim v odnosu do Čisto drugega veže vernika na vse druge. Tu živi povezanost z Bogom. Nespoznavni se pusti najti v odnosu do slehernega drugega in ostaja nespoznan. Pravzaprav etično nosi samo v sebi teološko in obratno. Vera, upanje in ljubezen, po katerih se izraža naš odnos do bližnjega, nas vodijo k Bogu in nam hkrati odkrivajo zakon, po katerem bomo uresničili naš odnos z drugim.

3. Vera iz človeka naredi vernika

Vsi torej živimo v materialnem in duhovnem svetu hkrati. Istočasno si zidamo hišo in ustvarjamo dom. Zavedamo se, da življenje ni le jed in pijača, temveč da življenje omogočajo tudi odnosi, ki nas povezujejo med seboj. Ti dajejo našemu bivanju veliko večji pečat kakor imetje, ki ga posedujemo. Medčloveški odnosi pa ne posegajo na področje védenja, temveč na področje vere, v kateri se, posredno ali neposredno, zavestno ali nezavestno, znajde vsak človek. Verovati namreč pomeni zaupati oz. nekomu, ki ga ne poznaš, reči »ti«. Ker pa je naše (s)poznanje drugega zelo omejeno, je torej življenje brez vere popolnoma nemogoče. Zato je za vsakega človeka zelo pomembno vsaj nekoliko poznati verovanje, v katerem se je že znašel.

Znanstveno razpravljati o verovanju pomeni govoriti o tem odnosu, v katerem smo se znašli. V tem primeru zibelko in ohranjevalko življenja, v kateri preprosto smo, spremenimo v objekt opazovanja. Prav tako lahko odnos spremenimo v objekt opazovanja tudi takrat, ko se prisotnost in odsotnost med nami razmakne do skrajnosti, ko se drugi spremeni do take mere, da ga ne (pre)poznamo več in ga kljub temu še vedno kličemo s »ti«.

Toda »govorjenje o drugem«, spoznanje ali znanost, ne prinaša življenja v polnosti. Življenje prejmeš v polnosti takrat, ko te objekti spoznanja sploh ne vznemirjajo več, temveč komuniciraš z »drugim«, četudi ga ne poznaš. Zato tudi poznanje in priznanje Boga ni odločilno: ko se človek znajde v odnosu z Njim, t.j. ko mu ne reče več »on« (ko več ne govori »o njem«), temveč mu reče »ti« (ko govori »z njim«), takrat človek postane vernik. Čim bolj si pripravljen drugemu podati roko, ne da bi ga vsaj malo poznal, a želiš biti ob njem in živeti zanj, ko te torej drugi kot objekt sploh ne vznemirja več, temveč komuniciraš z njim kot subjektom, takrat se znajdeš v veri, ki iz človeka naredi vernika. Ne moreš pa postati vernik na osnovi spoznanja Boga (ker ga pač ne moremo spoznati). Zato je znanosti verovanje nedosegljivo.

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[8] Prav tam , 90.

[9] Prav tam (V ljubezni je srečanje tista točka, ki ne izniči želje, temveč jo ohranja in jo brez prenehanja krepi.)

[10] Prav tam, 89 (Ljubezen predpostavlja različnost, razdaljo, ločitev in si istočasno prizadeva, da bi to troje izničila, toda prizadeva si v veselju, da tega ne bo dosegla. Ker ne more obstajati drugače kot v ohranjeni razdalji, je ljubezen iz reda želje).

[11] Prav tam.

Bog – verovanje ali izkustvo

Ali je umsko spoznanje skrajno spoznanje?

Zoran Mihajlović
Duhovna univerza
Zavod CDK, Ruska 13, Ljubljana
01 433-93-03
zoran.mihajlovic@cdk.si

Povzetek

Že od nekdaj zgodovina beleži mistične izkušnje, ki po opisih odstopajo od običajnega spoznavanja sveta in so predstavljale oz. še predstavljajo osnovo za iskanje odgovorov na večna vprašanja o obstoju boga, duše in duhovnih plasti življenja. Glede na občutek izjemne realnosti doživetega, glede na množičnost pojava, ki je prisoten v vseh kulturah sveta, pa tudi glede na pozitivni vpliv izkušenj na kvaliteto življenja (prebujen etični čut, kreativnost ipd.), lahko sklepamo, da mistične izkušnje vendarle imajo neko realno ozadje. Obstajata dva temeljna pristopa k spoznavanju boga: dualistični in panteistični pristop, pri čemer prvi gradi na veri, drugi pa na neposredni izkušnji.
Za spoznavanje je potrebna drugačna, višja oblika kognitivnosti, ki lahko odstre neraziskane plasti človeka. Za ta spoznavni pristop se uporabljajo različna poimenovanja: višja zavest, intuicija, dušna zavest ipd. Te spoznavne mehanizme lahko dosegamo z metodami, ki jih je razvijal predvsem Vzhod in so utemeljene na umiritvi mentalnih procesov in razumskega moduliranja zunanjega sveta. Z razcvetom novodobnih duhovnih iskanj pa so dobili večjo težo tudi v Zahodnem svetu. Vključitev tovrstnih kognitivnih načinov spoznavanja, ki potekajo mimo običajnega, diskurzivnega spoznavanja, lahko odpre nov zorni kot razumevanja človeka in obogati sedanja spoznanja o naravi in bistvu človeka.

Problem spoznanja duhovnega sveta in božje prisotnosti

Kako spoznati boga? Ali je to sploh možno? Je bog zgolj stanje duha ali morebiti celo stanje neaktivnosti razuma? Kako torej dokazati ali ovreči obstoj najvišje entitete? Zaenkrat se kljub nekaj tisočletnemu poizkusu utemeljevanja realnosti božje prisotnosti, le-ta izmika tako utemeljitvi kot zavrnitvi njenega obstoja. Možna razloga sta dva: da boga sploh ni ali pa je način spoznavanja teh razsežnosti obstoja neustrezen.

1. *duhovnega sveta in božje prisotnosti v resnici ni.*

Ta trditev je privlačna, saj če sprejmemo tezo, da je razum najvišja oblika spoznavanja, in če kot taka ne prinese pritrdilnega rezultata o vprašanju boga, lahko sklepamo le, da boga ni in ga v resnici ni moč izkušati. Po drugi strani pa se je s trditvijo, da v mističnih izkušnjah čisto ničesar ni, da je vse skupaj zgolj iluzija nepotešenega razuma, spričo premnogih opisanih izkušenj iz različnih kultur sveta, težko strinjati. Med drugim tudi ali predvsem zaradi očitnih posledic tovrstnih doživetij: prebuditev etičnega čuta, kreativnega navdiha, pomiritve, spodbude (Vpr. DU-1/2, CDK, 2003, N=44)

2. *racionalni spoznavni pristop ne seže v sfere, ki jih dosega mistično izkustvo oziroma od vzorcev izčiščena in neodvisna zavest.*

Obstoja boga ni mogoče dokazati na isti ali podoben način kot fizikalne zakone. Kar pomeni, da morda božansko obstaja na neki drugačni bivanjski osnovi, ki je našim čutilom in razumski sposobnosti zaznavanja nedostopna. Zato gredo subjektivno intenzivne in nedvoumne izkušnje mimo diskurzivnega spoznavanja oz. umevanja.

Ali je izkušnja možna - višje oblike kognicije

Torej se spričo navedenega zastavlja vprašanje – ali je umsko spoznanje res skrajno spoznanje? Ali morebiti ne obstaja nekakšna višja oblika kognicije, ki predstavlja osnovo za mistične izkušnje? Tradicije tako Zahoda kot Vzhoda govorijo o višjih stanjih zavesti, o kozmični zavesti, ki omogoča globlji uvid v resnico življenja, v transpersonalni psihologiji se omenja izraz vrhunsko izkustvo (Maslow, 1954).

Že od pradavnin obstajajo pričevanja tako religioznih mistikov kot običajnih ljudi, ki opisujejo bodisi mistično izkustvo srečanja z Najvišjim, bodisi spremenjena stanja zavesti, ki omogočajo drugačno zaznavo. Danes se spričo porasta zanimanja za tovrstna vprašanja kopičijo dokumentirani primeri podobnih izkušenj, ki jih omogočajo različne oblike samospoznavanja - v glavnem gre za meditativne postopke. Novodobna duhovna iskanja namreč človeka vidijo kot večplastno duhovno bitje, ki ga je v procesu duhovne rasti potrebno spoznati z neko drugačno spoznavno metodo, ki ni utemeljena na logiki ali razumu.
V mnogih primerih tovrstnih izkušenj govorijo o spremenjenem nivoju spoznavanja – o višji kognitivni sposobnosti, ki po svoji pronicljivosti presega zavest običajnega budnega stanja in je utemeljena na čisti, z mentalnimi vzorci neobarvani zavesti. Uporabljajo se izrazi: "intuicija", "višje stanje zavesti", "čista zavest" (čit

– na Vzhodu), tudi "dušna zavest" ipd. Indijski modrec Ramakrišna je zapisal: "Boga ni mogoče videti z zemeljskimi očmi. Bog se kot čista zavest razodene čisti zavesti." (1994)

Dualistična mistika

Zahod gradi stik z bogom predvsem preko dualističnega odnosa. Kar niti ni nenavadno, glede na to, da je v vseh treh prevladujočih monoteističnih verstvih že v temeljnem nauku (Svetem pismu, Stari zavezi, Koranu) za osnovni okvir postavljen dualizem: bog je ustvaril svet. Torej obstajata, dva med seboj raznolika pola, Bog in svet. Če k temu dodamo še dejstvo, da je zahodna civilizacija predvsem razumska – torej razločevalno analitična, pridemo do odgovora na vprašanje: zakaj zahodni človek vendarle doživlja boga kot nekaj, kar je ločeno od njega.

Odtod izhaja prevladujoče prepričanje o nemoči, da bi s trudom dosegli božansko. Ali drugače: ključni element, ki prinese spoznanje in zlitje z Najvišjim, je božja milost. Tako je aktivna vloga vernika usmerjena predvsem v moralno-etično čistost ter karitativnost, ki sicer dajejo določeno notranje zadovoljstvo, oprijemljivejši rezultat pa prinesejo predvsem po smrti ob poslednji sodbi.

Sv. Simeon (bizantinski menih in mistik, 949-1022) pravi, da je mistično doživetje "karizma", božji dar in da ga s samim človeškim naporom ni mogoče doseči.
Prof.dr. Lev Milčinski je pred leti (1985) zapisal v prispevku o Mističnem in meditativnem doživetju, da je "… ena od značilnosti mističnih izkušenj določena pasivnost oz občutje, da gre za nekaj, česar si človek ni sam izdelal, kupil ali priboril, temveč mu je bilo naklonjeno, darovano. V tem lahko vidimo potrditev teze, da prava mistična izkušnja lahko pride le po božji milosti." Podobne rezultate zasledimo tudi pri drugih tovrstnih raziskavah npr. W. James (1929) ali J. Musek (1995).

Lahko bi sklepali, da so zahodni mistiki (Avrelij Avguštin, Frančišek Asiški) s svojimi poizkusi neposrednega zlivanja z božanskostjo presegli ta temeljni dualizem, vendar to ne drži. Neposrednost se nanaša bolj na samostojnost iskanja, neodvisnost od tretje osebe ali institucije. Sicer pa gre pogosto za dialoge z bogom, pri katerih se vernik obrača na Najvišjega po nasvet ali pomoč. V ozadju torej je dualizem.

Tudi na Vzhodu zasledimo element neaktivnosti. Tako v indijskem epu Mahabharata vojščak Ardžuna ne spozna boga (Krišne), dokler se mu ta sam ne razodene. Šri Aurobindo (1991) je učil: "Srečanje med človekom in Bogom je v resnici zmeraj v tem, da Božansko prežame in vstopi v človeško in da se človek vtopi v Božansko."

Vera kot invokativni element

Ramakrišna pravi, da " … bhakti ne more postati eno s sladkorjem, temveč želi izkušati sladkost sladkorja. Bhakti nikoli ne pravi: Jaz sem Brahman " (kot npr. zasledimo v Vedanti) (Reki str. 132). Vprašanje je tudi, ali si dosego takšnega cilja v resnici želi. Ali morebiti zlitje sploh ne sodi v njegov odnos do boga, saj mu zaradi doživljanja velikanskega razkoraka med božanskim in posvetnim, ki mu kot osebnost pripada, doseganje tovrstne enovitosti v resnici predstavlja nepredstavljiv cilj?

Pri takšnih, dualističnih temeljih, je za glavnega nosilca duhovne izkušnje postavljena vera. Vera v božjo eksistenco ter posledično v božanske atribute: pravičnost, dobrohotnost …

Obstajajo najmanj trije temelji za nastanek vere v boga, so si pa različni glede na osnovo, iz katere izhajajo.

1. racionalno utemeljena vera, pri kateri je osnova privzeti miselni koncept: v ozadju je npr. "logična razlaga", ali "glej, vse religije o tem govorijo", "večina človeštva veruje v Boga"
2. iracionalna, subjektivno utemeljena vera – slutnja, notranji občutek, "čutim, da je to tako" (lahko nestabilna, občutki varirajo)
3. iracionalna, vendar na izkustvenih temeljih: osnova je mistična izkušnja, izkušnja duhovnih globin ipd. (trajna vera, ki redko zbledi)

Izkušnja močno vpliva na vero. Običajno mistično izkustvo še okrepi vero v boga, in močnejša vera predstavlja okrepljen invokativni moment. Vera in izkušnja sta tako v resnici elementa, ki sta, ko gre za boga, tesno soodvisna in se podpirata.

Enovitost boga in človeka

V nekakšnem nasprotju s prepuščanjem božji milosti se zdijo novodobna duhovna iskanja, ki prinašajo mistični koncept Božanstva kot zamisel o Celoti vsega, torej tudi o njegovi Enovitosti.

Že filozof Plotin ob opisu mistične izkušnje pravi: "V tej izkušnji ni dvojnosti. Dvojnost obstaja samo v ločenosti. Zato se ta izkušnja tudi upira opisu. Človek, ki je doživel zlitje s plimami Najvišjega, ne more govoriti o njih, kot da so ločene ..."
Takšen, panteističen, pristop zahodni filozofiji torej ni tuj (naj omenim vsaj še Spinozo in Bruna), v glavnem pa je v novodobnih duhovnih smereh povzet iz vzhodnih duhovnih iskanj, kjer je nekoliko bolj prisoten in je morda najizrazitejši v *advaiti* (nedvojni) *vedanti* ter nekaterih oblikah *joge* (npr. *radža* in *džnjana joge*). Ključni temelj *vedante* je rek *atman=Brahman*. Ali drugače: Človekov duhovni temelj (*atman*) je v enosti s kozmičnim duhovnim temeljem (*Brahman*). Podobno preberemo v indijskih Upanišadah: *Tat tvam asi* – tisto najvišje, kar je očem skrito in je povsod prisotno, tisto si ti.

To pa v osnovi precej spremeni možnost spoznavanja božjega. Če velja formula atrman=brahman, človek nikoli ni ločen od boga. Le v subjektivnem doživljanju se kaže razkorak med njima. Na nek način se odstro vrata do

božanskih globin preko lastnih duhovnih temeljev oz. preko lastne zavesti.
Na tej osnovi se pojavlja tudi razlika v temeljnem odnosu do spoznanja Najvišjega. Na Zahodu je v ospredju predvsem vera v boga, saj je ta odmaknjen v drugi pol stvarstva; medtem, ko je na Vzhodu, vključujoč tudi bhakti smeri, v temelju odnosa predvsem enost. S tem se izkušanje božjega precej približa, postane realno in je odvisno od sposobnosti poglabljanja v lastne duhovne korenine.

Človek kot aktivni dejavnik
Ta pristop iskalca boga postavlja v bolj aktivno vlogo. V ta namen so nastali nasveti in prijemi, ki prefinjujejo zavest, jo osrediščajo vse do točke ničnosti oz. izničenja zunanje jaznosti, ko ostane zgolj sposobnost golega nepogojenega spoznavanja.

Eden najpogostejših ključev za dosego tega cilja je očiščenje zavesti konceptualnih modelov in podob, ki vežejo zavest nanje (temu se posvečajo različne oblike jog, budizem, zen …). *Joga citta-vrti nirodha* je temeljni rek Panjdžalijeve Nanizanke o Jogi. Jogo (zlitost, enost med duhom in materijo) dosežemo z ukinitvijo modifikacij uma, oz. z ukinitvijo vrtincev zavesti na vseh ravneh njenega delovanja. Ali kot je zapisal prof. dr. Marko Uršič (1994): Gre za "Usrediščenje krožnega toka zavesti v enem samem stanju – čistega brezčasnega bivanja."
Pri tem je treba opozoriti na vizualizacijske meditativne tehnike, ki so utemeljene na izgradnji mentalnih form, vendar je njihov pomen zgolj prehodnega značaja – so opora – in v končni fazi ravno tako morajo izzveneti v čisti zavesti (čit).

Nauk vedante pravi: edina resničnost in edina snov je Brahman – vse ostalo je maja. Po vzhodnih naukih je torej ena glavnih ovir za dosego mističnega izkustva nemirni, po informacijah hlastajoči razum, ki ga v budizmu opisujejo "… kot opica, ki skače z veje na vejo …". Problemu čistosti oz. konceptualne in občutkovne neobarvanosti zavesti se je vzhodno duhovno iskanje temeljito posvetilo. Pomembno vlogo v tem smislu igra nauku o *maji* – temeljni iluziji razuma, ki je osnova za mentalno oblikovanje podob zunanjega sveta. Seveda so isti problem moduliranja razuma obdelovali tudi zahodni misleci (npr. Platon s Podzemno votlino, Kant z naukom o nespoznavnosti stvari na sebi), vendar na duhovno iskanje, v tem smislu kot nauk o *maji* na Vzhodu, niso imeli večjega vpliva.

Torej se z lastnim trudom da dvigniti kvalitativno stanje osebnosti do te mere, da omogoča stik z duhovnimi sferami. Kljub temu se tudi na Vzhodu implicitno razume, da brez pripravljenosti in odprtosti "na drugi strani" ni rezultata. Vseeno pa Vzhod vidi iskalca pretežno kot aktivega akterja v procesu srečanja z bogom in ne toliko kot odvisnika od božje milosti. Kar pa seveda ne drži za vse duhovne smeri Vzhoda.

Nedvoumno je, da je vzhodna religija pretežno izkustvena religija in je po tej plati lahko nekoliko bliže znanosti. Morda bi celo lahko rekli, da je nekakšen spoj znanosti in vere, kar pričajo nekateri sveti teksti (npr. staroindijske Vede), v katerih je poleg opisov duhovnih svetov zaslediti tudi razlage zakonitosti same narave in sveta. Znanosti pa se približa tudi ob iskanju konkretnega ponovljivega izkustva (eksperimenta). Je pa vendarle, tako kot zahodne religije, utemeljena na veri v smislu globokega zaupanja, predanosti ter odprtosti do duhovnih globin.

Kako do mistične oz. duhovne izkušnje?
Po Ramakrišni lahko povzemam preprost model odnosa do boga:

1. "Bog je tam zgoraj"
2. "Bog prebiva v vseh srcih … "
3. "Vse, kar vidimo, so le različne oblike enega in istega boga."

Od tega, kakšno predstavo o bogu imamo, je odvisen način, kako bomo pristopali v stik z njim. Pri dualističnem doživljanju boga je to molitev. Je nekakšen nagovor bogu ali priprošnja za božansko skrb, morda intervencijo. Pri drugi in tretji točki pa poglabljanje v lastne duhovne globine oz. globine zavesti.
Eden od najbolj razširjenih postopkov za doseganje duhovnih izkustev je meditacija. Pri tem je potrebno poudariti, da je beseda meditacija zelo širok pojem, in se ga uporablja v različnih povezavah (razmišljanja, sproščanje, poslušanje glasbe …). V najožjem smislu besede, pa je namenjena preseganju čutnih, duševnih in mentalnih vsebin, s ključnim namenom srečati se z duhovnimi sferami življenja.

V tej povezavi se prepletata dva tipa izkušenj: prva je doživljanje božjega blagoslova v smislu objemanja ali spuščanja božanske prisotnosti, božje milosti na meditanta (blaženost, luč, energija ipd), drugi pa je povezan predvsem s trudom doseči "dvig v svet transcendence", kjer se zgodi zlitje in izginotje v Božjem objemu. Gre za odtegnitev iz pojavnega sveta, za popolno abstrakcijo zavesti iz sveta materije – iz fizičnega telesa, pa tudi iz duševnosti in razuma, kar je pogoj za zlitje - *samadhi*. Življenjske funkcije običajno zdrknejo na komaj zaznavni minimum, med tem ko meditant ne ve ne zase kot fizično bitje, ne za dogajanje okoli sebe, ne za čas. Vse kar doživlja, je zlitost, enost bivanja. To je tudi razlog, da se ponekod samadhi opisuje kot "stanje transa" oz. "smrt jogija". Morda bi vzporednico temu stanju lahko našli v zahodnem "unio mystica" ali judovskem "sabatu sabatov".
Takšno stanje lahko traja od nekaj kratkih minut, pa do nekaj dni, v izjemnih primerih celo nekaj mesecev (Indijski modrec in mistik Ramakrišna naj bi v samadiju preživel 6 mesecev.)

Uporabnost izkušenj
Ali je čista zavest, kot višja kognitivna sposobnost, lahko temelj za nove korake v spoznavanju sebe in sveta? Raziskave kažejo velik odstotek ljudi (v ZDA med 50 in 85 %.), ki so prepričani, da so imeli mistične izkušnje. Tudi če se precejšen procent teh izkušenj ne nanaša na tiste najgloblje, ki bi jih lahko povezali z izkustvom božanskosti, so vseeno signifikantni pokazatelj, ki nakazuje resno možnost, da je izkušnja dostopna mnogo širšemu krogu ljudi, kot so zgolj mistiki in duhovni iskalci. Glede na to, da je v ta stanja zavedanja moč vstopiti tudi nadzorovano, z določenimi "prijemi", se odpira logično vprašanje: ali ni to morebiti pot, za nov korak v spoznavanju sveta. Na začetku morda zelo zahteven korak, pozneje s prakso in izkušnjami pa čisto uporaben in dostopen. Konec koncev je tudi razum kot spoznavni princip začel dobivati krila šele s starimi Grki in pozneje z razsvetljenstvom.

Sklep
Če duhovna plat življenja obstaja, oziroma če morebiti obstaja sam Bog, potem se že po definiciji zagotovo razodeva, ne zgolj objektivno skozi stvaritev sveta, temveč tudi preko možnosti subjektivnega doživljanja. V tem primeru ga je moč izkusiti, vendar ne z običajnimi kognicijskimi metodami. Kako ta proces spoznavanja toliko približati znanosti, da bo lahko nedvoumno potrdila ali ovrgla obstoj nematerialne plati življenja, pa je proces, ki se v današnjem času šele začenja? Pričujoča kognitivna konferenca je lahko korak k iskanja novih pristopov in drugačnih oblik kognicije, ki bi lahko odprle novo smer raziskovanja in umeščanja človeka tako v materialni, kot subjektivni prostor.

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ZAVEDANJE ONKRAJ MOŽGANOV

Darja Cvek Mihajlović
Duhovna univerza
Zavod za izobraževanje, vzgojo, razvoj in kulturo
Ruska 13, 1000 Ljubljana, Slovenija
+386 1 4339303
darja.cvek@cdk.si

Povzetek
Povezava med umom in telesom še vedno ni povsem pojasnjena. Ali lahko zavest (um) deluje ločeno, neodvisno od fizičnega telesa (možganov)? To je predmet številnih raziskav:

- **izkušenj bližine smrti (v nadaljevanju okrajšano IBS; angleško NDE – Near Death Experience) in**
- **zunajtelesnih izkušenj (v nadaljevanju okrajšano ZTI; angleško OBE – Out of Body Experience).**

Izkušnja bližine smrti - IBS - pri pacientih, ki so preživeli srčni infarkt
Ljudje, ki jim je odpovedalo srce, so pogosto imeli obsmrtno izkušnjo. Da zdravniki potrdijo klinično smrt ob srčnem infarktu, so potrebni trije kriteriji: odsotnost spontanega dihanja, odsotnost srčnega utripa, čemur v nekaj sekundah sledi še prenehanje aktivnosti predela možganov, ki je odgovoren za ohranjanje življenja (možgansko deblo) in miselnega procesa (možganska skorja). Krvni pritisk pade na nezaznavno raven in istočasno možgani prenehajo delovati, kar je v približno 10 sekundah razvidno iz ravne črte možganskih valov na elektroencefalografu. Tako stanje je prisotno ves čas, ko oživljajo pacientovo srce z električnimi šoki ali adrenalinom, vse dokler pacienta ne oživijo.

Ker so torej možgani neaktivni, ne bi mogli pričakovati jasnega, dobro strukturiranega miselnega procesa, skupaj z jasnim spominom. V nasprotju z znanstvenimi pričakovanji so številne raziskave pokazale, da se tak miselni proces vendarle pojavi pri klinično mrtvih ljudeh, ki doživijo IBS. Tovrstne izkušnje seveda odpirajo nova vprašanja o povezavi med umom in možgani. Mar um živi dalje, tudi ko možgani ne delujejo več?

Raziskave IBS
Velika Britanija
Raziskava, ki je potekala v Splošni bolnišnici v Southamptonu (Southampton General Hospital) na kardiološkem oddelku in na oddelku intenzivne nege, je obsegala 63 ljudi, ki so preživeli srčni infarkt. 6-10 % ljudi, ki so doživeli srčni infarkt, je poročalo o IBS in ZTI. Kot je bilo izmerjeno v krvi, ni bilo ničesar, kar bi dokazovalo vpliv zdravil, kisika ali ogljikovega dioksida kot povzročiteljev teh izkušenj. Raziskavo sta vodila dr. Sam Parnia[1] in dr. Peter Fenwick (2001, Resuscitation).

Nizozemska
Dveletna raziskava 344 pacientov iz 10 bolnišnic, kjer so okrevali po srčnem infarktu, je pokazala, da je 41 ljudi (12 %) poročalo o IBS. Te paciente so po osmih letih od srčnega infarkta ponovno intervjuvali: poročali so, da imajo manj strahu pred smrtjo in da je njihov pogled na življenje globlji, bolj duhoven. Raziskavo je vodil kardiolog dr. Pim van Lommel (2001, The Lancet).

ZDA
Profesor Kimberly Clark z Univerze v Washingtonu (University of Washington) je poročal o primeru, ki je postal mednarodno znan, ko je pacientka doživela v bolnici srčni infarkt in ZTI. Zunaj telesa je popotovala v višja nadstropja bolnice in sicer v shrambo, v kateri seveda nikoli ni bila. Na vrhu omarice je videla star športni čevelj. Ko se je vrnila v telo in prišla k sebi, je povedala profesorju, kar je videla. Njeno videnje je preveril in prav vse podrobnosti so se ujemale, celo znamka izdelovalca športnih čevljev.

Zunajtelesne izkušnje - ZTI
ZTI je spontana, ali pa hotena ločitev zavesti od fizičnega telesa. Gre za izkušnjo, ko človek zapusti svoje fizično telo in ga opazuje, prav tako svet okoli sebe, s točke izven svojega telesa. Čez čas se zavest povrne v telo. Spontano lahko pride do take izkušnje v različnih življenjskih okoliščinah, ki sprožijo izstop zavesti iz telesa: bližina smrti, udarec z glavo, različni prehodi v nezavestna stanja (npr. anestezija), trenutki med budnostjo in spanjem, meditacije, molitve.

Kar nekaj literarnih velikanov je razodelo, da so doživeli ZTI, med njimi na primer Ernest Hemingway, Lev Tolstoj, F. M. Dostojevski, T. Edgar Alan Poe, D. H. Lawrence, Virginia Woolf, Honore de Balzac, Emmanuel Swedenborg, Allan Kardec.[2]

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[1] http://www.damaris.org/dcscs/readingroom/2001/neardeathexperiences.htm

[2] Sandie Gustus (2004) in http://www.victorzammit.com/book/chapter16.html

Raziskave ZTI

Fenomen ZTI je torej zanimiv za znanstveno raziskovanje tudi takrat, ko ne gre nujno za IBS. O pogostnosti ZTI in eksperimentih, ki potrjujejo, da je ZTI realna in tudi preverljiva izkušnja, lahko razberemo iz številnih raziskav:[3]

- Raziskava na sociološkem oddelku Univerze Duke (Duke University) je pokazala, da je ZTI imelo 27,1 % študentov (1954).
- Od 380 anketiranih študentov Univerze v Oxfordu (Oxford University), jih je 34 % doživelo ZTI (Celia Elizabeth Green, 1967).
- Karlis Osis, parapsiholog, je leta 1973 poslal odprto povabilo vsem v ZDA, sposobnim zavestne projekcije, naj to storijo v Ameriškem društvu za psihične raziskave (American Society for Psychical Research - ASPR) v New Yorku. Izbranih je bilo 100 ljudi. Štirje ciljni predmeti so bili skriti v vnaprej določeni zgradbi. 15 % udeležencev je podalo jasen dokaz, da so bili tam kot z nekakšnim ekstrafizičnim telesom.
- Raziskava J. Palmerja in M. Dennisa leta 1975 je pokazala, da je 25 % študentov in 14 % prebivalcev Charlottesvilla v Virginii imelo ZTI.
- Karlis Osis in Donna L. McCormick sta leta 1979 na ASPR v New Yorku preizkušala kinetični učinek projicirane zavesti. Merili so prisotnost domnevnega ekstrafizičnega telesa človeka, ki je izstopilo iz fizičnega telesa (Alexander Tanous je razvil sistem senzorjev v zapečateni sobi). V 197 poskusih je bilo 114 zadetkov in 83 zgrešenih zaznav.
- Na internetno raziskavo Mednarodne akademije za zavest (IAC – International Academy of Consciousness) leta 1999 se je odzvalo 7000 ljudi. Raziskava je obsegala 98 fenomenov, povezanih z ZTI. Kljub temu, da udeleženci te raziskave niso predstavniki običajne populacije (uporabljajo internet in imajo interes za raziskovanje paranormalnega), je ugotovitev raziskave ta, da ZTI doživljajo ljudje po celem svetu, različnih starosti, obeh spolov, z različnim etičnim, kulturnim, religiološkim ozadjem, različnih stopenj izobrazbe in socialno–ekonomskega stanja. Zanimivo je, da jih je od prvih 1185 ljudi, ki so se odzvali na raziskavo, kar 1007 poročalo o določenih senzacijah, ki se dogajajo pri ZTI.
- Dr. Robert Crookall je analiziral več kot 700 poročil o ZTI. 81% ljudi z ZTI je trdno prepričanih o življenju po smrti, kar pripisujejo osebnemu izkustvu zunajtelesnosti.
- Dr. Elisabeth Kübler-Ross je poročala, da je pri svojem delu naletela na izkušnjo, ko je slepi pacient videl določene dogodke, ko je bil zunaj telesa. Ti dogodki so se izkazali za resnične.

Leta 1966 je raziskovalec Charles Theodore Tart poskusil z mlado žensko, staro nekaj nad 20 let, znano pod psevdonimom gospodična Z., preveriti, če je možna zavestna projekcija (lucidna projekcija) v laboratoriju. Eksperiment je potekal v ZDA na kalifornijski univerzi (University of California at David) in sicer v štirih nezaporednih nočeh. Naloga gospodične Z. je bila, da prebere petmestno število, ki ga je naključno izbral Tart. Listek s številko je bil na polici, ki je bila 1,5 metra nad njo. Vsakokrat je ležala na hrbtu, z elektrodami na različnih predelih glave, obraza in rok, priključenimi na merilne inštrumente. Spremljali so možganske valove (EEG), REM (rapid eye movement), bazični upor kože (basal skin resistance – BSR), galvanski upor kože (galvanic skin resistance - GSR), srčni utrip in krvni pritisk. Zadnjo noč je poročala o videni številki: 25132. Bila je prava! Ko je bila gospodična Z. domnevno zunaj telesa, je EEG zapisal ravno črto možganskih valov in poudarjeno alfa aktivnost. Odsotnost REM-a kaže, da lucidna projekcija ni avtosugestija ali sanje, temveč specifično stanje zavedanja, drugačno od spanja, sanj, polsna, običajnega budnega stanja ali spremenjenih stanj zavedanja.[4]

Janet Lee Mitchell, raziskovalka v ASPR (American Society for Psychical Research) in Karlis Osis sta leta 1972 več mesecev, po 2 do 3 dni v tednu, raziskovala pojav videnja zunaj fizičnega telesa. Ingo Swann, surrealistični slikar in pisatelj, star 40 let (in tudi jasnoviden), je sodeloval pri tej raziskavi, ki se je odvijala čez dan, v sedečem položaju, in popolnoma budnem stanju. Elektrode so bile priključene na njegovi glavi in zatilju. Njegova naloga je bila opisati in narisati 8 skritih predmetov, ki so bili na ploščadi na višini 3,5 metrov od tal. Neodvisni sodnik je pravilno povezal 8 Swannovih risb in opisov z osmimi skritimi predmeti. Ko je bil zunaj telesa, je padla električna aktivnost in hitrejši možganski valovi so se pojavili v možganskem predelu, odgovornim za videnje. Padec v alfa stanje je bil bolj zaznaven na desni hemisferi. Vse ostale fiziološke aktivnosti so ostale nespremenjene.[5]

Mednarodna akademija za zavest (IAC)

Raziskovanju življenja onkraj fizičnega telesa se posvečajo tudi sodelavci Mednarodne akademije za zavest (International Academy of Consciousness, IAC).[6] Ustanovil jo je dr. Waldo Vieira v Braziliji, leta 1981, danes pa je razvejana po celem svetu. Posveča se raziskovanju zavesti, njenih potencialov in evoluciji, s posebnim poudarkom na njeni zmožnosti manifestacije zunaj fizičnega telesa (ZTI) ter pojavov, povezanih z ZTI.

[3] http://www.victorzammit.com/book/chapter16.html

[4] W. Vieira (2002)

[5] W. Vieira (2002)

[6] http://www.iacworld.org

"S tem, ko nam zunajtelesne izkušnje nudijo možnost izkušanja nevidnih in vendar obstoječih nefizičnih dimenzij, prispevajo k širjenju zavedanja – evoluciji zavesti in posledično k razvoju zunajčutnosti in senzitivnosti. Človek izkusi, da ni le fizično telo, temveč razvijajoča se zavest; dojame fizično rojstvo in smrt kot točki prehajanja med fizično in nefizično resničnostjo. Spoznanje, da obstaja življenje po smrti, prinese s seboj zavedanje o prepletenosti odnosov, sedanjih in preteklih, in seveda odstiranje naloge, globljega namena v tem fizičnem življenju."[7]

Navajam zanimivo raziskavo IAC-a, s katero tudi sama sodelujem. Tematiko zunajtelesnih izkušenj namreč obdelujemo tudi na Praktikumu intuicije, izkustveni smeri Duhovne univerze. Nekaj izbranih izkušenj smo objavili v knjigi z naslovom Ali živimo le enkrat? (Novak Škarja B. in sod., 2005).

Raziskava sodelavcev IAC-a se je odvijala na dveh seminarjih: avgusta 2001 v Évori na Portugalskem (84 udeležencev) in decembra 2001 v Segovii v Španiji (21 udeležencev).[8]
Da bi spoznali, kako razum dojema, interpretira in 'zabeleži' informacije, do katerih pride med ZTI, so imeli eksperimentalno sobo in ciljno sobo, v kateri so morali videti - v zunajtelesnem stanju - z računalniškim programom naključno izbrano sliko na zaslonu. S tem so izključili možnost prekognicije (ekstrasenzorne percepcije), saj udeleženci ne morejo videti slike vnaprej. Slika je namreč le vzorec enic in ničel na računalniškem trdem disku.
Metodologija raziskave je temeljila na spoznanjih in izkušnjah sodelavcev IAC-a, da je ZTI objektiven pojav-zavest bi o njihovem mnenju dejansko lahko zapustila telo in delovala v nadfizični dimenziji. Zavest torej ne bi bila le lastnost fizičnih možganov, saj bi lahko preživela telesno smrt.
Analiza vprašalnikov udeležencev obeh seminarjev je pokazala, da je imelo ZTI 52 ljudi (od 105), zabeleženih pa je bilo vsega skupaj 93 ZTI.
Ugotovitev tega raziskovalnega projekta je pokazala, da je med samo projekcijo težje videti podrobnosti v fizičnem svetu. Lažje so videli oblike in barve (še posebej osnovne), težje pa so določali, kaj slika predstavlja. Ne glede na to, so imeli udeleženci težnjo, da so svojo zaznavo umestili v svoj osebni kontekst, na primer s prevodom geometrijskih oblik v stvari, s katerimi so imeli opravka v vsakodnevnem življenju. V bodočih raziskavah bodo zato raje uporabili prave predmete namesto slik.
Možna razloga za manj natančno zaznavo sta hipnagogno stanje in s tem manjša analitičnost ter razlika med fizično in nadfizično zaznavo (fizična zaznava uporablja specifične nevronske poti, ki omogočajo lažje pomnjenje in spominjanje; zunajtelesna zaznava pa ne prihaja do možganov po teh specifičnih nevronskih poteh, kar posledično pomeni manj natančen proces pomnenja).

ZTI se tudi bistveno razlikujejo od običajnega sanjskega doživljanja:[9]

- Aktivna, budna zavest v ZTI je sposobna sprejemanja odločitev in uporabe mentalnih atributov (v sanjah je več pasivnosti in ni nadzora nad izkušnjami).
- Okolja in situacije, doživete med ZTI, so urejene in smiselne (v sanjah so najpogosteje zmedene in nesmiselne).
- Situacije v ZTI se pojavijo neodvisno od ustvarjalnih in domišljijskih zmožnosti posameznika.
- Ker se ZTI zgodi onkraj fizičnih možganov, se je je težje spomniti.
- Ko je človek zunaj telesa, lahko vidi svoje fizično telo (sanje se pojavijo znotraj fizičnega telesa).
- Pri ZTI so pogosta doživetja svobode, razširjene zavesti in včasih evforije nad zmožnostjo letenja in prehajanja skozi fizične predmete (v sanjah so občutki in izkušnje bolj posvetne, zemeljske narave).
- Pogosta je zaznava nekakšnega subtilnejšega, nesnovnega telesa, ki se oddvoji od fizičnega telesa in vrne nazaj vanj (to se ne dogaja v sanjah).

Kaj pravi znanost o povezavi med umom in možgani?
Po uveljavljenem znanstvenem prepričanju je um produkt delovanja možganskih celic (nevronske aktivnosti). Dokazano je, da določeni skupki možganskih celic (nevronov) v različnih predelih možganov postanejo metabolično (kemijsko in električno) aktivni ob odzivu na določeno misel in občutenje. Iz tega se je oblikovalo splošno prepričanje, da je določen del možganov, ki so ga opazovali in se je metabolično spremenil, enak proizvajanju določene misli.

Vendar pa to lahko le nakazuje vlogo teh celic kot prenašalcev misli, in ne nakazuje nujno tudi izvora misli same. Neznanka nevrologije je namreč, kako možganske celice - nevroni, ki kot druge celice v telesu proizvajajo molekularne produkte kot so na primer proteini, lahko peljejo v subjektivno izkušnjo uma in misli. Čeprav je konvencionalni znanstveni pogled ta, da je razum produkt kompleksnih kemičnih in električnih procesov v skupinah možganskih celic, nevronskih mrežah, obstajajo tudi znanstveniki, ki se s tem ne strinjajo.

Drugačni pogledi - znanstvene hipoteze o nevronskih mrežah
Nekateri znanstveniki, med njimi sta najbolj opazna Stuart Hameroff, anestezist iz Arizone in Roger Penrose,[10] matematik iz Velike Britanije, zagovarjajo stališče, da je

[7] Sandie Gustus (2004)
[8] Nanci Trivellato in Wagner Alegretti (2002)
[9] Sandie Gustus (2004)
[10] www.consciousness.arizona.edu - Hameroff & Penrose/

lahko um ali zavest produkt kvantnega procesa v možganskih celicah.

David Wilde, raziskovalec na Univerzi v Manchestru[11] (University of Manchester), pravi, da je skupna ideja različnih teorij o ZTI ta, da v določenih okoliščinah možgani na določen način izgubijo stik s senzornimi informacijami telesa. To sproži serijo psiholoških mehanizmov, ki peljejo do ZTI.

V seriji predavanj na Univerzi Sorbonne (University of Sorbonne) v Parizu je profesor pediatrične kirurgije Bahram Elahi[12] definiral 'zavest' ali 'dušo' kot ločeno entiteto, narejeno iz subtilne materije, ki še ostaja neodkrita. Tako v nasprotju z običajnim prepričanjem definira 'duhovnost' kot samostojno znanost s svojimi zakonitostmi, teorijami in aksiomi.

Zaključek

Pojav IBS pri ljudeh, ki so preživeli srčni infarkt, in pojav ZTI, podpirata hipotezo, da je um, zavest ali duša ločena entiteta od možganov. To pa bo potrebno še dokazati z obsežnimi raziskavami o prisotnosti zavesti in aktivnega uma v času, ko možgani ne delujejo in je dosežen kriterij klinične smrti. Medicinske raziskave bodo prav gotovo osvetlile te izkušnje in verjetno nakazale, da morda po smrti ostaneta um in zavest. Če bodo rezultati pozitivni, bodo dokazali obstoj starodavnega filozofskega koncepta o duši in tako odprli novo polje znanosti. Tako spoznanje bi zagotovo pomenilo veliko spremembo v okviru razumevanja človeka in njegovih potencialov.

Naj zaključim z mislijo Roberta A. Monroa,[13] raziskovalca ZTI: 'Največja iluzija je, da je človek bitje omejitev.' ('The greatest illusion is that man has limitations.')

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[11] http://www.manchester.ac.uk/press/title,39579,en.htm
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[13] http://www.monroeinstitute.org/

Reinkarnacija – vera ali dejstvo

Barbara Novak Škarja
Center za duhovno kulturo
Zavod za izobraževanje, vzgojo, razvoj in kulturo
Ruska 13, 1000 Ljubljana, Slovenija
Tel: +386 1 4339303; fax: +386 1 4339303
barbara.novak@cdk.si

ABSTRACT

The subject of reincarnation was a matter of religious or personal belief up to the middle of the past century. Today, however, it represents a scientific hypothesis, whereby scientists try to explain the experiences of children who claim to remember their past life. Dr. Ian Stevenson, psychiatrist from Virginia, collected and investigated over 3000 such cases. In 35% of the cases, children had also one or more birthmarks or bodily defects, which were connected with the detrimental wound from the past life. Dr. Stevenson stated different hypotheses, including paranormals, to explain different features of the cases. For the more complex cases which include birthmarks and defects, reincarnation seems to be the only possible and reasonable explanation. "Why the main-stream scientists do not accept our evidence for reincarnation?" asks Stevenson himself. Accepting the hypothesis of reincarnation would mean scientific revolution, a big shift in the scientific paradigm. Reincarnation supposes that along with the physical there is another plane of life; that man is not only physical, but also spiritual being and perhaps that paralleling the biological evolution there is also the evolution of consciousness. Trying to explain some features like bioenergy, telecinesis and telepathy, science came to its limits. Will it be able to make a step forward and put these phenomena in the centre of its research? As Nikola Tesla said: When science starts to research nonmaterial phenomena, it will progress more in ten years than previously in centuries of its development.

1. Uvod

Nauk o reinkarnaciji ali nauk o ponovnem rojstvu, ki je bil do sredine prejšnjega stoletja stvar vere ali osebnega prepričanja, danes predstavlja eno izmed znanstvenih hipotez s katero skušajo pojasniti nenavadne pojave kot so: izkušnje otrok, ki trdijo da se spominjajo svojega preteklega življenja, njihova nenavadna nagnjenja, talente, načine vedenja, strahove, osebnostne motnje, telesne okvare in bolezni, ki jih ni mogoče pojasniti s pomočjo psihologije, medicine, genetike ali jih pripisati vplivom okolja. Izhodiščne predpostavke nauka o reinkarnaciji so naslednje (Novak in sod., 2005):

- človekova individualnost se izraža na več ravneh: fizični, energijski, čustveni, miselni in duhovni;
- po smrti fizičnega telesa človek biva naprej v svojem psiho-energijskem telesu in ohrani svojo identiteto, svoje čustvovanje in mišljenje; izgubi pa stik s fizičnim svetom, ki je možen edinole preko fizičnega nosilca oz. fizičnega telesa.
- po določenem času bivanja v psiho-energijski realnosti se psiho-energijski človek znova utelesi - poveže s fetusom
- kot kažejo raziskave obsmrtnih izkušenj (Williams Cook, in sod., 1998). se človekova zavest o sebi ob tem ko zapusti fizično telo, zbistri in razširi, medtem ko se pri utelešenju zavest zamegli in zoži (Platon je govoril o tem, da duša, preden se rodi, pije iz reke pozabe). Pri nekaterih otrocih ta proces zameglitve zavesti zakasni in prav njihove izkušnje današnji znanosti ponujajo okno, skozi katerega bo lahko, če bo to želela, pogledala in vstopila v svet, ki se morda nahaja onkraj fizične resničnosti.

V nadaljevanju prispevka bom povzela raziskave, ki jih je s svojimi sodelavci opravil ameriški psihiater dr. Ian Stevenson. V njih se osredotoča na izkušnje otrok, ki trdijo, da se spominjajo svojega preteklega življenja. Predstavila bom različne hipoteze, ki skušajo razložiti ozadje teh izkušenj ter pokazala njihov domet in pomanjkljivosti. V razpravi bom odprla vprašanja, ki bi jih hipoteza o reinkarnaciji, če bi jo sprejeli kot resnično, odprla na različnih področjih življenja.

2. Kdo je dr. Ian Stevenson?[1]

Ian Stevenson je bil rojen 31. oktobra 1918 in je svojo 40 letno kariero posvetil študiju primerov, ki nakazujejo možnost reinkarnacije. Sam pravi, da v njegovem življenju ni bilo kakšnega posebnega dogodka, ki bi usmeril njegovo zanimanje k psihičnim zadevam. Prišlo je naravno po študiju medicine, kjer se je posvečal psihosomatskim boleznim in psihiatriji. Kmalu je ugotovil, da obstoječe teorije ne morejo v celoti pojasniti vseh zdravstvenih in psiholoških problemov človeka, zato je začel iskati globlje in širše razlage. Leta 1964 je zapustil mesto predstojnika Odseka za psihiatrijo na univerzi v Virginiji in se popolnoma posvetil raziskovanju psihičnih fenomenov in reinkarnacije. To mu je omogočil Chester Carlson (izumitelj Xerox stroja), ki je zagotovil finančna sredstva za ustanovitev posebne katedre za to področje. Ne glede na to, da gre za mejno področje znanosti, je dr. Stevenson prav s svojo metodološko brezhibnostjo in izjemno objektivnostjo prispeval k resni obravnavi te tematike. Herbert S. Ripley, predstojnik psihiatričnega oddelka washingtonske univerze v Seatlu je o njem dejal: »Srečni smo, da imamo nekoga s tolikšno stabilnostjo in integriteto za raziskovanje tako kontroverznega področja«. Dr

[1] http://www.childpastlives.org/sf_stevenson_omni.htm

Harold Lief pa je v reviji Journal of Nervous and Mental Diseases zapisal: »Ali dela ogromno napako ali pa bo znan kot Galilej dvajsetega stoletja«.

3. Primeri otrok, ki trdijo da se spominjajo svojega preteklega življenja

Od leta 1964 dalje dr. Ian Stevenson skupaj s svojimi sodelavci dokumentira pričevanja otrok, ki trdijo, da se spominjajo svojega preteklega življenja. Gre za dokumentacijo, ki ni nastala na osnovi modnih New age virov, kot so »readingi« in hipnotična regresija, ampak gre za spontane spomine, pri katerih otrok vztraja mesece in leta, čeprav se družina pogosto močno trudi, da bi jih potlačila.

Primer 1: Suzanne je deklica, ki živi v Bejrutu in verjame, da se spominja življenja ženske, ki je umrla pri srčni operaciji v Richmondu. Ko je bila stara 16 mesecev je, po pripovedovanju staršev, vzela v roke telefonsko slušalko in rekla, »Hallo, Leila?« in to je ponavljala vedno znova. Kmalu je začela trditi, da je Leilina mama. Pri dveh letih je Suzzane omenila imena drugih otrok, ki jih je imela ta ženska, ter ime njenega moža, staršev in bratov – skupaj je imenovala 13 ljudi. Ko je bila stara 3 leta je recitirala del pogrebne slovesnosti za brata te ženske. Nazadnje je Suzanne prosila svoje starše, da jo peljejo v njen »pravi« dom. Poiskali so Libanonsko mesto, v katerem naj bi deklica živela v svojem prejšnjem življenju in našli družino, ki je ustrezala izjavam, ki jih je dala Suzanne. Ta družina, vključno z Leilino sestro je potrdila večino tega, kar je Suzanne navedla v svojih izjavah: imena oseb, krajev, citat s pogrebne slovesnosti. Suzanne je na fotografijah identificirala člane družine umrle ženske, katere življenja se spominja. Čeprav je bila otrok, se je do »svojih« odraslih otrok obnašala tako, kot bi se obnašala mati. Vprašala je tudi, če so strici, ko so se vrnili v Libanon razdelili njen nakit Leili in njeni sestri. To je bila želja, ki jo je izrekla na smrtni postelji in jo je poznala edino ta družina. Zvedeli so tudi, da naj bi ženska, katere življenja se Suzanne spominja, preden je šla na operacijo srca, obupano poskušala poklicati svojo hčerko Leilo.

Kot je razvidno iz primera, otroci navajajo zelo natančne podatke o osebah za katere trdijo, da so bili. Nekateri so sposobni prepoznati svoj prejšnji dom, soseščino. pa tudi še živeče prijatelje in sorodnike. Spominjajo se dogodkov iz prejšnjega življenja in tudi načina kako so umrli. Doslej so zbrali in dokumentirali preko 3000 primerov iz različnih dežel in kultur: Indija, Sri Lanka, Libanon, Turčija, Tajska, Burma, Afrika, Evropa, Amerika. Primerov je več v deželah s kulturo in religijo, ki sprejema nauk o reinkarnaciji. Razlog je lahko v tem, da v drugih deželah take izjave bolj pripisujejo otroški domišljiji, kot pa možnosti, da bi bili to resnični spomini iz preteklosti.

Pri otrocih, ki trdijo, da se spominjajo svojega preteklega življenja so ugotovili sledeče skupne značilnosti:

- Otroci začnejo govoriti o svojem prejšnjem življenju, brž ko se jim razvije dar govora. To spontano govorjenje se začne med 2. in 4. letom starosti in se nadaljuje vse do 5. in 6. leta, ko začnejo pozabljati na prejšnje življenje ali pa vsaj vse manj govoriti o njem.
- Otroci imajo pogosto nagnjenja, ki so neobičajna za sedanjo družino, vendar običajna za prejšnjo (izrekanje muslimanske molitve v hindujski družini, radi imajo določeno hrano, vedejo se, kot da pripadajo višji kasti, se drugače oblačijo …)
- Vedejo se zelo zrelo za svojo starost.
- Imajo fobije, ki ustrezajo načinu, kako so umrli.
- Mnogokrat imajo kožna znamenja in telesne deformacije, ki ustrezajo usodni rani iz prejšnjega življenja.
- Včasih bolehajo za kakšno boleznijo, za katero so bolehali v prejšnjem življenju in je sedanji družini tuja.

Analiza 895 primerov iz različnih kultur je pokazala, da ima 35% otrok, ki trdijo da se spominjajo svojega preteklega življenja tudi prirojena kožna znamenja in telesne okvare (Stevenson 1993). Ko je Stevenson (1997) na temelju medicinskega poročila ali mrliškega lista primerjal lokaciji rane in rojstnega znamenja, je ugotovil, da se v 88% primerov, za katere je obstajala taka dokumentacija, med seboj ujemata.

Primer 2: Deček Giriraj Soni je bil rojen marca 1979 v hindujski družini v vasi Morhi. Čeprav je porod potekal normalno, je imel deformiran hrbet in ramena ter številna znamenja na glavi, trebuhu in roki. Ko je bil star dve leti, je začel govoriti o svojem prejšnjem življenju, v katerem naj bi bil musliman Subhan Khan iz vasi Amla (27 km proč od njegovega rojstnega kraja). Hoora Bai, vdova Subhan Khana, je slišala za Girirajeve trditve in ga je obiskala. Njegovo vedenje in poznavanje dogodkov iz njunega življenja jo je prepričalo, da je reinkarnacija njenega moža. Obiskovala ga je 10 let, vse dokler se njegova družina ni preselila v drug kraj.

Subhan Khan je bil fizično zdrav človek. S silo si je prilastil kmetijsko zemljišče, kjer je živel z ženo in devetimi otroki. Bil je neizobražen in nasilen človek, vpleten v številne rope in izsiljevanja drugi ljudi. Mnogi so imeli težave z njegovim vedenjem, vendar se mu posamično niso upali upreti. Ko pa se je ponudila priložnost, so ga napadli v skupini ter ga z meči, kamni in težkimi kiji pobili do smrti. Znamenja in deformacije, s katerimi se je rodil Giriraj, ustrezajo poškodbam, ki jih je utrpel Subhan Khan.

Giriraj se je vedel nenavadno za sedanjo družino. Kot otrok si je privzel navado izrekati muslimansko molitev in pri tem vztrajal do 7. leta. Bil je grob v medsebojnih odnosih. Lomil je kruh z obema rokama in jedel kot necivilizirana oseba. Čeprav so bili v družini vsi vegetarijanci, je Giriraj zahteval meso in povedal, kako naj mu ga pripravijo. Bil je trmast in rad je kradel stvari iz hiše, česar nihče od njegovih bratov ni počel. Po dveh letih je zapustil šolo, medtem ko so vsi njegovi bratje končali srednjo šolo. Giriraj se je rodil obrezan, kar je zanimivo rojstno znamenje, saj naj bi bil Subhan Khan kot musliman obrezan, medtem ko za hindujce to ni običajno. Ko je bil star 7 let, se je Giriraj nehal spontano spominjati preteklega življenja, vendar pa mu je pri 15-tih še vedno močno ostalo v spominu, kako so ga umorili.

4. Metode raziskovanja

Metode raziskovanja, ki jih uporablja Stevenson so podobne tistim s področja prava in sociologije. Osnovna metoda raziskovanja je intervju, ki ga opravijo z otrokom, če je pripravljen govoriti; z njegovimi starši, če so še živi; sorodniki, prijatelji, sosedi, učitelji, skratka z vsemi, ki lahko o otrokovih izjavah in obnašanju poročajo neposredno. Na strani umrle osebe, katere renikarnacija naj bi otrok bil, opravijo intervju s preživelimi člani družine in vsemi, ki lahko posredujejo informacije o dejstvih iz življenja umrle osebe iz prve roke. Tisto, kar dr.Stevensona zanima so izključno dejstva. Posebej dragoceni so podatki in trditve, ki jih otrok poda preden se družini prvič srečata, saj se s tem izključi možnost, da bi otrok dobil podatke od družinskih članov. Skrbno se raziščejo vse možne povezave med obema družinama. Dr. Stevenson skuša poiskati vse možne načine, po katerih bi lahko otrok prišel do podatkov. Pričevanja se navzkrižno preverjajo ter hkrati beležijo vse možne motive, ki bi jih posameznik lahko imel za ali proti reinkarnaciji. Zapišejo se tako večkratne potrditve neke izjave, kakor tudi morebitna nasprotja v pričevanjih. Ne da bi družina vedela, poiščejo tudi sovaščane, ki niso neposredno vpleteni v primer in na osnovi pogovora z njimi pridobijo dodatne podatke o karakternih lastnostih družine. Po nekaj mesecih ali letih nenapovedano obiščejo družino in ponovijo intervju. Če dr. Sevenson, ne obvlada jezika (govori jih pet) poteka intervju s pomočjo prevajalcev, vsaj dveh ali treh. Poleg tega so pogovori tudi zapisani in snemani. Nadalje pridobijo vse podatke o zgodovini in poteku materine nosečnosti, ki bi morda lahko bili povezani s prirojenimi znamenji in telesnimi okvarami. Prirojena znamenja in okvare pregledajo, opišejo, skicirajo in fotografirajo. Zabeležijo si tudi, kako otrok povezuje prirojena znamenja in okvare s prejšnjim življenjem. Kjerkoli je možno pridobijo tudi kopijo medicinskega poročila ali mrliškega lista.

5. Različne hipoteze

Da bi razložil ujemanje med otrokovim pričevanjem in dejstvi, ki se nanašajo na osebo katere reinkarnacija naj bi otrok bil, ter ujemanje prirojenih znamenj in telesnih okvar s poškodbami preminule osebe, katere reinkarnacija naj bi otrok bil, je Stevenson postavil različne hipoteze.

Hipoteza naključja predpostavlja, da do ujemanja lahko pride preprosto zato, ker ima vsak od nas eno ali več rojstnih znamenj. Starši otroka, ki opazijo tako ujemanje, lahko le-to povežejo s prejšnjim življenjem in ga tako vsilijo otroku. Otrok lahko začne verjeti, da je resnično živel preteklo življenje, ki mu ga pripisujejo.

Ta hipoteza ima tri slabosti. Prvič, starši nimajo niti časa niti interesa, da bi razvijali tako predstavo o preteklem življenju in nato vzgajali otroka, da jo sprejme. Pogosto gre za neprivlačno identiteto, ki si je starši za svojega otroka ne bi želeli. Neredko se dogaja, da se v hindujsko družino inkarnira oseba, ki je bila v prejšnjem življenju musliman ali obratno. Prihaja tudi do menjave kast in spolov. Drugič, običajna rojstna znamenja so navadno manjša področja večje pigmentacije, ki so lahko tudi rahlo izbočena. Rojstna znamenja v teh primerih so večja kot običajna in nenavadnih oblik. Gre za področja, ki so manj pigmentirana in lahko spominjajo na brazgotine. Pogosta so tudi območja brez las. Tretjič, v mnogih primerih obstaja ujemanje med dvema ali več ranami ter dvema ali več prirojenimi znamenji. Verjetnost ujemanja večjega števila ran s prirojenimi znamenji je mnogo manjša kot pri enem znamenju.

Hipoteza materinih vtisov temelji na prepričanju, da šok ali drug močan vtis, ki ga doživi noseča ženska, lahko povzroči znamenja in druge okvare na otroku (Stevenson, 1992, 1997). Ta hipoteza bi lahko razložila primere, ko se obe družini poznata in bi noseča ženska videla okvaro ali rano na telesu preminule osebe. Ne more pa razložiti primerov, ko med družinama ni bilo nobenih stikov in se mati ne spominja, da bi kadarkoli videla rano na preminuli osebi. Tudi ta hipoteza bi zahtevala nenavadno motivacijo s strani staršev, da otroku vsilijo identiteto osebe, ki je bila umorjena v neprijetnih okoliščinah ali pa pripada drugi kasti ali religiji. Ta hipoteza tudi ne more razložiti vedenja, ki ga ima otrok o dogodkih, za katere njegova lastna družina ne ve.

Hipoteza telepatske zaznave predpostavlja posebno zmožnost, da otrok dobi vse potrebne informacije neposredno iz uma preživelih sorodnikov preminule osebe s katero se identificira. Ta hipoteza ne zmore pojasniti zakaj otrok nima nobenega vedenja izven okvira, ki je bil znan umrlemu, niti ne pozna dogodkov, ki so se zgodili po tem, ko je prejšnja osebnost umrla. Če bi otrok imel zmožnost, da pride do informacij telepatsko, bi lahko poznal tudi dogodke, ki so se zgodili po tem, ko je oseba, s katero se identificira, umrla. Ta hipoteza ne upošteva prisotnosti prirojenih znamenj in telesnih okvar, ki jih prav tako ni mogoče razložiti s paranormalno zaznavo.

Hipoteza o posedovanju predpostavlja, da je otrok pod vplivom neinkarniranega duha ali entitete, ki mu vsiljuje svojo identiteto. Če se je otrok rodil z rojstnimi znamenji in prirojenimi okvarami še preden je začel govoriti (ali se obnašati) kot bi bil obseden z drugo osebnostjo, potem hipoteza ne more razložiti prisotnosti prirojenih znamenj in okvar.

Hipoteza o reinkarnaciji predpostavlja, da je poznavanje dogodkov in izražanje drugih informacij samo nadaljevanje subjektovega lastnega osebnega življenja, pa čeprav v drugem času in z le delnim izražanjem lastnosti prejšnje osebnosti. Druge normalne in paranormalne razlage imajo določeno vrednost vendar posamično nobena od njih ne more zadovoljivo pojasniti vseh detajlov posamičnega primera. Vsaka popolna razlaga primera mora upoštevati subjektove kognitivne spomine, behavioristične lastnosti, ter telesna znamenja. Če upoštevamo celoto vseh pojavov, edino hipoteza o reinkarnaciji lahko razloži vse posebnosti vključno s prirojenimi znamenji in telesnimi okvarami.

Glede na dokazno moč v prid hipotezi o reinkarnaciji, dr. Stevenson razdeli primere na dva tipa. Tip A so primeri, ko je bil intervju narejen po tem, ko sta se družini prvič srečali. Tip B so primeri, ko je bil intervju narejen še preden sta se družini srečali. Primeri tipa B so redki in še posebej

dragoceni. Dr. Stevenson deli primere tudi na rešene in nerešene. Rešeni primeri so tisti, kjer lahko na osnovi spontanih in natančnih spominov, ki jih ima otrok najdemo izključno eno osebo, ki ustreza tem podatkom. Pri tem je pomembno, da otrok do teh podatkov ni mogel priti na kakršenkoli normalen niti paranormalen način. Iz dokaznih primerov za reinkarnacijo so torej izločeni primeri, ki jih je mogoče pojasniti s telepatijo ali posedovanjem. Edina možna razlaga, ki ostane je, da je to spomin iz preteklega življenja. Stevenson vedno začne s predpostavko: »Mora obstajati normalna razlaga.« Nato postopoma izključuje možnost normalnih in paranormalnih razlag, vse dokler ne ostane ena sama možnost – reinkarnacija. Takšnih preverjenih in rešenih primerov ima Dr.Stevenson v svojih arhivih več kot osemsto. Posebej močni so tisti primeri, kjer otrok navede veliko število preverljivih trditev (20 do 30), kjer je oddaljenost med družinama (fizična, ekonomska ali socialna) velika, kjer družini še nista imeli nobenih stikov, kjer so prisotna telesna znamenja in okvare, ki ustrezajo poškodbam iz prejšnjega življenja. Obstaja več kot 200 rešenih primerov (Stevenson, 1997), ki vključujejo tudi rojstna znamenja in telesne okvare.

Stevenson sam zase je prišel do naslednjega zaključka (Shroder, 1999): »Mislim, da razumna oseba, na osnovi te dokumentacije, lahko verjame v reinkarnacijo«. Po drugi strani pa se sprašuje (Shroder, 1999): »Zakaj predstavniki glavnih znanstvenih tokov ne sprejemajo dokazne evidence, ki jo imamo za reinkarnacijo?«

6. Kaj bi pomenilo sprejeti reinkarnacijo kot dejstvo?

Možnih razlogov za to, da glavni znanstveni tokovi zavračajo hipotezo o reinkarnaciji je več. Na kolektivni ravni bi sprejeti reinkarnacijo pomenilo spremeniti znanstveno paradigmo, ki je danes utemeljena izključno na materializmu. Sprejeti reinkarnacijo bi poleg tega pomenilo konflikt s katoliško cerkvijo, ki na zavedni ali nezavedni ravni močno vpliva na življenjski nazor in vrednote zahodnega človeka – tudi znanstvenika.

Tako-imenovani »znanstveno-religiozni materializem« ali vera, da je edino materialni svet objektivno resničen, predstavlja glavno oviro za današnji napredek znanosti. Materialistična znanstvena paradigma ima danes podobno vlogo, kot jo je imela v srednjem veku inkvizicija. Tako, kot je inkvizicija branila cerkveno dogmo, tako »trda« znanost danes brani materialistično dogmo, ki zagovarja tezo, da so možgani bistvo človeka, zavest pa je le posledica biokemijskih in bioelektričnih procesov, ki se odvijajo v njih. Ves razvoj naj bi bilo mogoče pojasniti z evolucijskimi prednostmi in slabostmi, kar je zorni kot fizičnega preživetja enega posameznika oziroma njegove vrste.

Dr. Stevenson skuša pokazati nasprotno, da je zavest kot nosilec individualnosti in informacije samostojna entiteta, ki se izraža skozi fizične možgane. Poleg biološke evolucije naj bi obstajala tudi evolucija zavesti. Skozi evolucijski proces se zavest seli iz telesa v telo in si pridobiva vedno nove izkušnje. Človek se ne rodi kot nepopisan list, ampak nosi s seboj tudi dediščino preteklosti, ne le genetsko, tudi izkustveno in informacijsko. Človek tako ni le enkratni produkt genetike in okolja, ampak je del celovitega kontinuiranega evolucijskega procesa na našem planetu. Sprejeti nauk o renikarnaciji bi pomenilo na novo odpreti vprašanja: Kaj človek v resnici je? Od kod prihaja in kam gre? Kaj je cilj človeške evolucije? Je to res zgolj čim bolj uspešno preživetje in nadaljevanje vrste, kot to predpostavlja Darwinov nauk. Ali pa je življenje celota, katere del smo in katere zakonitosti in smisel postopoma odkrivamo. Ali bo človeštvo naredilo ta korak naprej, pa ni toliko odvisno od sposobnosti znanstvenikov, da z metodami materialne znanosti dokažejo resničnost verskih naukov in mističnih izkušenj, ampak od njihove vere, da obstaja onkraj materialnega še kaj, kar je vredno raziskovati in čemur je vredno posvetiti svoje življenje. Dr. Stevensonu se čas tega življenja izteka. Lahko se vprašamo: Kaj je gnalo in še žene tega človeka, da se je odpovedal uspešni znanstveni karieri, da se je odpovedal podpori družine, de je sam sebe izključil iz »resnih« znanstvenih krogov in se podal na samotno pot iskanja razlage za tista dejstva, za katera današnja znanost nima ustreznega pojasnila. Darvinizem za človeka ne velja niti po kolikor toliko ozaveščenih neodarvinistih. In če nek zakon ne more razložiti vseh posebnosti posamičnega pojava, je to še lahko zakon, ali pa je čas, da ga nekoliko razširimo, na novo opredelimo. Otroci, ki se spominjajo preteklega življenja, obsmrtne izkušnje, nemoč da bi pojasnili vzroke številnih zdravstvenih in psiholoških težav, nemoč, da pojasnimo kako delujejo bioenergija, telepatija, telekineza, kako moč misli in molitve vpliva na telo kliče po znanstveni revoluciji, po novi paradigmi. Po prenovi ali vsaj dopolnitvi pa kličejo tudi religiozni nazori zahoda. Zaključimo z mislijo, ki jo pripisujejo Nikoli Tesli: »Ko bo znanost začela raziskovati nematerialne pojave, bo v desetih letih napredovala bolj, kot v stoletjih svojega razvoja«.

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DUHOVNA INTELIGENTNOST, VERNOST, VREDNOTE IN PSIHIČNO BLAGOSTANJE

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 desetletju je pritegnil pozornost nekaterih psihologov pojem oziroma konstrukt duhovne inteligentnosti. V tej raziskavi smo želeli preveriti odnos med duhovno inteligentnostjo, vernostjo, vrednotami in psihičnim blagostanjem. Izsledki so pokazali, da obstajajo substancialne korelacije med omenjenimi spremenljivkami, najvišje pa so med verskimi vrednotami in duhovno inteligentnostjo. Vse vrednote pojasnjujejo okrog 45 odstotkov variance duhovne inteligentnosti in izkazujejo tako znatno napovedno moč. Samo verske vrednote pojasnijo več kot 30 odstotkov variance duhovne inteligentnosti. Na drugi strani pa tudi duhovna inteligentnost pojasni kar 70 odstotkov variance v verski vrednotni orientaciji. Izsledki študije torej potrjujejo povezanost med vrednotami in duhovno inteligentnostjo, nakazujejo pa tudi substancialno povezanost duhovne inteligentnosti s psihičnim blagostanjem.

1 UVOD

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, 2000; Rokeach, 1973; Schwartz in Bilsky, 1987, 1991). Glede na strukturo in hierarhijo vrednotnega prostora (Musek, 1993b, 2000) je duhovne in verske vrednote treba locirati na področje apolonskih vrednot in to na obe njegovi veliki podpodročji, kategoriji moralnih, predvsem pa izpolnitvenih vrednot. 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).

Razumljivo se zdi vprašanje, ali se duhovna inteligentnost, kot jo merijo razpoložljivi psihološki instrumenti, povezuje z ocenjevanjem vrednot, torej z vrednotnimi usmeritvami. Lahko domnevamo, da duhovna inteligentnost (Zohar in Marshall, 2000) korelira z vrednotnimi usmeritvami, kar seveda pomeni, da obstaja med obema sklopoma skupna varianca in da lahko zaradi tega na podlagi sprememb v enem sklopu do določene mere predvidimo spremembe v drugem sklopu. Na osnovi tega lahko dalje domnevamo, da obstajajo med vrednotami in duhovno inteligentnostjo vzročne povezave, bodisi neposredne, bodisi posredne. Smiselno se torej zdi raziskati, kakšen je odnos med duhovno inteligentnostjo, vernostjo in vrednotnimi usmeritvami in tudi ugotoviti, ali lahko duhovno inteligentnost uspešno napovedujemo na podlagi informacij o vrednotni usmerjenosti posameznikov in obratno, v kolikšni meri je mogoče vrednotne usmeritve napovedati na podlagi duhovne inteligentnosti. Naslednje vprašanje zadeva odnos med duhovnostjo in psihičnim blagostanjem. Kot kažejo raziskave, je vernost do neke mere povezana z merami psihičnega blagostanja (Myers in Diener, 1995). Domnevamo lahko, da se tudi duhovna inteligentnost povezuje pozitivno s psihičnim blagostanjem.

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

V raziskavi 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 inteligentnosti smo uporabili posebno lestvico duhovnosti, ki smo jo oblikovali na podlagi izbora in modifikacije večjega števila postavk (med njimi tudi s prilagajanjem nekaterih postavk lestvice BMMRS, Idler in sod., 1999). V končni izbor vprašalnika je prišlo 5 postavk:

1. Doživljam povezanost z vsem živim

2. Moja duhovnost daje smisel dogodkom v mojem življenju
3. V svetu prepoznavam navzočnost božanskega
4. Čutim povezanost z izvirom vsega življenja
5. V svojih odnosih z drugimi izražam in prejemam ljubezen in odpuščanje

Koeficient zanesljivosti (Cronbachov alfa) vprašalnika je 0,87. Natančnejši opis vprašalnika je najti v Musek in Maravič, 2004.

Psihično blagostanje smo merili z znano Dienerjevo Lestvico življenjskega zadovoljstva (Diener, 1984).

Oblikovanje raziskave

Raziskava je potekala v obliki korelacijskega in multivariatnega raziskovanja, ki je vključevalo regresijske analize in analize multikavzalnih vzročnih modelov.

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 programih SPSS.12 in LISREL 8.54. Uporabljene so bile metode korelacijske analize, multiple regresije, konfirmatorne faktorske analize in metode preverjanja veljavnosti vzročnih modelov s pomočjo analize kovariančnih struktur.

3 REZULTATI IN DISKUSIJA

Rezultati raziskave so razdeljeni po logičnem redu, tako smo najprej analizirali korelacijske povezave med posameznimi vrednotami in vrednotnimi kategorijami (srednjega, večjega in največjega obsega) na eni strani ter duhovno inteligentnostjo na drugi. Tej korelacijski analizi sledijo nato regresijske analize, v kateri so vrednote in vrednotne kategorije prediktorji ali neodvisne spremenljivke, duhovna inteligentnost pa kriterijska ali odvisna spremenljivka. Regresijske analize pa smo opravili tudi v nasprotni smeri, hoteli smo namreč ugotoviti, v kolikšni meri lahko na podlagi postavk duhovne inteligentnosti prediciramo nekatere vrednotne usmeritve. Ker nas je zanimalo tudi vprašanje, ali velja hipoteza o vzročni povezanosti med duhovno inteligentnostjo in vrednotnimi usmeritvami, smo opravili nato še preskus te povezanosti s pomočjo modela kovariančne analize (LISREL).

Korelacije med duhovno inteligentnostjo, verskimi in drugimi vrednotami

Najprej smo izračunali korelacije duhovne inteligentnosti z vsemi ostalimi spremenljivkami, to pa so posamezne vrednote, vrednotne kategorije srednjega obsega (med njimi verske vrednote), vrednotne kategorije večjega obsega in vrednotne kategorije največjega obsega. Najvišje in to zelo signifikantno korelira z duhovno inteligentnostjo vrednota vera v Boga (vera), enako pa seveda tudi vrednotna kategorija verskih vrednot, ki jo prav ta vrednota edina reprezentira (r = 0,555). Očitno je tudi, da se dionizične, hedonske, čutne in statusne vrednote v celoti negativno, apolonske, moralne, tradicionalne in spoznavne pa pozitivno povezujejo z duhovno inteligentnostjo. Morda je presenetljiva nizka negativna korelacija duhovne inteligentnosti z aktualizacijskimi vrednotami. Ta negativna korelacija v skupini aktualizacijskih vrednot gre na račun negativnih korelacij duhovne inteligentnosti z vrednotama znanje in poklic, medtem ko je korelacija z vrednoto samoizpopolnjevanje pozitivna, a statistično nepomembna. Verjetno prav zato tudi korelacija pri kategoriji izpolnitvenih vrednot (katerih sestavni del so aktualizacijske vrednote) ni trdno presegla praga pomembnosti, čeprav je »praktično« pomembna (p = 0,051).

Dobljene korelacije v glavnem torej niso presenetljive. Pričakovali bi, da se bo duhovna inteligentnost povezovala z versko vrednotno orientacijo, prav tako pa tudi, da bo bliže apolonskemu kot pa dionizičnemu polu vrednot. Vendar iz posameznih korelacij ne moremo jasno uvideti dejanske višine povezanosti duhovne inteligentnosti z vrednotami, saj je prav mogoče, da je ta povezanost na ravni multiple korelacije drugačna. Šele vpogled v multiple korelacije bi nam podal jasnejšo podobo o omenjeni povezavi, s tem pa tudi več osnove za odgovor na vprašanje, ali pomeni konstrukt duhovne inteligentnosti kaj več kot sintezo posameznikove vrednotne orientacije.

Prediktivna vrednost vrednot v odnosu do duhovne inteligentnosti

Zato smo skušali z metodo multiple regresije odgovoriti na zgoraj zastavljeno vprašanje. Ločeno smo izvedli regresijske analize duhovne inteligentnosti kot kriterijske (odvisne) spremenljivke glede na posamezne vrednote kot prediktorje (glej Preglednici 1 in 2) in glede na vrednotne kategorije srednjega obsega kot prediktorje (glej Preglednici 3 in 4).

Preglednica 1 kaže vrednosti multiple korelacije za sedem prediktorskih modelov, pri katerih ob večanju prediktorskih spremenljivk napovedljivost duhovne inteligentnosti še bistveno naraste. Vrednost R po sedmem modelu znaša 0,670, kar pomeni okrog 45 (44,9; iz proporca 0,449, kar je vrednost kvadriranega R) odstotkov pojasnjene variance v duhovni inteligentnosti (oziroma prav tak odstotek skupnih faktorjev med vrednotami in duhovno inteligentnostjo). Vsekakor gre levji delež te napovedne in pojasnitvene moči na račun vrednote vera v Boga (vera), ki sama pojasni kar 0,306 variance v duhovni inteligentnosti (model 1). To prednost zadrži omenjena vrednota, tudi če v modelu upoštevamo delež drugih pomembnih prediktorjev, kar jasno kažejo t in beta vrednosti v Preglednici 2. Veri sledijo nato po vrstnem redu napovedne moči vrednote denar, samoizpopolnjevanje, zdravje, narava, privlačnost in lepota. Pri tem vrednote vera, samoizpopolnjevanje, narava in lepota prispevajo svoj delež s pozitivnimi korelacijami, vrednote denar, zdravje in privlačnost pa z negativnimi.

Preglednica 1. Prikaz sumarnih rezultatov regresijskih modelov (metoda po korakih) za posamezne vrednote kot prediktorje v odnosu do duhovne inteligentnosti kot kriterija (odvisne spremenljivke).

Model	R	R^2	Prilagojeni R^2	Standardna napaka ocene
1	,553(a)	,306	,304	44,485
2	,613(b)	,376	,373	42,228
3	,631(c)	,398	,393	41,541
4	,642(d)	,412	,406	44,485
5	,656(e)	,431	,423	40,498
6	,663(f)	,440	,432	40,210
7	,670(g)	,449	,439	39,943

a Prediktorji: (konstanta), vera
b Prediktorji: (konstanta), vera, denar
c Prediktorji: (konstanta), vera, denar, samoizp
d Prediktorji: (konstanta), vera, denar, samoizp, zdravje
e Prediktorji: (konstanta), vera, denar, samoizp, zdravje, narava
f Prediktorji: (konstanta), vera, denar, samoizp, zdravje, narava, privlac
g Prediktorji: (konstanta), vera, denar, samoizp, zdravje, narava, privlac, lepota

Preglednica 2. Vrednosti regresijskih koeficientov za prediktorje v uporabljenih regresijskih modelih odnosa med posameznimi vrednotami in duhovno inteligentnostjo. Tabela vključuje nestandardizirane in standardizirane koeficiente, t vrednost, signifikantnost.

Model		Nestandardizirani koeficienti		Standardi-zirani koeficienti	t	Sig.
		B	Standardna napaka	Beta		
1	(konstanta)	245,824	4,554		53,978	,000
	vera	8,725	,663	,553	13,165	,000
2	(konstanta)	279,233	6,632		42,106	,000
	vera	8,378	,631	,531	13,272	,000
	denar	-5,633	,848	-,266	-6,643	,000
3	(konstanta)	253,023	9,560		26,466	,000
	vera	8,081	,626	,512	12,908	,000
	denar	-6,784	,889	-,320	-7,633	,000
	samoizp	4,232	1,128	,157	3,750	,000
4	(konstanta)	275,963	12,037		22,926	,000
	vera	7,945	,621	,504	12,796	,000
	denar	-5,894	,926	-,278	-6,367	,000
	samoizp	5,831	1,231	,217	4,736	,000
	zdravje	-4,437	1,440	-,146	-3,081	,002
5	(konstanta)	263,342	12,382		21,268	,000
	vera	7,708	,615	,489	12,525	,000
	denar	-5,752	,913	-,272	-6,300	,000
	samoizp	5,077	1,232	,189	4,122	,000
	zdravje	-5,663	1,460	-,186	-3,878	,000
	narava	3,771	1,061	,148	3,553	,000
6	(konstanta)	263,956	12,296		21,466	,000
	vera	7,833	,613	,497	12,778	,000
	denar	-4,476	1,034	-,211	-4,329	,000
	samoizp	5,746	1,250	,214	4,595	,000
	zdravje	-5,200	1,461	-,171	-3,559	,000
	narava	3,994	1,057	,157	3,777	,000
	privlac	-2,953	1,151	-,129	-2,567	,011
7	(konstanta)	259,267	12,359		20,978	,000
	vera	7,876	,609	,499	12,929	,000
	denar	-4,656	1,030	-,220	-4,522	,000
	samoizp	5,219	1,260	,194	4,142	,000
	zdravje	-5,177	1,451	-,170	-3,567	,000
	narava	3,485	1,070	,137	3,257	,001
	privlac	-3,810	1,194	-,166	-3,192	,002
	lepota	2,648	1,063	,113	2,491	,013

Ob tem se lahko povrnemo k prejšnji ugotovitvi, da aktualizacijske vrednote malce presenetljivo negativno korelirajo z duhovno inteligentnostjo, pa tudi neposredna korelacija duhovne inteligentnosti s samoizpopolnjevanjem ni signifikantno pozitivna. To je očitno posledica korelacijskih povezav samoizpopolnjevanja z drugimi vrednotami, ki dušijo čisto povezanost med samoizpopolnjevanjem in duhovno inteligentnostjo. Regresijska analiza, ki parcializira vpliv posameznih prediktorjev glede na vplive drugih, pa upošteva prav to očiščeno povezanost, za katero se je torej pokazalo, da je signifikantna. Parcialna korelacija samoizpopolnjevanja z duhovno inteligentnostjo je 0,205, kar je bistveno več kot je korelacija ničelnega reda (0,097). Samoizpopolnjevanje je celo med tremi najpomembnejšimi prediktorji duhovne inteligentnosti (glej model 3 v Preglednicah 3 in 4).

Preglednica 3. Prikaz sumarnih rezultatov regresijskih modelov (metoda po korakih) za vrednotne kategorije srednjega obsega kot prediktorje v odnosu do duhovne inteligentnosti kot kriterija (odvisne spremenljivke).

Model	R	R^2	Prilagojeni R^2	Standardna napaka ocene
1	,555(a)	,308	,307	44,44827
2	,590(b)	,348	,345	43,20891
3	,600(c)	,360	,355	42,88274
4	,615(d)	,378	,371	42,32162
5	,621(e)	,385	,377	42,12027

a Prediktorji: (Konstanta), verske vrednote
b Prediktorji: (Konstanta), verske vrednote, statusne vrednote
c Prediktorji: (Konstanta), verske vrednote, statusne vrednote, kulturne vrednote
d Prediktorji: (Konstanta), verske vrednote, statusne vrednote, kulturne vrednote, varnostne vrednote
e Prediktorji: (Konstanta), verske vrednote, statusne vrednote, kulturne vrednote, varnostne vrednote, spoznavne vrednote

Preglednica 5. Vrednosti regresijskih koeficientov za prediktorje v uporabljenih regresijskih modelih odnosa med vrednotnimi kategorijami srednjega obsega in duhovno inteligentnostjo. Tabela vključuje nestandardizirane in standardizirane koeficiente, t vrednost, signifikantnost in tri vrste korelacij.

Model		Nestandardizirani koeficienti		Standardizirani koeficienti	t	Sig. B
		B	Standardna napaka	Beta		
1	(konstanta)	245,583	4,532		54,185	,000
	verske vrednote	8,754	,660	,555	13,257	,000
2	(konstanta)	269,126	6,525		41,244	,000
	verske vrednote	8,652	,642	,549	13,471	,000
	statusne vrednote	-5,227	1,068	-,199	-4,891	,000
3	(konstanta)	253,239	8,831		28,676	,000
	verske vrednote	8,539	,639	,542	13,365	,000
	statusne vrednote	-6,514	1,167	-,248	-5,583	,000
	kulturne vrednote	3,268	1,235	,118	2,646	,008
4	(konstanta)	278,542	11,481		24,261	,000
	verske vrednote	8,448	,631	,536	13,386	,000
	statusne vrednote	-5,915	1,165	-,226	-5,078	,000
	kulturne vrednote	5,306	1,359	,191	3,903	,000
	varnostne vrednote	-4,925	1,455	-,160	-3,386	,001
5	(konstanta)	266,368	12,719		20,942	,000
	verske vrednote	8,245	,635	,523	12,987	,000
	statusne vrednote	-5,595	1,169	-,213	-4,788	,000
	kulturne vrednote	4,062	1,469	,146	2,766	,006
	varnostne vrednote	-6,299	1,579	-,204	-3,989	,000
	spoznavne vrednote	3,778	1,734	,114	2,179	,030

Duhovna inteligentnost, vernost in psihično blagostanje

Duhovna inteligentnost signifikantno pozitivno korelira s samooceno psihičnega blagostanja (zadovoljstvo z življenjem). Korelacija znaša 0,291 in je visoko signifikantna ($p<0,001$). Multipla korelacija med petimi postavkami lestvice duhovne inteligentnosti in psihičnim blagostanjem je celo 0,325, kar pomeni, da je več kot 10 odstotkov skupne variance med duhovno inteligentnostjo in psihičnim blagostanjem. Zanimivo pa je, da korelacija med versko vrednotno usmeritvijo (vernostjo) in psihičnim blagostanjem statistično ni pomembna ($r=0,074$; $p=0,14$).

4 ZAKLJUČKI

Izsledki naše raziskave so trdno dokazali povezanost med vrednotnimi usmeritvami, vključno z vernostjo in duhovno inteligentnostjo. Prav tako nedvomno obstaja pozitivna povezanost med duhovno inteligentnostjo in psihičnim blagostanjem, medtem ko povezanost med vernostjo in psihičnim blagostanjem ni statistično signifikantna. Vrednotne usmeritve so torej pomemben in močan prediktor duhovne inteligentnosti. Naši izsledki vsekakor potrjujejo, da obstaja med duhovnostjo in vernostjo precej skupne variance. Zlati tesna je torej povezava med verskimi vrednotami in duhovno inteligentnostjo.

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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'2005 - Sodelovanje in informacijska družba« so predstavljena spoznanja, povezana s komunikacijskimi, organizacijskimi, pravnimi, ekonomskimi 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, upravljanje in delovanje 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 – lokalnih, mednarodnih, univerzitetnih, poslovnih in interdisciplinarnih. 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'2005 conference proceedings present actual research and projects related to the communicative, organizational, legal, economical and technical aspects of collaboration. Authors have focused on issues that are crucial for successful 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 and evaluated within the scope of the projects in various sectors and domains (research, education, industry, business, IS development, multidisciplinary) and communities (i.e. local and global/international). 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'2005 - Collaboration and Information Society Conference Chairman

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Mag. Urška Kežmah
University of Maribor, Faculty of Law

MANAGEMENT OF DISTRIBUTED EXPERTISE MODE

Dr. Kimmo Salmenjoki
University of Vaasa, Department of Computer Science
Box 700, 65101 Vaasa, Finland
Tel: +358 6 3248 442
e-mail: kimmo.salmenjoki@uwasa.fi

Matti Tyynelä
University of Vaasa, Seinäjoki unit
Kampusranta 9, 60320 Seinäjoki, Finland
Tel: +358 20 1244205
e-mail: matti.tyynela@uwasa.fi

Dr. Lorna Uden
Faculty of Computing, Engineering and Technology,
Staffordshire University,
The Octagon,
Beaconside, Stafford, ST18 OAD. UK
Tel: +44-1785-353276
e-mail: l.uden@staffs.ac.uk

ABSTRACT

This paper describes international collaboration and development of a regional networking partnership within projects for various actors in the Ostrobothnia (Pohjanmaa in Finnish) region in the western Finland. Through this research we advocate the internationalization and collaboration together with coordination of already existing activities in the region. The developed network and methodologies will support R&D project development, especially their further evolution and management.

1 DESCRIPTION OF THE MODE WORK AND GOALS

In the paper we will develop methodologies and best practices for finding and advocating innovations. The overall goal of MODE is to create an action plan for development projects within the Ostrobothnia region. For this end, we will establish hierarchical models, through which different actors can find each other in the various collaboration networks For improving the present operations we will use the regionally existing infrastructures and other communal actors towards a growing and vital regional collaboration based on distance studies and courses with internationalization.
The focus is primarily on web based technologies and their application to the further enhancement of project based work groups and schemes taken back to the organizational level for summary and further planning. This paper describes qualitatively the activities and processes in order to develop the operations for the example unit at hand. As an example system, we will use here the coordination and collaboration of common activities between the University of Vaasa and its distance unit in Seinäjoki, see [1].

2 MANAGING PROJECTS WITH SUPPORTED ACTIONS

Based on years of practical experience in the Seinäjoki unit for the development and execution of projects we will suggest in this section a generic description of the essential features of projects and their management within this organization. The overall life cycle of a project, containing establishment, build-up, execution and follow up in a R&D network will be addressed. This key is to combine the internal and external activities, processes and their description within an operational unit. In the following figure we will split the holistic view of project work into its design and implementation parts described by the two circles within the oval.

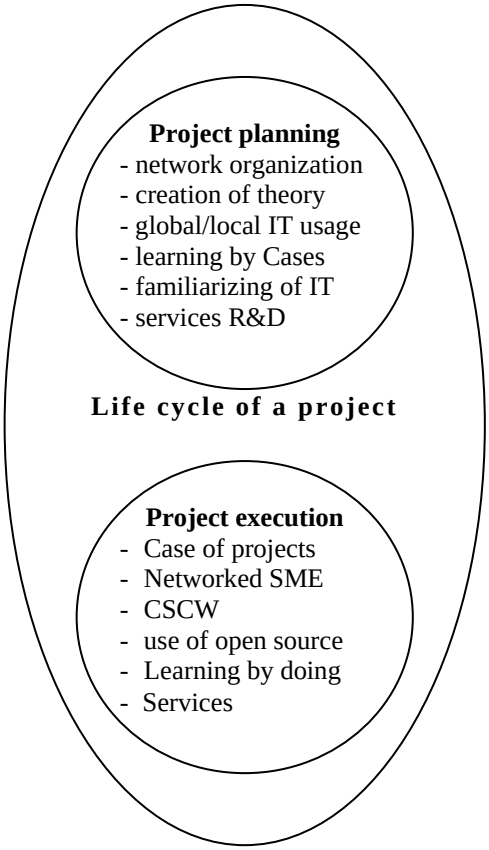

Figure 1. D*escription of a generic project's life cycle in the MODE scope*

The purpose of this approach is to be able to overview, align, integrate and evaluate the separate research efforts and knowledge within the projects into more coordinated and long term actions within the whole unit. For more extensive approaches see [3], for example.

3 SOLUTION APPROACHES FOR MANAGEMENT OF DISTRIBUTED EXPERTISE

3.1 ORGANIZATIONS AND ENVIRONMENTS: UNIT OPERATIONS AND THE NATIONAL AND REGIONAL GOALS

We next describe the dual approaches for knowledge management of projects of Figure 1 in general. On top of the internal and practical project view we will address iteratively its organizational goals and operation. As a timeline, the organization's present goals and history will affect the practice of its current projects. After the execution of individual projects, some kind of reflection will be done based on the practical follow-up of the practitioners' work and project activities and the management will tie up the targeted goals and achieved goals to the future strategies of the whole organization.

3.2 TECHNOLOGICAL APPROACH: USING ORGANIZATIONAL METHODOLOGIES FOR MODE

Based on [2], the following methodologies could be used with our generic project description: general database, semantic web or activity theory used together with our broad project metadata description of Figure 1. For the long term and iterative organizational needs the activity theory provides the necessary setup to in-host the dynamic roles of the project planning. The use of activity theory will address the effects of raw project data and organizational background data with the communication and personal aspects of the shared data being used in our project knowledge management scenario. The goal is to be able to cumulate and combine the necessary common knowledge of the unit operation and the individual projects that are executed in the unit.

In general, there has to be research for modes of operation and new business models, and the further implications of regional and technical networking towards more unified R&D activities. For the region and SMEs it is important to find new modes of operation for traditional collaboration and more strongly networked and global economical models.

In this section we will address the use of ICT technologies for project execution part in Figure 1 and its knowledge management. Here we again try to oversee the project as a whole from the outside, not it's internal management or daily operation. The practical internal project operation and management work will be done with the classic IT tools such as PHProject or Microsoft Project. Besides using the common methodologies of the previous section, we will focus especially on finding and combining existing simple and sharable tools and their coordinated usage within the example unit.

It is important to find critical variables and both qualitative and quantitative measures or estimates that can be used in the (internal) evaluation of the projects. For this purpose, a data collection method and analysis of sample projects will later be done, so that we can find suitable criteria for overseeing the project's essential data. Based on the project and unit metadata descriptions, a unified environment and knowledge source will be established, that can be used in the planning and management of old and new individual projects. After technical piloting for a knowledge approach we will develop further technologies and tools to use with the chosen methodological approaches and dependencies, links and processes between unit and project metadata usage. Technically this problem description will be analyzed with the semantic web approach (using RDFS, RDF and generic semantic web tools) in a follow-up paper. Out of this analysis, more quantitative and descriptive properties will be derived through a cross analysis of the practical project data scenarios and their

generalizations, [4, 7, 12]. The outcome of this technical work will be the first rough version of a PROJECT CASING pilot system using semantic web with activity theory, [6, 11]. This work will lead to a knowledge tool that allows prototyping with structural and visual project management data.

4 EXAMPLE PROJECT BASED ACTIVITY PROCESS IN THE SEINÄJOKI UNIT

For establishing the project metadata and collecting the project data for testing the pilot, the different projects (in different phases of their respective lifecycle) will be considered. As an example, we describe here the Electronic village network (Finnish abbreviation is eKylve, http://www.ekylve.fi) –project. The eKylve-project is one of the first serious attempts to affect the paradigm of the digital divide-phenomenon in the rural areas of Western Finland. Twenty-two rural villages participated in this EU-financed project over a three year period. The aim of eKylve is to fight against the unequal share of digital services between urban and non urban areas.

The purpose of the project was not merely to share the information about the village activities, but to create a group sense among the actors and act interactively according to the principles of problem solving.

The formation of virtual online communities, of different domains, pinpointed a totally new way of conducting cooperation between rural villages and their actors. Normally, inhabitants of different villages do not act as single group of actors, but every village has its own group of activities. The informal and distributed management of expertise was totally new for most of the villagers and initially it created some misunderstandings among the villagers. Strangely, the introduction of new technology was less disturbing than the presence of set of totally unknown persons in the virtual group! Figure 2 describes again the dual views of technical and virtual in the case of the village communities and their collaboration.

The sense of belonging and trust was gradually created by the participants by the common goal and the shared vision of the future task. The students working in this project noticed that ideas, tasks, problems and benefits of every village were practically equal and the formation of a virtual community took place.

The main conclusion was that the learning-by-doing, together in virtual form and through a set of networked computers, was of the utmost importance for the success of the projects, and therefore the management of virtually distributed expertise has to be taken into account in the earliest phase of designing any project activities. More information about the case of eKylve is available in [8, 9].

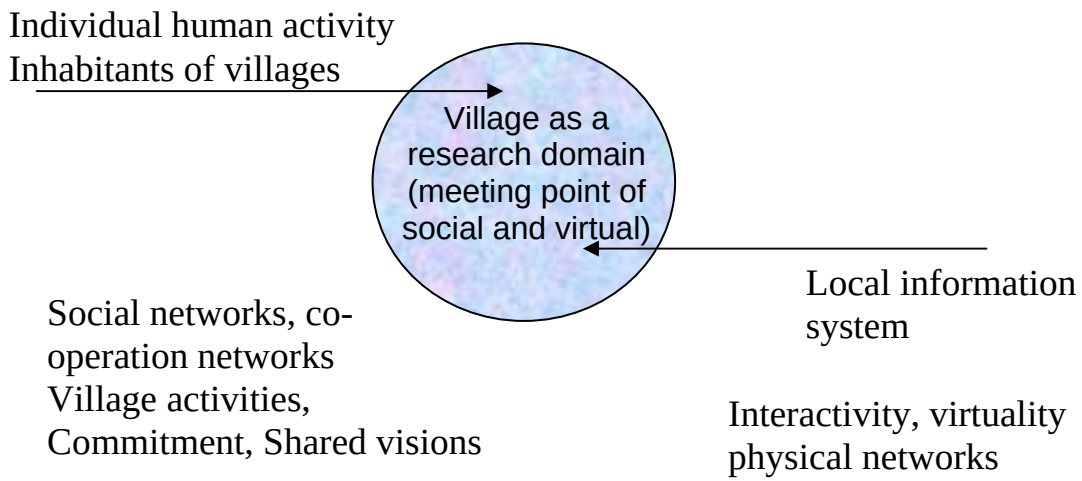

Figure 2. *The research domain of eKylve is a meeting point between local information systems and social networks of actors in the rural villages.*

5 CONCLUSIONS

For practical implementation the generic project description of Figure 1 has to be combined with the operational environment conditions of the unit. After tests with the case data and the fusion of the necessary methodologies, a common metadata description framework for unit and project knowledge will be developed together with our national and international partners. This will be further automated by using the existing data from the already existing projects and their description. When this knowledge is shared and used collaboratively in and out of the partner organizations, the networking between the partner units has been intensified and expanded, including shared workers, internal development work and planning even with partner-to-partner meetings. The different shared collaboration projects will further intensify R&D collaboration. Using the hierarchical two-level operation (unit activities versus project actions) further, integration of both in companies and between units can be supported. These activities are unified under the ICT and eBusiness initiatives for different business areas and to all partners. The special features of the region allow one to test and develop completely new approaches for project development that can be even further developed, together with other similar regions under the technology-related EU projects and R&D activities. This higher level knowledge of the unit can be further used in coordinating the unit's higher goals and related activities in the larger scale. These coordination R&D issues (unit's R&D metadata description) will be addressed in a follow up paper later with releted technical approaches like [5].

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THE EU PROJECT MANAGER JOB ROLE: A SKILL CARD DEFINITION AND ONLINE ASSESSMENT

Katja Harej[1], *Romana Vajde Horvat*[1], *Richard Messnarz*[2]
[1]Faculty of Electrical Engineering and Computer Science,
Institute of Informatics, Gosposvetska 84, SI-2000 Maribor, Slovenia
Tel: +386 2 235 5123; Fax: +386 2 235 5134;
[2]ISCN GesmbH, Schieszstattgasse 4, A-8010 Graz, Austria
Tel: +43 316 811198, Fax: +43 316 811312;
e-mails: katja.harej@uni-mb.si, romana.vajde@uni-mb.si, rmess@iscn.com

ABSTRACT

This paper presents the planned scheme for standardization of jobs within the European Union. The main idea is to define the so called Skill Cards, which define required skills for a specific job. The skill card for manager of projects, financed by EU Commission, is presented in details. The design of the Skill Card is being developed within the EU Leonardo da Vinci project called "ManagEUr" (HU/B/03/F/PP/170028, 2003-2006). The scheme for trainings, exams and certification and the supporting skills portal is also briefly described. The ManagEUr skill card is currently being configured into a skills portal and allows managers to browse the required skills, to do self assessment, to receive guidance and after training to get certificate for European Project Manager.

1 INTRODUCTION

The anticipated entrance of pre-accession countries in the EU, and the recent entrance of others, means the entrance of countries that have no experience in the field of European administration and especially in management of projects regarding to the requirements of EU Commission. Therefore it is clear that organisations from these countries need guidance and training on development and management of the European projects [1]. Thus, ManagEUr addresses needs originating in two current developments [2]:

- The use of outsourcing partnerships and supply chains in the industry which often lead to multinational distributed development teams.
- Accession of new countries to the European Union.

The project is ManageEUr is one in the group of Leonardo da Vinci projects that develop the Skill Cards for specific jobs (like Innovation Manager, e-Commerce Manager, etc.). Within these projects are being developed: lists of required knowledge for a specific job (skill cards), training materials, pools of questions for exams and the skill portal, which supports the learning. Developed materials are inserted into the skill portal, where students and trainers can work interactively.

The structure of skill set follows the EU standards and the feedback of user experiences in trial phase for skill card for ManagEUr were positive in all aspects – the content, assessment and getting the certificates.

2 SKILL CARD FOR EU PROJECT MANAGER JOB ROLE

A skill definition concept (skill card) is an approach where by using NVQ (National Vocational Qualification Standards) standards proposed by the DTI (Department of Trade and Industry) in the UK, a common sense is created among different countries and institutions (as a collection of good practices and required skills) and illustrated in a standard skills description structure. These NVQ models have been already re-used and slightly modified by other countries when they started employing skill cards, so we also base our work on these models [3, 4]. This allows benchmarking of required skills against a European proposed skills set and the establishment of learning portfolios to upgrade the skills of nowadays European project managers to a higher efficiency.

Skill card design

Nowadays, a lot of discussions are about work force flow within European Union. A skill card like a personal ID card which would store the employee skill profile to fulfil specific professions, job roles, and tasks, may be useful to all organizations. Thus, for implementing this idea, we need:

- A standard way to describe a skill set for a profession, job, or specific task
- A standard procedure to assess the skill and to calculate and display skill profiles.

The Job role of a European project manager is a specific position in an organization that understands all these factors: contract management and planning, quality management, financial reporting, deliverable design, e-working and team management and other reference systems.

For structuring a skill set, project ManagEUr followed the EU standards for skill cards [5]:

- A **Domain** (an occupational category), contains
- **Job Roles** (a certain profession that covers part of the domain knowledge), which contains
- **Units** (a list of certain activities that have to be carried out in the workplace), which contains
- **Elements** (description of one distinct aspect of the work performed by a worker) which contains

- **Performance Criteria** (description of the minimum level of performance a participation must demonstrate in order to be assessed as competent) whic must be proven by
- **Evidences** (proof of competence).

Skill card content definition

Using the terminology outlined in the skills definition model and including the skills identified during the demand analysis at the beginning of the project, the skills hierarchy and content definition presented on Figure 1 for the job role EU Project Manager has been designed. The project team looked for skills an EU Project Manager should gain to manage a specific project where different partners with different skills and working and living cultures participate. Where to find and how to select partners to collaborate? How to establish trust between participating partners? How to prepare a project that suit to a proposed program from European Commission? How to manage meetings with partners from different countries? What are differences between international projects and EU projects? How to negotiate with the European Commission (about financing and tasks to be performed)?

For these and much more questions we will find answers within the content of EU Project Management Skill Card.

For each element, ManagEUr project developed a training module which covers all *performance criteria (PC)* listed for the learning element in the skill card. Let's see some examples of PCs for three different elements (and units) of the Skill Card. For the element *Planning* within the unit *Contract Management and Planning* (see Figure 1) one PC is described as: The EU project manager should know how to integrate the know-how of different partners into a more complete solution and idea, so that by a joint effort and by sharing competencies the project will realise a bigger solution (partners see that they can achieve more by sharing).

For the element *External Reviews* within the unit *Quality Management*, an example of PC is: The EU Project Manager is able to deal with rules of European Commission projects to prepare and manage external reviews. The external review manager must also have special knowledge regarding financial and administrative rules and requirements in projects financed by the European Commission.

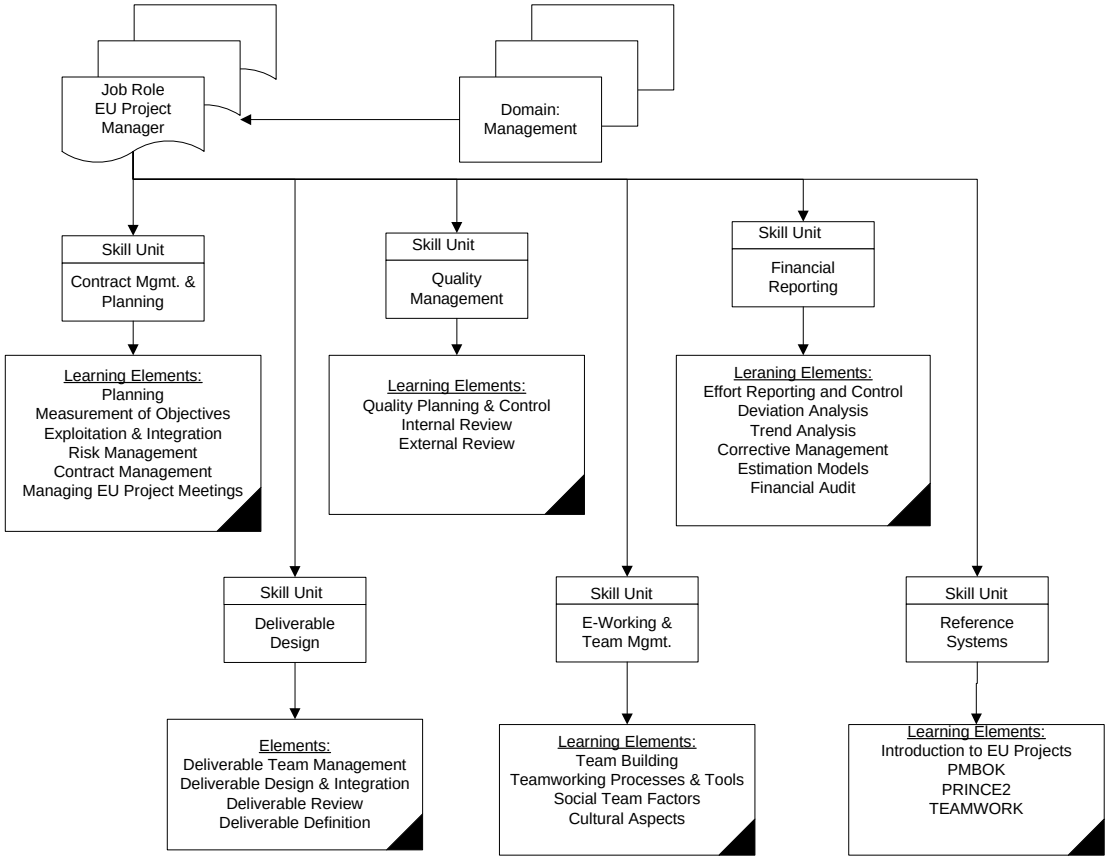

Figure 1: Skill Card of an EU Project Manager Job Role

For the element *Social Team Factors* within the unit *E-Working and Team Management* an example of PC is: The EU Project Manager knows how social/national factors influence the creation of a community of trust and a joint vision for the project.

Together, there are 151 performance criteria defined for all 6 units and 27 learning elements for skill card EU Project Manager. These skills are available also for online browsing and for online skills self-assessment.

3 TRAINING AND CERTIFICATION SCHEME

The detailed instructions for performing trainings (time limitations, teaching approaches and examples) are being defined together with the complete training material for each skill unit. For the trainers the trainer notes are being developed to provide trainers with additional information required for training.

Participants of training can get training certificate when they finish the training and job certificate. The scheme for recognition of certificates within EU countries still has to be established in the future.

4 AN ONLINE SYSTEM – SKILLS PORTAL

Managers can identify skills gaps required to become a skilled EU project manager with an available up-to-date solution (system stems from the previous project, MM 1032 multimedia project CREDIT- Accreditation of Skills via the Internet, 1998 – 2001) which offers an online system (www.manageur.com) for browsing the presented skills card, performing self assessment online, collecting evidences, and receive a formal assessment of the evidences online. A skills gaps profile shows which course modules the student still have to attend to manage the accreditation as a certified EU project manager (learning recommendations). Such idea has already been well established by open universities within European countries such as UK, The Netherlands, and France. They established support for APL (Accreditation of Prior Learning) where the skills of students are assessed, already gained skills are recognised, and only for the skill gaps a learning plan is established.

The online skill assessment bases on defined skill units (see Figure 1) and a skill profile displaying how much of the skill units are covered [1]. The process model for skill assessment and learning guidance is composed by activities in the sequence as shown on Figure 2.

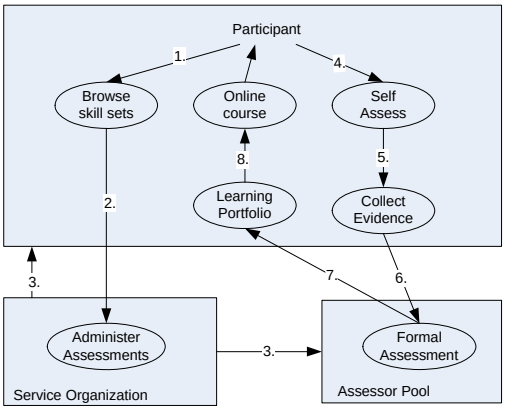

Figure 2: Skills assessment and learning guidance process model

After an online self-assessment or formal assessment, a skill portal enables to a participant (an assessment) an insight to results as presented on Figure 3. An assessor may also put the specific notes for participant to understand more in details what specific results mean. Assessor may also suggest additional references or guidance list that participant should look to fill up a specific lack of knowledge/skills.

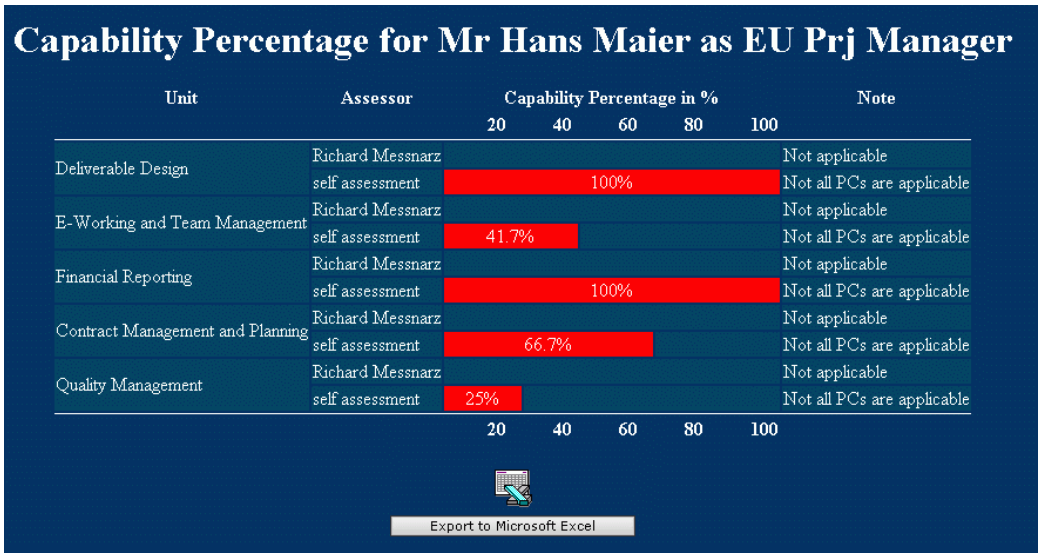

Figure 3: An example of view of self-assessment profile

5 SKILL CARD USAGE SCENARIOS

From first point of view, a skill card is meant to be used to certify people as well as to accredit training providers. The later may need to upgrade their knowledge as it is described within so called Trainer notes, where a lot of references and other guidance for additional information are listed. Training providers get this Trainer notes on courses for the trainers.

Than, skill cards may be used by different organizations (regardless of type or domain) that are willing to establish knowledge management into organization. What knowledge flows through organization? Where and how can we reach that specific knowledge? Who possess the specific knowledge? The answers on such questions the organization can find by skills assessments of its employees.

Organizations may use skill card also to define what knowledge and skills are needed for specific workplace in organization. An employee may perform self-assessment to see what knowledge he or she has to gain, to have more possibilities to reach the desired function level in the organization.
Another usage scenario for organizations is more and more popular exchange of employees for specific projects or particular tasks.

Universities may use this skill card to refine their study programmes to cover all aspects of the skill card and become comparable on a European level. While universities create study programmes which focus on 4 to 5 year long learning schemes where students learn all skills related with general skill domain (e.g. computer science, business etc.), the industry (under constant time pressure and competition) has to focus and tailor much towards specific skill sets and job roles (software architect, e-business manager, etc) [6]. Thus, learning must be possible from the workplace to upgrade skills for specific job role.

6 CONCLUSION

Recently, 101 participants (from universities and other organizations from industry – different domains) from Slovenia, Austria, Hungary, and Ireland get course attendance certificates and 63 of them passed the test and get EU project manager certificates. Some of them did not perform the tests jet and some failed the tests. Generally the participants were satisfied with the lectures and usage of online system.

Skill cards and skills portal have also been successfully used in cases of accreditations of training organizations which are being certified for covering the skills card of a specific job role, for example: the certified software tester, the certified e-commerce engineer, e-business manager, e-strategy manager and e-marketing manager, than the certified innovation manager and also the certified EU project manager.

Defined skill card and developed skills portal bring an organization closer to European level of performing tasks and projects where usually more than two different organizations with different organization culture participate. Thus, an organization that never collaborates within such EU project has now a good choice to reach all benefits that European Commission offer within the specific program invitation. An employee that gets the certificate for EU Project Manager Job role has a good grounding in the subject of performing successful European projects.

7 ACKNOWLEDGEMENTS

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GEOGRAPHICALLY DISTRIBUTED MULTIDISCIPLINARY COLLABORATION

Adel Taweel
School of Computer Science, University of Manchester, Manchester, M13 9PL, UK;
a.taweel@manchester.ac.uk

ABSTRACT

Scientists from different disciplines, now more often than before, join up forces and collaborate to share and search for innovative solutions to outstanding research problems. With specialised skills located in different institutions, for many projects these skills, in different combinations, come together aiming to provide a coherent solution. Although technological advances in the internet and collaboration tools facilitated collaborations across institutions, adjusting to different patterns of working and cross-organisations collaboration can carry high co-ordination costs. This paper reports preliminary observations on such a project that required collaboration across three different disciplines and six institutions: medicine, computer science and health informatics.

Keywords: multidisciplinary, multi-institutional, innovation, distributed work, geographic dispersion, organizational boundaries

1 INTRODUCTION

Multidisciplinary research has increasingly become a common practice for many academic and R&D institutions, research projects and industrial organisations. This is not a new phenomenon, scientists and practitioners from different disciplines collaborated on solving problems for decades if not centuries [4]. However, due to technological advances these types of collaborations have become even more possible. The potential outcomes of multidisciplinary collaboration have made many policy makers and industrial organisations to encourage, exploit and fund such collaborations. Cognitive science is one such example that was developed out of multidisciplinary collaboration [6]. However with specialised skills and scientists from different disciplines located in different departments and institutions, cross-institutions or departments collaboration has become essential for many projects. Previously, because of distance, collaboration across institutions was not easily possible and can be expensive, both, in terms of effort and time. However, with the availability of the internet and advances in collaboration tools, such collaborations are now more feasibility to occur.

In this project, one of its aims is create a virtual clinical research environment for clinicians and clinical researchers to query, analyse and interrogate the underlying clinical data. To come up with coherent and useable solution this required collaboration between clinicians to provide clinical domain knowledge, computer scientist to provide computing and technological skills and expertise, and health informatics scientists to provide expertise on ways of standardising and attributing clinical data. Initially, many expectations were taken as granted from the three different groups of scientists in the project. However, it was realised, although not very early, that each group of scientists have their expectations, different ways of practicing science, different working patterns and different ways of approaching research problems. For example, computer scientists tend to take a systematic approach to providing a solution; on the other hand, clinicians tend to take a diagnostic approach to finding a solution.

The project included six institutions distributed across the UK with distances between them ranging from 50 to 500 miles. In addition to distance, which was a major barrier, the busy schedule of clinicians added another obstacle to having virtual/electronic[1] or face-to-face meetings. In this study, the paper will look at one aspect of this collaboration from a computer scientist view, encountered problems, adopted approaches and suggests a solution to overcoming some of the obstacles. In particular, it will look at how software development approaches or methodologies in their pure form were not sufficient to make a collaboration succeed.

2 THE DEVELOPMENT PROCESS

Initially, this project followed a standard development methodology to manage the input efforts and come up with a process to design and present the solution to the end users, which in this case were mainly the clinicians. However, it became clear that whatever design process one follows in the early phases of the project, computer scientists, including designers and developers, constantly complain that requirement specifications are not clear enough. Project leaders are anxious for the project to get started and in a way has high expectations that the project sticks to schedule, and other people in the project feel frustrated because their input is not sought or is not making progress. These expectations initially created uneasy feelings in the project and were seen by some as the other is not providing the input or delaying the progress. The way people are used to work and approach problems, the expectations and the interests of different groups and dynamics of how the research or flow of work is conducted

[1] Using internet-based collaboration tools, e.g. tele or video conferences tools.

were all contributing factors to these obstacles and uneasiness in the initial phases of the project. For example some of computer scientists approach in the project, on the one hand, was that they are researching to provide a suitable or best technical solution to a medical data access or storage problem.

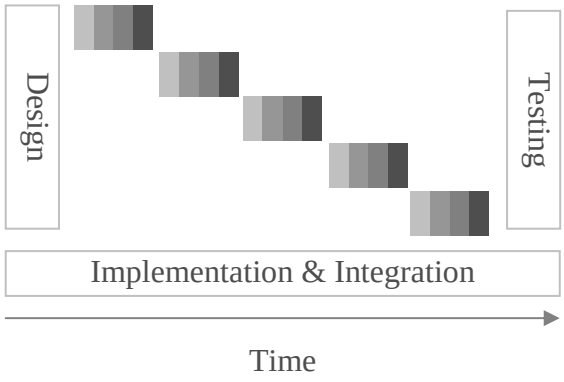

Figure 1: Waterfall Model

Thus their initial expectations were that this part of the medical domain was another application for the computer science discipline and it is a matter of finding ways of applying computer science, perhaps already developed, concepts.

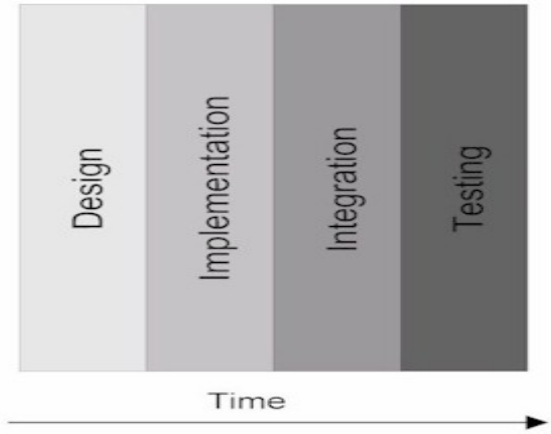

Figure 2: Spiral Model

However, when the scale of the problem was understood their approach completely failed. The complexities in the medical domain, and the amount of variables and standardisations that needed considering presented a huge challenge to computer scientists to overcome. It also justified and explained why clinicians and information were unable to give clear and specific requirements specifications. Therefore, one of the main aspects is that project leaders should make sure that are clarified and explained are expectations, and complexity and the scope of the problem. Understanding of other needs and ways of working solves many of the common misunderstandings in such type of collaboration or project.

Another important aspect, that one need to consider carefully what development process or model should one follows. For multidisciplinary projects, it is vital to follow a development methodology that's dynamic enough to accommodate changes and complexities. As mentioned above, requirement specifications are constantly changing and only incrementally they become clearer as the project progresses. For example, adopting the traditional waterfall model, shown in Figure 2, for such projects would not be suitable. It is one of the main limitations of this model that requirement specifications are defined early on at the starting phases [1]. With this multidisciplinary project requiring new research and new solutions, one cannot adopt a rigid development model that adheres to particular sequence of phases. Software is the by-product that of the new solution or research. Therefore, it is a creation process that involves problem solving, opposed to a manufacturing process, which the waterfall model fails to treat it as such. On the other hand, the spiral model (see Figure 1) or the rational (enterprise) unified development process (EUP) are more dynamic in response to iteratively changing requirements [5, 7]. The spiral and EUP models allow the team to better handle the iterative nature in project development. Unlike the waterfall model, they allow both incremental and iterative processes. Incremental process is better followed for projects that have some general direction, with a regular review of the project and adding new features to it as it develops, thus the name incremental. The iterative on the other hand, is more effective for projects that doing new type of research or development with loosely defined scope and project plans. It allows developers to continually keep revising and refining the developed features with a loop-like cycle between different phases of development, thus the name iterative.

For such multidisciplinary projects that more likely to result into innovative solutions, the latter two models allow higher flexibility and can cope with frequent change. The need for dynamic model is not unique to multidisciplinary research, however the anticipated change in this type of projects is certainly more often and frequent. In the case study project, the EUP model was adopted, however it was essential to convey that to the whole team and achieve consensus and overall commitment for it to succeed. Also, although the flexibility of the EUP model allowed for change, it was not sufficient as a model to cope with the change in working patterns and problem solving approaches across the different disciplines. Therefore, several collaboration steps were undertaken to overcome these obstacles as explained below.

3 COLLABORATION

As mentioned above, the project has suffered initially a slow and troublesome start, however once some of the above mentioned main issues were clarified and overcome, the project managed to re-establish a common and consistent working pattern. However, because many members of the team were unfamiliar with the adopted development methodology, they did not adhere to the implication of the noted development phases. Therefore, it was essential to plan for a series of collaboration sessions

that each includes limited set of people from different disciplines to allow better understanding of common objectives and ways of defining and solving problems. In the initial phase, face-to-face meetings were essential to establish trustful working relationships and that included deliberately designed short sessions that allow greater personal interactions and greater personal bonding between different team members.

At the beginning of each (iteration or) phase of the development plan or model, an extensive series of collaboration sessions were usually set to make sure that phase starts on a well-grounded discussions and features. In cases, where fewer or no collaboration sessions were used, it was noted that either the phase took longer to complete or more iterations were need to achieve the desired features.

Although there are reports that technology is helping to bridge distance [7], data in this project indicates that unless a strong working relationship is established collaboration tools were not very effective. Distance still remains an obstacle to achieve a highly productive collaboration [3]. This especially was noted when electronic collaboration sessions included technical discussions with people from different disciplines and different background or approaches were involved. In some other cases, electronic collaboration sessions were productive especially if the team size is kept small with a focused scope and limited technical content [8]. Also electronic collaboration sessions were noted to be used more often by team members from within the same discipline or with the same background [8]. Nevertheless, the data indicates that the larger the distance between institutions, the less is the number of collaboration sessions. Multidisciplinary face-to-face collaboration sessions were conducted more often than electronic collaboration sessions using tele- or video conferences or other tools, especially when it involves team members from institutions that are 50 – 100 miles away.

4 CONCLUSION

Multidisciplinary collaboration has become essential for many projects to succeed. It promotes innovation and provides a fertile ground for technical discoveries or new insights, new ways to using existing technologies or creative approaches to problems. However, for successful multidisciplinary collaboration a number of challenges and obstacles need to be carefully considered and overcome.

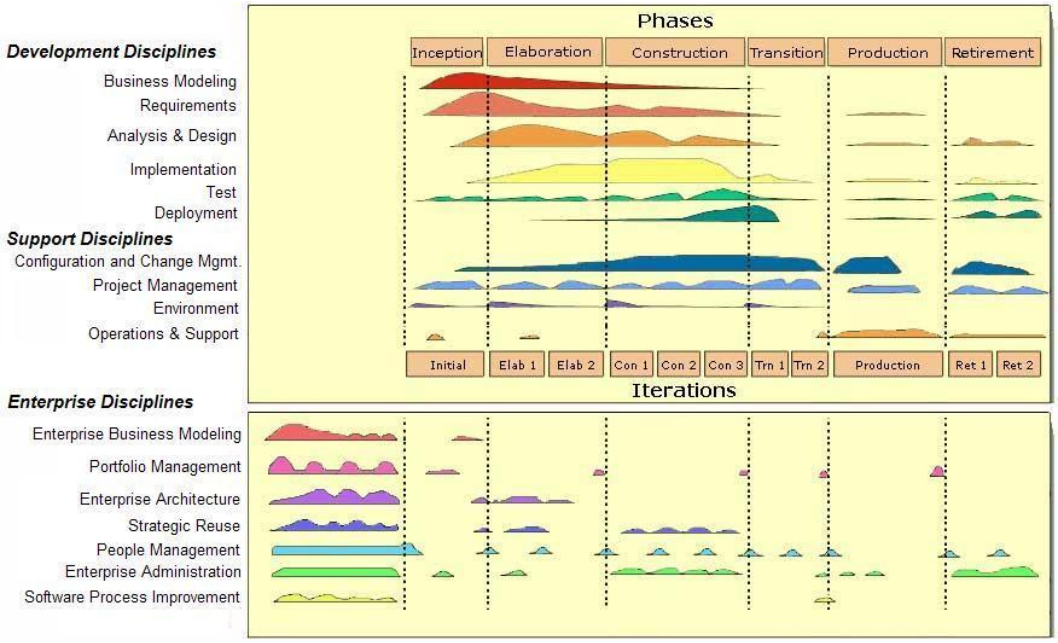

Figure 3: EUP Model

These include understanding the different ways of people working, different ways of scientific analysis or approaches to problem solving, the sought after different objectives or research outcomes and complexity of undertaken problems.

Such collaborations require adopting a dynamic development methodology, a one that is able to accommodate frequent changes and allow iterative and/or incremental development of research and technical solutions, and a well integrated and planned collaboration pattern that frequently addresses the inherited (although may get overlooked) needs, complexities and diversities in such widely varied skills and groups.

Although this paper attempts to uncover some of the obstacles and challenges and reports on some of the undertaken solutions to overcome them, a number of issues need addressing, such as whether interactions between set of disciplines different from one another, resolving or fulfilling personal objectives, widening or sizing the multidisciplinary team and complexities of introducing new members to such a team.

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STRENGTHENING THE EDGES IN TRIANGLE 'ECONOMY – RESEARCH – EDUCATION'

Milan Zorman[1,2], Peter Kokol[1,2], Matej Mertik[1,2], Gregor Štiglic[1,2], Viktor Vaupot[3]

[1]University of Maribor, Faculty of Electrical Engineering and Computer Science
Smetanova 17, SI-2000 Maribor, Slovenia
Tel: +386 (0)2 220 7459; Fax:+386 (0)2 251 1178
e-mail: milan.zorman@uni-mb.si

[2]Centre for Interdisciplinary and Multidisciplinary Research and Studies at th University of Maribor
Krekova 2, SI-2000 Maribor, Slovenia

[3]eAliansa Cluster of Information Technologies
Efenkova 61, SI-3320 Velenje, Slovenia

ABSTRACT

Are the three spheres collaborating enough to produce what the market needs? Does the work of the majority of the representatives from research and education spheres in Slovenia correspond to and satisfy the needs of the economic sphere? Is the knowledge of the students really not on the level where the industry would want it to be and are the research results in many cases to abstract to be applied in practical applications. What is the truth, what is the reason for it and are all parties involved doing everything they can to strengthen the collaboration between economy, research and education sphere? We will represent an attempt to improve the current situation in the field of computer science and tightly connect the parties involved. The work presented here has been performed as a part of the TrioERE project, supported by the Project Preparation Facility Grant Scheme – PPFII.

1 INTRODUCTION

According to our knowledge, the majority of representatives from research and education spheres in Slovenia think that their work and their results correspond to and satisfy the needs of the economic sphere. The opinion from the remaining side, the companies, representing the economy, is on the other hand quite the opposite. According to their statements, the knowledge of the students is not on the level where they would want it to be and the research results are in many cases to abstract to be applied in practical applications. What is the truth, what is the reason for it and are all parties involved doing everything they can to strengthen the collaboration between economy, research and education sphere? We will represent an attempt to improve the current situation in the field of computer science and tightly connect the parties involved. Some observations may be biased, since many of us come from the fields of research and education, but we did our best to give as neutral observations as possible.

2 MYTHS ABOUT THE ACCUSATIONS BETWEEN THE 'EDGES' – ARE THEY ALL TRUE?

From this point of view the mentioned triangle in Slovenia, as in many other countries, is not balanced. We can observe a much stronger cooperation between the education and research sphere, than in any other of the two remaining edges. Why is that so? Almost all lecturers are also active researchers and when addressing the students, both the research an education sphere are often represented by a single person. But is this good? According to the voice of industrial sphere, it is not. And here we have the first two accusations:

Acc1:'Researchers work on problems, which serve no actual purpose.'

Acc2:'Students are taught subjects, that are too abstract and not useful in the professional career.'

Let us look at the situation and start with the second statement. Is mixing research and education good? Where to draw the line?
In many cases the projects students work on come from the research areas, on which the lecturers and assistants are working. Such assignments are often too abstract, not enough explained and too far away from the real world to attract students' whole attention. In the worse case scenario, the students are working on badly explained assignments, with no idea where their product can be used and no support from the people, who live for the research and cannot understand how it is possible that almost

nobody knows and understands their (actually very specific and narrow) research area. Not to mention the other often used option – student projects from the books, where they are actually fed with the theory from the lectures again. In this case, we get similar outcome as in the above mentioned case.
In such cases students are more vulnerable for offers from the companies, giving them 'real' work for not so little, but still not enough money.
But with a proper feel for the presentation of the assignments, appropriate project leading, use of motivation techniques and selection of appropriate topics for the assignments, students can gain a lot of very useful knowledge, which will serve them good after they start their professional career.
On the other hand, are companies doing enough to be involved into the educational process and research work? The ball returns with two accusations from the research/education side:

Acc3:'Industry has no interest in cooperating in research work.'

Acc4:'Companies are stealing us students before they graduate to get cheap, but well trained work force.'

What to tell about the two accusations? The first one involves financial involvement. In small and medium size companies there is almost no money reserved for research. Not for research in the company and of course not for research outside the company. Even if the company has some ideas about new potential areas, only few have the money and manpower to do the research and investigate them more thoroughly. Frightened by the thought, that the competition may get there first, they are hiding their ideas. So we have no money, no available time and no fresh ideas coming from the industrial side.
Why is it so? A lot of companies involved in IT are working on their limit. People are given too much work, there is always a struggle for more cheap and effective workforce. And at this point students come in very handy. Given relatively little money, with no obligations in the form of family and living and being supported by their parents, with fresh knowledge and will to work, they are an ideal 'solution' for the companies. Given some money and a lot of work they start neglecting their obligations at the faculty and very few of them actually graduate in a decent time.
Usually, this is where the circle closes. Not attending lectures and progressing toward graduation means not gaining the knowledge they were supposed to gain. No students progressing and graduating means no money for the educators. Under trained, underpaid and from some point in time on not satisfied workforce does not mean any good for the companies. Struggling companies mean no time and money for the research and cooperation with the research and education sphere. And we are back at the beginning.

3 WHERE TO START STRENGTHENING THE EDGES IN THE TRIANGLE?

Even if this might sound like a cooking recipe it is not one. First we need to have the representatives from all three sides that are aware of the problems, willing to admit some mistakes they have been doing and willing to do something about it.
The next step is gathering ideas for the solutions. This means also peeking over the fence to the neighbours to learn on their mistakes and experiences in order not to reinvent the wheel.
Given our current situation we decided, it is better to start with small steps and slowly progress toward the goal in order to open some eyes, attract as many partners involved, and not scare most of the potential partners off. We expected some ups and downs, but eventually the strengthening of edges should stabilize and give some positive results for all parties involved.

4 THE ACTUAL CASE – THE TrioERE PROJECT

The whole process started after the critical mass of representatives from all three spheres joined the cluster of information technologies eAliansa [1]. Started in the Savinjska region it first expanded toward the north east part, being joined by the Complex and Intelligent Systems Institute, located in the Centre for Interdisciplinary and Multidisciplinary Research and Studies at the University of Maribor. Then it gained some partners from central and southeast regions, all the way to the University of Primorska.
Being aware of the problems and willing to do something about it we started the '*Student projects of eAliansa*' project in the summer semester of the year 2003/2004. The main idea was to involve companies with their ideas in a part of an educational process and give some additional flavour to the projects students were working on as a part of their regular assignments.
The ideas in a form of a TrioERE project were also submitted to the PHARE Project Preparation Facility II call [2] and the project was granted. Foreign partners in the project were the representatives of the Jyvaskyla region in Finland, which is known to be row-model for the successful economic resurrection from the lowest possible economic situation to being one the most perspective regions in Finland and in Europe.
With experience from the first iteration of the '*Student projects of eAliansa*' we used the visits of Jyvaskyla Polytechnic and University of Jyvaskyla to discuss their experience in cooperation with the companies. They have a well-established way of cooperation, where university and company sign an agreement. The company pays a certain amount in the range of few thousand EUR to the partner to get the students to work on their projects and is obliged not to interfere with the students' future after they finish the project and before they graduate. Mentors from both sides monitor the work on the projects and until now

all the parties involved were very satisfied with the progress of the students and results of the projects.
Considering their approach, we saw that our concepts are quite similar. The biggest difference was in financial involvement of the companies, which is somehow logical, since we intend to introduce that form of formalisation in the near future.
After some adaptations we currently run the '*Student projects of eAliansa*' in the following way:

- A call for project proposals is placed approximately 2 months before the start of the semester.
- The project proposals are selected and the final list is formed.
- The projects are presented to the students, which select their projects and form project groups.
- Projects are run under the supervision of a teaching assistant and a mentor from the company.
- At the end of semester projects and reports are presented to the company representatives on a formal meeting. Companies usually decide to give symbolic rewards to the best project groups.

5 RESULTS

The '*Student projects of eAliansa*' project proved to be a simple, but successful way of cooperation between the spheres. Such way of cooperation gives all involved parties an advantage, which was not known before:

- Students:
  - take the assignments more seriously,
  - their level of motivation is higher,
  - they get an additional skill of 'negotiating with the customer'
  - the overall success is better, than it was before.
- Companies:
  - get an opportunity to be involved in the educational process and help forming the profile of the future graduate,
  - test their ideas for which they do not have time in their company in a form of student projects,
  - test their potential employees and get a better feeling of what they can expect from them in the future,
  - get in the contact and exchange wishes/information with the research personnel.
- Educational and research staff:
  - enhance the educational process and 'produce' better students,
  - get in contact and exchange wishes/information with the companies,
  - meet potential partners for industrial projects.

During the last two years many companies and institutions expressed their interest in cooperating in our and similar projects.

Measurable advantages of the projects are in number of students finishing the assignments:

Academic Year 2003-04:
- Summer semester – students of the 2nd year of Professional Higher Education Program in Computer and Information Science (PHEP-CIS) were very successful in their work on the projects, assigned by the cluster members. All 7 groups finished their assignments in time - a case which never happened before!

Academic Year 2004-05:
- Winter semester - students of the 3rd year of University Degree Education Program in Computer and Information Science (UDEP-CIS) were working on smaller projects in groups of 3-4 people, under the supervision of students from 4th year of UDEP-CIS. 21 from the original 22 groups finished their assignments, almost all in time!

- Summer semester - students of the 2nd year of PHEP-CIS. All 8 groups finished their assignments in time.

After the presentations at the end of the summer semester 2004/2005 company representatives (Fig. 1) and academic staff (Fig. 2 and Fig.3) presented small prizes to the best groups of students.

Figure 1: *Presentation of the prize from the company representative*

Figure 2: *Presentation of the prize*

Figure 3: *The winners are proud to have won*

6 CONCLUSION

In this paper we presented our view and contribution to strengthening the edges in triangle 'ECONOMY – RESEARCH – EDUCATION'. We think that there is some truth in each of the accusations listed in the second section of the paper and we are doing our best to improve in all critical fields.
So far we are satisfied with our results and we intend to continue with the process of student project.
We hope that we will soon catch up and reach level, presented in the model from Finland.
According to the Bologna Agreement, the cooperation between the spheres should become stronger in order to make the European higher education area more competitive and adoptable to the needs of society and advances in scientific knowledge, so we will continue our work in that direction to fulfil the goals set.

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COLLABORATIVE RESEARCH BETWEEN UNIVERSITIES

Dr Lorna Uden
Faculty of Computing, Engineering and Technology, Staffordshire University, Beaconside, Stafford, ST16 9DG, England, UK.
Tel: +44-1785-253276
Fax: +44-1785-353497
Email: L.uden@staffs.ac.uk

Dr. Kimmo Salmenjoki
Acting Professor, Ph.D.
University of Vaasa, Department of Computer Science, P.O. BOX 700, FIN-65101 VAASA
Tel: +358 6 324 8442
Fax: +358 6 324 8467
Email: kimmo.salmenjoki@uwasa.fi

Dr. Marjan Hericko
University of Maribor, Faculty of Electrical Engineering and Computer Science, Smetanova 17, SI-2000 Maribor, Slovenia
Tel: +386 2 235 51 12
Fax: +386 2 235 51 34
Email: marjan.hericko@uni-mb.si

Dr. Gurumusamy Arumugam
Department of Computer Science Madurai Kamaraj University, Madurai-625021, Tamilnadu, India
Email: gurusamyarumugam@yahoo.co.in

ABSTRACT

Knowledge management research requires expertise from many different disciplines. It is almost impossible for small or medium universities to have the necessary skills to carter for all aspects of the research. Each university would have their own areas of interest that are not always compatible with each other. There may be areas of overlap of interests that a particular university does not possess. It would be good to have a network of research for institutions to work together. To address the effective management of Knowledge Management Research requires that we establish a network of knowledge researchers working together. Each of them addresses certain KM elements. However, none of them appears to subsume all of the others. The major contribution of this proposal is to present a more comprehensive and unified framework for describing the nature of KM research by drawing on the expertise of different partners internationally. This paper presents a brief review of our KMO collaborative research group.

1 INTRODUCTION

Instead of having a central approach to coordinate the research, a distributed knowledge management (DKM) method is used. According to the DKM approach, knowledge is considered local, deriving from continuous negotiation within organisational units (Wenger 1998). A DKM is managing the processes of creating local knowledge within autonomous groups and exchanging knowledge across them (Bonifacio, Bouquet & Traverso 2002). According to these authors, in a distributed knowledge management architecture, an organisation is viewed as a constellation of knowledge nodes (KNs) that are autonomous, locally managed knowledge sources, which represent organisational and social units at a technical level (Bonifacio, Bouquet & Cuel 2002). There are several benefits for allowing multiple classification of a KM system for a complex organisation (Bonifacio, Bouquet & Cuel 2002).

- Local classification enables each organisational unit to make explicit and stronger common perspective, therefore helping in making sense of its daily practices and local know how.
- The outcome of sense making allows each unit to access a different viewpoint on the organisation and be able to get an intuition of how the worlds would look like from a different perspective.
- The continuous interplay of multiple local perspectives triggers innovation.

2 A DISTRIBUTED APPROACH

The KM methodology adopted in our approach is based on the work of Bonifacio, Bouquet and Cuel (2002). The DKM approach is based on two principles: the principle of autonomy that grants organisational units a high degree of autonomy in managing their local knowledge (e.g. creating their own knowledge maps called contexts), and the principle of coordination, which allows each organisational unit to exchange knowledge with other units through processes of double loop learning (Argyris 1999) or perspective taking (Boland & Tenkasi 1995).

According to Bonifacio, Bouquet and Cuel (2002), knowledge node (KN) is a useful abstraction that allows us to identify, within organisations, people who manage knowledge according to a local conceptual schema and personalised system of artefacts. A KN is described as a reification of organisational units – either formal, e.g. divisions, market sectors, or informal e.g. interest groups, communities of practice, communities of knowing) – which exhibit some degree of semantic autonomy. Semantic autonomy means the ability to develop autonomous interpretative schemas (perspectives on the world) to interpret, organise and store useful information. From an architectural point of view, this means that each community is allowed to build its own local application for managing local knowledge.

However, autonomy without coordination is useless for knowledge sharing in complex organisations. The autonomous knowledge sources need to be coordinated. The system must also provide a way for each community to make explicit its own semantic interpretation schemas. The coordination process among KNs is achieved through a context. A context is defined as a meta-data schema used in order to interpret the local system of meaning, making it syntactically comprehensible to others. For example, a context can be the directory structure of a web site or the taxonomy contained in an enterprise knowledge portal. Contexts are used in a DKM system to enable knowledge exchange among KNs. Each KN represents a semantically autonomous unit. It is composed of a system of artefacts: the system of procedures, activities, documents, archives, technologies, languages, etc. are used by the knowledge owner to manage local knowledge that best suits its environmental conditions and needs.

In DKM systems, emphasis should given to autonomy and coordination aspects so that each KN can manage her knowledge, exchange knowledge through meaning negotiation and cooperate with other KNs in order to achieve her goals. In order to manage the distributed expertise between various partners between the various regions as well as international collaboration, it is necessary to coordinate multiple projects conducted at multiple locations. For project management, much of the effort in incorporating technology should involve fostering ubiquitous communication among members of the project whilst facilitating knowledge exchange.

Knowledge generated by the KN can be knowledge in KNs, knowledge about KNs and knowledge from KNs (Damm & Schindler 2002). Knowledge in KNs requires a closer look at insights generated within each individual KN. Individual KN members need to know when, what, how, where and why something is being done and by whom, with the goal being to promote efficient and effective coordination off activities. At a macro level, the proposed system must have an inventory of all KNs under way at any given time, or knowledge about KNs. This helps in planning and controlling of resources to maximise utilities. The knowledge is a key determinant of future KN success, as it aids organisational learning (Desouza & Evaristo 2004).

- For the effective management of knowledge, a hybrid approach proposed by Desouza and Evaristo (2004) is adopted. The first component is the core of the system holding popular knowledge (knowledge about and from KNs). This serves as repository and index to the second component; knowledge available by peers (knowledge in KNs).
- The second component of the central repository, a centrally located index for knowledge in KNs, helps foster an efficient coordination mechanism. This index contains the sources of knowledge in KNs. According to Desouza and Evaristo (2004), it can serve as the knowledge dictionary to integrate individual knowledge, common terms and categories can be assigned, along with facilities to serve as an organisational thesaurus. Knowledge in KNs is exchanged via P2P. Its capture becomes efficient and effective as each KN team can set up its own protocols, build categories and develop filtering mechanisms. Because each KN is unique and each team is different, this allows for the establishment of flexible knowledge creation and exchange protocols.

The aim of the group is to explore the use of technology in knowledge sharing between the various KNs. We would like to understand how a virtual team work together. Important research questions to be addressed are:

- How do the dispersed, cross functional and cross cultural teams engage in sharing knowledge?
- How do we use available technologies in sharing knowledge?
- What is the role of technology in such engagement?

Aside from the technical issues concerning our approach, we are also interested in providing a theoretical framework to the methodology. The role of context can be entered from the global and the local perspectives. It is our belief that activity theory, a cultural, historical theory, can be used as a candidate for this study (Nardi 1996).

3 KNOWLEDGE MANAGEMENT IN ORGANIZATIONS (KMO) GROUP

In order to help with the knowledge e management research activities of different groups that are geographically distributed, a KMO structure is proposed based on the above DKM approach. The system for KMO should be able to support a KM environment among geographically distributed groups of researchers with differing expertise. The organisational structure of KMO is based on decentralised units where autonomy and independence are established in each group. . This ensures local innovation and the emergence of local knowledge.

The KMO is a knowledge network where people can share and reuse knowledge and experience, and to locate specialists and initiatives in order to improve the group's performance. The network is based on different groups of researchers with different interests and expertise involving global collaboration, virtual and face-to-face meetings, for sharing experience on a common interest. Each of the research group acts as a KN with autonomous operations, coordinated and managed by KMO sitting at the top level. The success of the system is based on local innovation networking and knowledge sharing. How do we support the emergence of knowledge management research group? The following section discusses the issues that are relevant for the research of future KM applications.

3.1 Web services

According to Davies and others (2004), Web Services technology can be enhanced by the harnessing of Semantic Web technology to deliver a step change in capability. Web Services provide an easy way to make existing (or indeed new) components available to applications via the Internet. However, currently, Web Services are essentially described using semi-structured natural language mechanisms. This means that considerable human intervention is needed to find and combine Web Services into an end application. The Semantic Web will enable the accessing of Web resources by semantic content rather than just by keywords. Resources (in this case Web Services) are defined in such a way that they can be automatically 'understood' and processed by machine. This will enable the realisation of Semantic Web Services, involving the automation of service discovery, acquisition, composition and monitoring. Software agents will be able automatically to create new services from already published services, with potentially huge implications for models of eBusiness. Semantic Web Enabled Web Services will allow the automatic discovery, selection and execution of inter-organization business logic making areas like dynamic supply chain composition a reality.

3.2 Semantic web

Internet and the phenomenon of globalization have resulted in many organizations and project teams being increasingly geographically dispersed. According to Yoke and others (2003), in order to cope with this paradigm change, the organizations require knowledge management tools that enable better understanding of the distributed organizational and project-specific digital knowledge and its corresponding containers, thus, enabling efficient collaboration as well as knowledge capture, representation and user adapted access. Most of the currently available knowledge management tools have limitations. The Semantic Web can be a very promising platform for developing knowledge management systems. Semantic Web enables automated information access and use based on machine-processable semantics of data.

3.3 Data mining

Knowledge Management involves acquisition, enhancement and utilization of organizational knowledge. Given the enormous quantities of data stored in organizational data warehouses, it stands to reason that data mining approaches could contribute significantly to the Knowledge Management process at hand. A fundamental goal of knowledge management is to have a systematic process (Huber1991) that can capture and enhance such organizational knowledge over time. To address this goal, academic (Fayrad *et al* 1996) and industry (Reimers2000) work in organizational learning and knowledge management suggest leveraging data mining techniques, given the vast quantities of data that modern organizations capture and store.

3.4 Specialist groups

In order to cater for the above mentioned areas necessary for knowledge management research from the organizational and methodological points of view, the following research areas have been grouped. The roles of the partners from the participating universities would be organized as follows:

Staffordshire University, led by Uden would be in charge of the overall KMO group. Uden Will be coordinating the three sub groups each working on different aspects of KM. Three main areas have been identified based on their strength and expertise. These are:

1. Web Services in Finland led by Kimmo Salmenjoki
2. Semantic Web in Slovenia led by Marjan Hericko
3. Data Mining in India led by Gurumusamy Arumugam

Each of these KN groups will have their own research units located in their respective countries headed by their respective professor with researchers and students working under them.

4 CONCLUSION

Knowledge management research embodies multidisciplinary expertise. To support effective research among small universities, we have established a research network based on DKM. Each of the universities would act as a KN, with their own team working in their area of interest, but would draw on the other teams' knowledge when needed. The group would be coordinated by the KMO headed by Staffordshire University. We believe that by working together as a group, we will also able to identify issues in knowledge sharing, the use of tools to support the collaborative enterprise using activity theory. Other objectives of KMO include giving support and synergy between the individual PhD researchers and their supervisors and attract the interest of various companies working on information service business.

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AUTOMATED SYSTEM FOR FORMING AND UPDATING STUDY PLANS

Aki Vainio, Kimmo Salmenjoki
Department of Computer Sciences
Faculty of Technology
University of Vaasa
Box 700
65101 Vaasa
Tel: +358-6-324 8438; fax: +358-6-324 8467
Email: {aki.vainio, ksa}@uwasa.fi

ABSTRACT

In Finland, each university student is required to make a personalized study plan in the future. The goal is to help the student graduate faster by giving better guidance. However, the current systems are designed to make the process easier for the administration and they do little to guide the student.

This paper presents a system for designing and updating a personalized study plan in a collaborative environment. The system is able to suggest a study plan and if needed, identify potentially problematic choices in the future, thus bringing dynamics in to the system. After identifying a problem, a given agent can try to find a better choice. By collaborating with other agents in a multi-agent environment, the chances of finding a mutually beneficial result is improved.

The project is currently at a very beginning stage, but a prototype of the system for creating study plans exists and many of the same ideas can be reused.

1 INTRODUCTION

The Bologna process forces many changes to the system of higher education. In Finland, one of the more recent changes is the new limit to the amount of time a student can study. Currently, it is common to study for six or more years to obtain a master's degree. In the future, five years should be the norm. Since none of the parties involved are willing to relinquish any of the requirements for a master level degree, better planning is needed.

According to [1], the tool for this planning is the personalized study plan, which is a requirement for all students in Finland in the future. Since a first year student does not have enough knowledge to make decisions for the whole span of his studies, keeping the personalized study plan up to date is important as the student becomes more knowledgeable. [1]

Current systems are not using the full potential of information systems. OVI [2] and Oodi [3] are attempts at simplifying the process, but neither seems able to so as all they do is store the study plan. OVI even requires the student to make all the picks, even though the mandatory courses could easily be selected beforehand. Oodi will include such functions and according to the current plan, it can also check the study plan for correctness, but the timetables for the project are such that a usable version will not be available for at least a few years.

Study plans could be used in a much better way. One specific problem in small departments is the lack of resources for arranging courses annually. Often many courses, which are not popular, are only arranged every other year or even less frequently. In order to optimize the use of resources, the departments can use the information gained from the personalized curricula to arrange only the courses with enough interest.

The proposed system could also use this same information to examine beforehand which courses are likely to be arranged in a given year. If the system finds that a student has chosen a course with low interest, it could let the student know of the problem. The system could also try to find other courses which might be of interest to the student, based on the student's earlier choices and the choices made in other curricula.

The new system is a will be a part of Wompat-system [4], which is designed as a tool for students to use when planning their schedules. It has been used in University of Vaasa for two years with good feedback from both administration and students. Also, the consortium behind the Oodi system has expressed interest in it.

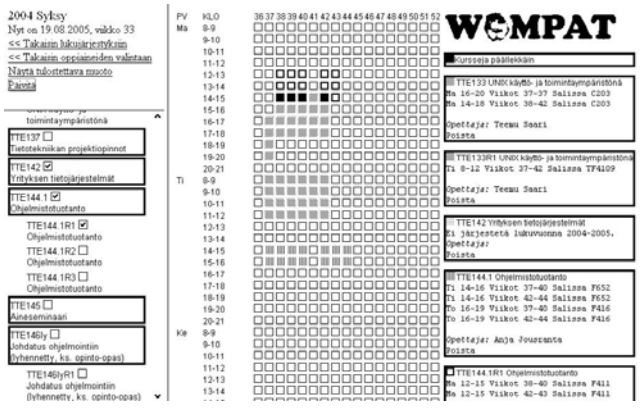

Figure 1. Screenshot of the current Wompat-system with course options on the left, schedule organized by weeks, days and hours in the center and courses chosen by the student in the right.

2 DECISION MAKING

The system needs decision making when suggesting courses for a study plan and when finding the correct timing for a course. In many cases, the latter is not a real problem, but it is in some instances, where some courses might be suitable for two or more years.

Finding the courses, which are probably not arranged, is simple. The system can find them by simply checking how many people have chosen a course on a given year. The system can either be equipped with the knowledge of how many students are usually required for a course to be held. It can also be equipped with the knowledge of how many of the courses will be arranged in a given year and make an estimation based on that information.

The decision making in the system is based on knowing the prerequisite courses required for more advanced courses, the interests of the student and learning. Through these methods, the system can find suggestions to present to the student.

2.1 Prerequisite courses as a tool

The relationships of prerequisite courses and advanced courses form a directed acyclic graph (DAG). This graph can be used to find appropriate courses based on what the student has already taken or on the other hand, if the student or system sees fit to choose an advanced course, the system can easily find the prerequisite studies needed for that course and suggest them to the student. By using the DAG, the courses can be easily found by moving through the graph recursively. On the other hand, if the student has not completed all the needed prerequisites and doesn't have enough time to complete them all, the system can stay away from those courses.

2.2 Interests of the student

As a student can focus his or her studies in a number of ways, depending on the courses offered, certain prepared areas of orientation can be used to help the decision making. After these areas are defined, each course can be given a weighted relationship with these areas by an expert, for example a teacher.

To give the system information on which to base the decision making on, the student can give his or her interests in the orientation in a manner reminiscent of fuzziness, where the student can choose from descriptions acting as variables [5].

2.3 Learning

Since the system should be able to function as autonomously as possible, learning is required to give them some freedom from the subjective or uninformed views of the people who give the agent the preliminary information on the relationships between the orientations and the courses. Since the system has access to full feedback from all the decisions it has made, in the form of whether or not the students follow its advice, learning can be very fast.

Learning can be based on simple decision theoretical analysis using frequency as a basis for decision. However, with small group sizes, this isn't always possible or the data is not accurate enough. For this reason, a set of values based on the preset relationships can be used to give the system some basis to work on when there is not enough gathered data to draw conclusions from. This also stops the system from learning too much from the first few students. By using this method, the system does not work on probabilities, but rather an approximation of probabilities.

If needed, the system can be taught in a supervised manner. By giving the system some sample personalized curricula, it can use those to learn from.

After the system has been in use for a long period of time, it might not be able to learn as quickly as before. The need to learn is still there as the curricula, tastes of the students and other matters change over time. This problem can be overcome by simply introducing limits on the number of students used.

Learning has another important function: Often the courses have no set year for completion. Even if the window is usually only years in these instances, this information might make a difference in the decision making process. This information can be learned from averages, with some tolerance for error. This learning also removes the need for telling the system when courses should be completed by the student. The system can make those decision based on the prerequisite courses as described in 2.1 and learning.

2.4 Combining the methods to form a suggested study plan or to suggest a course

The system has information on the structure of the curriculum and from this information it can find the last modules which have optional courses in them. This is important as the approach used is that the student has a clear goal in his or her studies and the study plan is used to reach that goal.

Based on this approach, the choices on orientations made by the student are used to find the most suitable courses for the student based on learned suitability or values given by the expert.

After the courses have been chosen, the system uses the information on prerequisite studies and automatically adds them to its suggestion. After this, it moves down the curriculum to the next module with optional courses. At this point, the system may have already filled this module, if there were many prerequisites for the more advanced courses. If there is still a need for new courses, enough are chosen and the system checks for prerequisites again. This is repeated until the whole curriculum has been handled. In the end, all the mandatory courses are added.

With all the courses selected and after having given the student a chance to have his or her input on the choices by selecting or removing courses, the system can move onto arranging the courses by year. A basic layout can be formed by using a topological sort. Many courses find their natural timing this way, but not all. The process continues by using the learned data on correct timings.

3 DATA STORING REQUIREMENTS FOR THE STUDY PLAN ENVIRONMENT

All of the information needed for the decision making and the study plans can be stored in a relational database. Figure 2 represents a possible structure for such database. This structure is used in the prototype version [5, 6].

The design is built around the student and the curricula. Curricula are divided into modules (basic studies, major, minor and so forth), which can have several different variants, although in many cases they don't have any. Modules are made up of courses and the student's study plan comprises of these.

As described in 2.4, the system requires some information on which courses are more advanced than others. This information is presented by forming a tree. The root is the curriculum itself and it usually has two children: bachelor level studies and master level studies. These are again divided into two or more sections and so forth. If a module has both mandatory and optional courses, these have been divided into different sections.

The tree is represented in the database by giving each module the values 'left' and 'right'. Beginning with the root, each vertex is given the values depth first. On the first visit, the 'left' value is assigned and on the final visit, the 'right' value is assigned. Thus root will have values of left is 1 and right is double the total number of vertices. The children of each vertex can be identified by using these numbers as both of the values of all the children will be between 'left' and 'right' of the given vertex. The main advantage of this method is the ease of depth first searches. The whole tree and thus the curriculum can be easily represented by ordering it based on 'left' values and using indentation [8].

Prerequisite courses are represented by a table with two separate foreign keys linking it to the courses. This table functions as the method for forming the DAG (see 2.1).

The orientation options are in their own table, with another table connecting them to the courses and the choices made on them by the students. The table connecting the orientations and courses holds the key information for the system to base its decisions on selecting courses. The table holds the weight proposed by the expert, who is working on the orientation, as well as the learned weight from previous choices by the students. Also, the number of students, from whom the weight was learned, is presented. This figure does not have to be accurate. It can be used to control the learning process somewhat. In the prototype, each course has a default 2 on this value and it can never go higher than 10, except momentarily.

The learned information on correct timing for courses is situated in the table 'module_courses' which represents which courses belong to which module.

The database structure is slightly redundant, as the information used for learning could be derived from the other tables, but the redundancy can be used for the aforementioned control and the structure can also make the system more efficient. The latter depends on how people use the system. If the study plan is constantly changed and not only looked over, the redundancy should probably be removed.

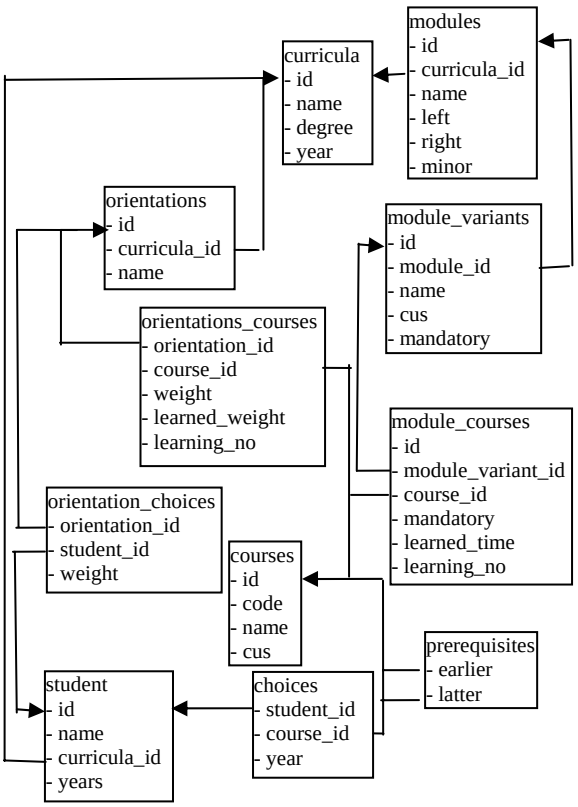

Figure 2: Structure of the database

4 MULTIAGENT BASED APPROACH

To keep the study plans up to date without the need for the student to check it regularly, the checking should be automated. This work can be done by an agent or several agents. [9]

When the agent encounters a problematic choice, it notifies the student and begins to look for another course or courses which to suggest to the student. It can also leave a notification to a central message station that if others agents are having problems finding a suitable course they could perhaps make a common decision. This approach has the benefit of gathering a number of students to participate on a course so that the chance of that course being arranged is higher.

At this point, the agent must make a decision. Will it suggest another course, which is more interesting, but might not be arranged, if there aren't enough students, or will it suggest a course which is probably arranged, but is not as interesting to the student as the other possibilities?

The agent could also make an attempt to make a deal with the other agents. If the problematic course is a key course in the students study plan, the agent could offer to change another course in its study plan if other agents are willing to change a course in their study plans to the key course. Student input is crucial at many of the stages, since the student has to actually carry out the plan.

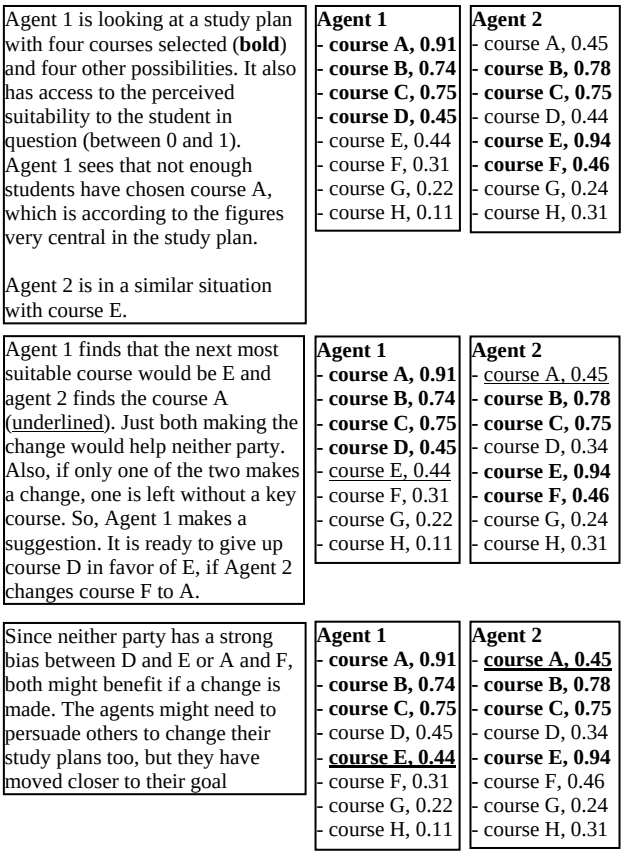

Figure 3: Example of a negotiation between agents

Figure 3 represents one case where two agents might be able to guide their students into mutually beneficial agreement. Since neither can make decisions without receiving input from the students, the process is slow. Also, the process might result in nothing, if there still aren't enough students who plan to take the course.

In this case, the most important thing is to keep the student aware of the situation, so that the student can take action too if necessary or it can stop the negotiation if the course suggested is not to his or her liking.

Technically the decision making can be done with in the same way as before. The environment could be a ticket-like system built on the same database structure as the rest of the system. The agent can leave or read tickets from the database and use them for evaluation of its situation.

Currently the problem of how to weight the risk of not being able to attend a course even after changes against choosing a course which will be arranged with a high probability is unsolved. Perhaps this should be left to the student to decide or the system could learn to find the best way to go from experience. This learning might take years before it could reach a reasonable level of functionality and there isn't necessarily that much time.

5 CONCLUSIONS

Finnish students are going to need more guidance in the future. Obvious solution would be to hire more counselors, but that as shown above, that is not the only option. In fact, the system could go beyond the capabilities of the counselor, if the whole system is used for decision making by the departments.

In this case, the system could be a usable tool for all parties: it can help the students plan their studies better which is also the goal of the public administration, and the departments can base their teaching plans on something more concrete.

The system is currently under technical development [6]. The system can already identify the suitable courses and construct a timetable with good accuracy [5]. The solution is generic and can be used in a number of environments.

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LEARNING VIRTUALLY, HOW TO COLLABORATE IN ULTRA-LOCAL PLATFORMS. EXPERIENCES AND PRACTICES IN FINNISH RURAL VILLAGES

Matti Tyynelä
University of Vaasa, Seinäjoki unit
Tel: +358 20 124 4205; fax: +358 20 124 4201
e-mail: maty@uwasa.fi

ABSTRACT

Electronic Village Network (Finnish abbreviation Ekylve) project in Etelä-Pohjanmaa, Western Finland is one of the first serious attempts to affect to the paradigm of the digital divide –phenomenon in the rural areas (Castells and Himanen , 2001). In three years period EU-financed project participates 22 rural villages. Its aim is to fight against the unequal share of digital services in the non urban areas (Gunkel, 2003). The main idea was to fulfil the claims of the villagers to first have computers with legal software, secondly to have fast internet connection, thirdly to have the skill to use the both, then to have own villages internet –based local information platform, which we here call a "Villageware" and "Inter-village" -service and lastly to create the fully empowered online communities for different purposes. As a part of this process emerged the technologically aligned on-line community of 14 persons (Preece, 2001), which was dedicated to give a proper maintenance to the Linux servers in which the Villageware service is running. In this partly critical (Walsham, 2005) and action –based participatory research the formation and success –factors (Swanson and Ramiller, 2004*) *of ultra-local on-line community were taken under a scope (Preece 1999).

1 INTRODUCTION

As almost anywhere in the European countryside, the way of living of rural regions in western Finland is in the turmoil. The traditional way of making living, the agriculture and farming is in the state of continuous change and new alternatives of livelihood are emerging in too slow pace. The young generation tends to find their future in the urbanized parts of the country and the rural areas are suffering the consequences of diminishing population. The reasons of the movement is said to be a lack of services provided by companies or authorities, so called digital divide phenomenon (Gunkel, 2003). By the other hand, the lack of population increases the deterioration of the traditional services. Local shops are vanishing. Many of the village primary schools are closing their doors. The traditional way of staying connected in the local activities of the villages and other villagers is vanishing in the same pace (Nicholas 2003).

The emerged information highway, Internet and the digital services it brings along is expected to be at least a partial cure to this negative development. The expectations of new working alternatives, virtually maintained distance jobs, distance learning, e-commerce as the parts of whole e-palette, are giving at least some hope to the inhabitants of rural regions to be able to survive with the way of living they had chose. (Schuler D, 1996).

The coin has two faces: firstly the emerged internet –based local services demand –despite the existence of technical devices and information networks- new skills and attitudes from their users, which in many occasions are very hard to gain (Castells and Himanen 2001). From the other hand the active use of internet offers a new possibility to maintain social relations with other inhabitants in the local level. The local school has vanished in many of the villages, but the school building has undergone a complete transformation to be a cradle of local activities, a village house. In its best, the village has been able to maintain the both, the village school and the village house in the same time. These fortunate villages and their even more fortunate inhabitants are quite few, anyhow.

To facilitate this development to take a place, 22 rural villages of Etelä-Pohjanmaa province in Western Finland area took an initiative to create a electronic village network, where Internet based local services to the villagers is a backbone of all other activities. This eKylve (Finnish abbreviation) project has five main goals, which all were aimed to reduce a digital divide gap between the urban and the rural areas. All these initiatives were created by the villagers themselves and they have a very practical problem solving background.

The research method used in this study is theory testing positivist case study (Dubé and Paré, 2003). The case is a learning community of 15 adult persons, which use video-conferencing environment in learning situation, which enables the virtualization of the learning place and the space. The data collection is made using the principle of multiple information sources. The other method is to study the success factors of the online communities (Preece, 2001). It is based on measuring the usability and functionality of the platform software, which is used by these communities to develop instruments for measuring different factors of interactive, real time software in relation of their use purposes.

2 THEORETICAL BACKGROUND

The success factors of online communities haven't been studied much. Jenny Preece has developed a method,

which can be used to verify usability and functionality of the platform –software used by the online communities in their activities. Simultaneously she has traced definitions and gauges of the success factors of the online communities. For this purpose has been developed a end-user based set of gauges, which is used to clarify the factors of interactive, real time software solutions in relation of their uses.

According to Preece, the success factors can be divided by the factors supporting sociability and usability. Sociability factors are divided by the significance of the software for its end-users, the population and the special needs of the end-users, and the procedures used in the sessions. The usability factors are divided by the time used of learning dialog and the interaction, how long takes the learning of the user information (help-section of the program), the internal navigation of software and its factors. Finally must be explored if the users are able to find all the needed components of the software. With all the mentioned factors has to be studied the time and the steps of each user while fulfilling the task (table 1).

Frame	Design criterium	Example of success factor
Sociability	Mean of use	How many and what kind of messages and comments are sent? How accurate is a discussion? How much interactivity is exploited? How much and what kind of interactivity is occurring? What is the quality of the interaction among the members of the community?
	People	How many and what kind of persons are members of the community? What are their roles within the community? How experienced users are they? What is their age and sex and possible special needs?
	Procedures	What kind of procedures is used in the community? How is organized the registration to the community and what is the model of common behaviour? What if improper behaviour occurs? How powerfull are these procedures? How to encourage the sociability and the human relations? How to improve the creativity?
Usability	Dialogue and the social support	How long it takes for user to learn the dialogue and social support? How long it takes to send or receive a message or carry out another activity? Are end-users satisfied? How many mistakes the end users make?
	Design of Information	How long it takes for end user to find necessary information to use the features of the software? How long it takes to carry out a information based task? How satisfied are the end users? How long the users remember the functions after finalizing the use?
	Navigation	How long it takes to learn to navigate inside the software and website and find the needed information? Can the end users find the needed information in reasonable time? How long the users remember the navigation structure? How satisfied are they? How many mistakes the end users make meanwhile the navigation?
	Access	Can the end users access to all the needed parts of the software? Is the time used in uploading within the rational limits? Are the end users able to upload and use every part of the software in reasonable time? Is the response time reasonable? What are the problems of uploading and installation of the software?

Table 1: Examples of the success factors (Preece 2001).

In this study the first task is to test Preece's existent success factors by the case of one online-community of learning environment and possibly complement these factors with emerging new items from the gathered experiments of case.

3 DESCRIPTION OF THE ON-LINE COMMUNITY OF THE STUDY

For the use of each village there is its own independent groupware which is located on the commonly used Linux based web-server of villages, which is initially created and maintained by the stuff the local unit of regional university. The server is moved after the suitable time into the village house of a participant village where the sites of different villages are maintained and are updated by the own expert of each village. The online community which forms the foundation of this study consists of the 14 inhabitants of the aforementioned villages who are more interested of the ICT and especially use of WWW applications than average villager. From the members of the group there were 5 females and 9 males. The age distribution was relatively even from the 21 years to 72 years. The members were located in Etelä-Pohjanmaa province geographically in 10 different villages. The longest geographical distance was 98 km from regional center Seinäjoki where the teaching without using video mediated classroom would have been arranged. (Chaladhi, R.K. and Gande, S. G. (2003).

In practice, all except two of members of the online community participated in learning sessions from their homes, because the usual education would not have been possible to them for the sake of the work obstacles, transportation obstacles or the lack of the sufficient motivation. From the group was asked if they were to participate in traditional learning sessions, the answer was negative. The economic investing on almost all the members of the group was relatively little because there was a PC already in the use of nearly every one. Two persons had to invest to DSL connection in order to participate in education and three persons participated from elsewhere than home for the sake of the lack of the

data communications link. The necessary auxiliary equipments were lent by the project to those who did not have them yet. The majority of the group acquired the necessary devices to themselves meanwhile participating in the education. The education was free to the participants. According to this one can think that the education sessions which are based on the virtual teaching place and on the virtual control of the teaching situation are especially useful there, where the distances are long and the road connections are bad but DSL data communications links are available.

4 COMMUNICATION AND COLLABORATION

The purpose of the teaching was not to share merely the information about the installing and maintenance of the WWW servers which function with the Linux operating system. The purpose also was to create a group sense of administrators and to foster the ability of participants to act interactively according to the principle of the problem solving. Because of this it was decided to use as a main learning base a video-connected classroom to which a web-based learning environment was connected. Thus the learning event became multi-level. The actual teaching, the teacher's advice, interaction and grouping was bound to the time, but a teaching room and teaching place was virtualized. (Schulze and Orlikowski (2001).

Accordingly all the material of the course was available in a virtual learning environment, what virtualized the time of study and studying environment. The exercises were carried out as if the group were present in physical computer class. The class was only dispersed geographically using the network of Linux –PC:s which were given to every student into use and where a VNC (Virtual network connection) facility were included. The teacher had opportunity to observe the individual work of every pupil and correspondingly may have directed the pupil without being physically present. Considering the holistic development of the use of internet –based services in the rural villages, this formation of virtual online community of maintenance of Linux-servers pinpointed totally new way of conduct in cooperation between rural villages and their actors. Normally, villages have not acted as a single group of actors, but every village has created its own group of activities, no matter what the kind of activity has been. The informal and distributed management of expertise was totally new for most of the villagers and it created in the beginning some misunderstandings among them. For example it was a slightly confusing to some of the participants, that the quantity of participants per village was not reduced but any interested was able and encouraged to participate in the learning sessions. The students were more used to act with the inhabitants of the own village, and the participation of the inhabitants of the distant villages was somehow scary. Even more, the use of new technology was less disturbing than the presence of set of totally unknown persons in the virtual group.

5 LEARNING AND KNOWLEDGE

Linux academy -concept was chosen to be executed because to it had the clear social order in the participating villages. The pupils had neither to be especially looked for nor had to be motivated because the knowledge acquired in the learning situation and skills will be available immediately in the administration of the groupware of each village. The training work which was closely related to the learning event was carried out directly likewise based on the practice and thus end users estimated their quality immediately. Linux academy -concept had been carried out earlier in connection with the software engineer education in the information technology of polytechnic academy and it had been estimated to be 10 credits worth.

The set demand was beforehand that every student would hear and would see all the other pupils and the teacher in real time and all the time. Every pupil has to be also in contact with the teacher's computer and the teacher to correspondingly the pupil's computer with the help of the VNC connection so that the solving of problem situations and the personal guidance would be possible. Every pupil also can use all the interactive server material of the course in real time. All this must also fit for telecommunications and for the computer to the definitions of minimum requirements. An attempt was made to avoid costs. The teacher was attempted by the fact that old teaching material does not need to be rewritten. For this, the basic requirement was that the Power Point transparencies and Word documents are as such available and divided in the document share part of the video conferencing environment. About half of the participants answered that they had earlier participated in some kind of net studies. – The video-conferencing software 76% of the participants used at home and thus participated in a real-time network-based learning situation. These participants were satisfied with the learning situation. From the ones which participated in the education from elsewhere all except one hoped that they were able to participate from the home in the education.

The participant’s discussion with the members and outsiders of the group varied fairly much. Half of the members of the group told that they had discussed with all the members of the group. All discussed of course with the teacher. About half discussed during the sessions with a member of the family or acquaintance outside the software. The technical matters prevented a most discussion and interaction with others, the factor which was manifested about 76% of the answers. The shyness had effect in one of the answers and the overlapping talking in two. Three interviewees hoped to pay more attention to the conduct rules of the video conference even though they also praised the virtual behaviour of the own group. On the other hand, the seeing of the discussion partner, on the other hand, the earlier knowing of the discussion partner promoted a discussion and most interaction. Also the encouragement to talking and the discussion was regarded as important. The significance of the video picture was emphasised by about half of the interviewees. Without the video picture 76% of the ones which had answered would not participate in these kinds of sessions at all.

6 DISCUSSION

Preeces concept from the success factors of the software which functions as the platform of on-line communities, got support of this study. Preece emphasises that the software which is used as the base and means of communication of the online community has to give active support for the forming of the sociability and for the promotion of the usability. In practice this means that the software has to support as versatile as possible and natural multi-channel sending of the messages and comments. The discussion should be as real-time as possible and interactive and multi-dimensional. The forming of the different roles during the session should be made possible and takes their possible special needs into consideration.

The support of a sociality, the forming of the group and of other normal human interaction as the built part of the software distinctly expands the usability of the learning environment. One can notice distinctly that the ordinary interaction models of the everyday life are an important part of the environment's functions also if these make the genuine and real interpersonal interaction possible. Unfortunately there has been fairly little support of the interaction like this for the group-oriented software but the PC based video conference software under examination seems to be an affirmative exception.

From the pedagogical point of view, the study brought out necessary to define "the new virtual learning circle "in which the property of the virtual distance learning would also have been included and where the relations between the "real" face-to face interaction and the virtual interaction are defined. It also is justified to continue the estimation of the success factors of different learning platforms and the directing of them to new types of groupware, until now untested. At the same time one can look for new unheard of areas of operation to this kind of learning platforms which makes possible excepting the distance teaching and the meeting practices, but truly versatile virtual and genuinely interactive social operation. These could be the virtual village meetings, elderly persons safety and care services or virtual consultation services.

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TEHNOLOGIJE ZA PODPORO SODELOVANJU V VIRTUALNI SKUPNOSTI

Katja Harej
Fakulteta za elektrotehniko, računalništvo in informatiko,
Inštitut za informatiko, Gosposvetska 84, 2000 Maribor
Tel: +386 2 235 5123; fax: +386 2 235 5134
e-mail: katja.harej@uni-mb.si

POVZETEK

Skupnost nam predstavlja skupino ljudi, ki se začno družiti zaradi izmenjave mnenj, izkušenj, znanja in na primer izmenjave različne dokumentacije. Ljudje so tako povezani v neko socialno okolje. Povezani se čutijo kadar tudi sami nekaj prispevajo, ko jih drugi potrebujejo ali samo ogovorijo. In, če postavimo to skupnost v spletno okolje, dobimo t.i. virtualno skupnost. To ni navidezna skupnost. Ravno toliko je realna, kot je realna skupnost v kateri sodelujemo vsaki dan, skupnost v kateri živimo, ko se na primer vrnemo iz službe in gremo na igro tenisa ter se z ostalimi igralci vživimo v pogovor o lastnih izkušnjah pri igri. Virtualno skupnost si lahko enko predstavljamo, le da pogovor ne poteka na štiri ali več oči, temveč ga omogočajo informacijske tehnologije (IT), s čimer lahko pridobimo še več možnosti za sodelovanje. V prispevku opisujemo tehnologije, ki so potrebne za vzpostavitev in delovanje takšne virtualne skupnosti. Raziskali smo, na kakšne načine lahko člani virtualne skupnosti sodelujejo in komunicirajo med sabo in kakšne funkcionalnosti jim ponujajo virtualne skupnosti.

1. UVOD

Virtualne skupnosti dajejo ljudem s podobnimi interesi možnost druženja, komuniciranja in medsebojne izmenjave idej in informacij preko interneta. S pomočjo teh aktivnosti posamezniki vzpostavljajo medsebojne vezi z drugimi člani skupnosti in s skupnostjo kot celoto. V zadnjih nekaj letih se je število virtualnih skupnosti povečalo [ADLER00] kot ena vsakdanjih in potencialno pomembnih zmožnosti interneta. Za vzpostavitev virtualne skupnosti je potrebna informacijska tehnologija, ki nudi podporo funkcionalnostim, potrebnim za uspešno vključevanje članov v posamezno virtualno skupnost. Pred predstavitvijo teh funkcionalnosti si poglejmo najprej kaj virtualna skupnost predstavlja in čemu ali komu je namenjena.

2. VIRTUALNA SKUPNOST

Virtualna skupnost je lahko vzpostavljena okoli skupine posameznikov, ki pripadajo določeni demografski skupini (npr. študentje, starši, mladostniki ipd.). Lahko je vzpostavljena tudi za skupino poslovnežev ali strokovnjakov (npr. zdravniki, programerji ipd.) ali samo za izmenjavo interesov (npr. za področje investicij, potovanj, za igranje na spletu ipd.). Ker se člani virtualne skupnosti povezujejo prav zaradi skupnih interesov, imajo zelo široko področje komunikacije [ADLER00].

Danes se virtualne skupnosti svobodno uporabljajo in interpretirajo le kot način druženja s pomočjo interneta. Ne predstavljajo nujno močnih vezi med člani. Poštni seznami imajo npr. na tisoče članov in komunikacija je lahko samo enostranska (v primeru, ko npr. lastnik seznama pošilja novice članom vpisanim na seznam) ali samo informativna (podajajo se vprašanja in odgovori – v tem primeru ostanejo člani relativno tujci in nezainteresirani en za drugega). Nivo članstva [WIKIPEDIA04] se tako lahko zelo razlikuje od ene virtualne skupnosti do druge.

Z obstojem virtualne skupnosti pridobijo tudi trgovci katerim se odpirajo večje možnosti za oglaševanje in potemtakem tudi ponudbo lastnih izdelkov/storitev ciljnim skupinam.

Sinonima virtualni skupnosti sta **spletna skupnost** (ang. online community) in **posredna skupnost** (ang. mediated community) [WIKIPEDIA04].

Nadalje, virtualne skupnosti so odvisne od baze članov in lahko vsebujejo tudi tehnologije, ki podpirajo registracijo, elektronsko poslovanje, upravljanje direktorijev (npr. direktoriji izdelkov, storitev, dobaviteljev, slik) in tehnologije iskanja (npr. za iskanje profilov članov, razne dokumentacije skupnosti, poročil, člankov, arhivov).

Možnosti za sodelovanje je torej več [ADLER00], med temi pa so najbolj v ospredju:
- tekstovni pogovori,
- neposredno sporočanje (ang. instant messaging),
- oglasne deske,
- poštni seznami,
- spletne strani članov in opisi njihovih profilov,
- objave raziskav in
- virtualni svetovi.

Večina virtualnih skupnosti zagotavlja tako »sinhrono« (v realnem času) komunikacijo s pomočjo tekstovnih pogovorov ali direktnim sporočanjem, kot tudi »asinhrono« komunikacijo (oglasne deske, vključenost v poštne sezname, spletne strani za člane in skupnosti,

objave raziskav). Kot generalizacija, je komunikacija v realnem času običajno bolj družabna po naravi, medtem ko je asinhrona komunikacija bolj osredotočena na določeno področje pogovorov [ADLER00].

Uspešna virtualna skupnost služi svojemu namenu z aktivnostjo članov in tudi z doseganjem prvotno zastavljenih ciljev ustanovitelja. Če vzpostavljamo novo virtualno skupnost ali samo izboljšujemo obstoječo, bomo uspešnejši, če bomo znali definirati:
- kakšen tip skupnosti vzpostavljamo,
- zakaj in
- za koga vzpostavljamo skupnost.

Vsaka skupnost je lahko uspešna ali ne, odvisno od tega, kako člani skupnosti oz. tisti, ki jo upravljajo ali sodelujejo v njej, definirajo uspešnost [JO-KIM00].

3 TEHNOLOŠKA PODPORA VIRTUALNIM SKUPNOSTIM

Virtualno skupnost je možno vzpostaviti z malo ali brez tehničnega znanja, vendar je nedvomno uporabno, če se spoznamo vsaj z nekaterimi tehnikami na katerih sloni skupnost. Če izberemo gostitelja ali t.i. ASP model (Application Software Provider), potem skoraj zagotovo ne potrebujemo in niti ne bomo videli programske kode, ki podpira delovanje naše skupnosti. Običajno so komponente takšne skupnosti dostavljene kot celota v enem paketu [ADLER00]. Te v večini primerov ni mogoče spreminjati.

Tehnologija sama ne ustvarja virtualne skupnosti, brez nje pa ne moremo sodelovati virtualno (oddaljeno).

Veliko različne vsebine, ki jo lahko najdemo v virtualnih skupnostih vodi v izbiro nekaterih ključnih elementov, ki označujejo virtualno skupnost. Implementacija teh ključnih elementov je lahko obravnavana kot jedro tehnološke osnove za podporo
vodenju virtualnih skupnosti [BENINI+01].

Med temi elementi ima zelo velik pomen generalizacija koncepta foruma. Ta je lahko definirana kot informacijski vsebnik, ki se nanaša na določeno vsebino. Primeri takega foruma so lahko: oddaljena predavanja, bazen mnenj uporabnikov o določeni temi ali na primer seznam kulturnih dogodkov, ki se bodo zgodili na določenem področju. Vse našteto je opredeljeno tudi kot virtualna skupnost.

Tehnologija, ki jo izberemo za vzpostavitev virtualne skupnosti je enaka tehnologijam za podporo dinamičnih spletnih strani, ki slonijo na podatkovnih bazah. Med takimi podatkovnimi bazami najdemo entitete kot so: forum, pogled, sporočilo, uporabnik in profil. Vsak forum sprejema niz sporočil. Omogočeno je objavljanje strukturirane vsebine in filtriranje le te. To predstavlja funkcijo različnih pogledov. Pogled je lahko različen za vsakega posameznega uporabnika, ki sodeluje v forumu. Forum je lahko dosegljiv samo preko izbranega pogleda. Na forumu imajo uporabniki različne pravice – kaj lahko nekdo, ko zagleda sporočilo, z njim počne. Uporabniki so avtorji sporočil in so identificirani in razvrščeni glede na njihovo(e) vlogo(e). Vloge so definirane na bolj globalnem konceptu profila in definirajo odnose med uporabnikom in različnimi pogledi. Tako lahko profili identificirajo vlogo ali homogene razrede uporabnikov.

Funkcionalnosti virtualne skupnosti so implementirane z uporabo omenjenih entitet:
- registracija in upravljanje uporabnikov; vsi uporabniki so registrirani za identifikacijo članstva v skupnosti. Tako ima vsak uporabnik svoje uporabniško ime in geslo za vstop v skupnost. Vsak ima, za večjo prepoznavnost, možnost dodajanja in spreminjanja dodatnih informacij o sebi (npr. slika, starost, zaposlitev, hobiji, ipd.). Glavne kategorije uporabnikov ali njihovi profili (v tehnološkem smislu) so lahko:
  - gostje: lahko prebirajo ali tudi objavljajo sporočila v določenih področjih in niso prijavljeni,
  - registrirani uporabniki: so splošni uporabniki, ki lahko uporabljajo vse funkcionalnosti, ki jim jih skupnost nudi,
  - moderatorji: upravljajo enega ali več forumov,
  - administratorji: imajo administrativne pravice in funkcionalnosti za skupnost kot celoto ali del nje;
- sodelovanje in komunikacija;
- poosebitev (personalizacija) namizja članov;
- iskanje po skupnosti;
- izdelava spletnih strani članov (hosting): nekatere skupnosti nudijo možnost izdelave spletne strani posameznih članov na njihovih strežnikih,
- nastavitev privatnih elektronskih pošt in uporabo osebnih koledarjev. Z večanjem storitev v skupnosti, dobijo člani večji občutek pripadnosti.

Iz naštetega lahko vidimo, da so nekatere funkcionalnosti enake funkcionalnostim, ki nam jih nudijo spletni portali. Če naštetim lastnostim dodamo še ostale lastnosti portalov, kot so:
- taksonomija,
- pomoč in npr.,
- upravljanje dokumentacije,

je rezultat lahko še vedno virtualna skupnost. Tako lahko sklepamo, da so virtualne skupnosti le zelo dobro organizirani spletni portali, ki nudijo uporabnikom, torej članom skupnosti, funkcionalnosti in vsebine, ki so zanje dovolj zanimive, da se počutijo povezane v izbrano skupnost. Med take virtualne skupnosti lahko štejemo tudi eno največjih in najodmevnejših skupnosti na internetu na področju glasbe, t.j. Napster (The Napster Music Community). Na področju odprtokodnih rešitev poznamo SourceForge.net skupnost, v katero je vključenih 300,000 uporabnikov in gosti več kot 30,000 odprtokodnih programskih razvojnih projektov skupaj z vso potrebno dokumentacijo (izvorno kodo).

Razlika med virtualno skupnostjo in portalom je mogoče le v pomembnosti ali podprtosti podanih funkcionalnosti. Na primer, pri virtualni skupnosti je komunikacija zelo pomembna, medtem ko je pri nekem portalu mogoče

pomembnejša taksonomija in iskanje po vsebini portala. Vseeno pa je še vedno vsaka funkcionalnost odvisna od namena skupnosti in/ali portala.

4 SODELOVANJE IN KOMUNIKACIJA V VIRTUALNI SKUPNOSTI

Programska oprema za podporo skupinskemu delu (ang. Groupware) je namenjena skupinam in komunikaciji. Uporabljena je lahko tudi za sodelovanje, koordiniranje, reševanje problemov, primerjanje ali pogajanje. Medtem ko se tradicionalne tehnologije kot je telefon tudi klasificirajo kot orodja za podporo skupinskemu delu, se ta izraz običajno nanaša na specifičen razred tehnologij, ki se sklicujejo na računalniška omrežja. Med njimi so npr. elektronske pošte, skupine za prejemanje novic, videotelefonija ali klepet na internetu [DBD04].
Programska oprema za podporo skupinskemu delu je običajno kategorizirana na dve glavni dimenziji:

- uporabniki te programske opreme, ki lahko sodelujejo na štiri načine [WHITE03]:
  - sinhrono (v realnem času),
  - asinhrono (odgovor na sporočilo je lahko objavljen čez določen čas),
  - potisni način (ang. push): pošiljatelj sporočila ima nadzor nad tem, kdaj je bilo sporočilo (informacija) dostavljeno ali neko opozorilo poslano,
  - povleci način (ang. pull): prejemnik sporočila ima nadzor nad tem, kdaj je nazadnje pregledal novo prispela sporočila in/ali informacije,
- uporabniki, ki sodelujejo nastanjeni v istem prostoru, na istem mestu (ang. »colocated« ali »face-to-face«) ali na različnih lokacijah, oddaljeno (ang. »noncolocated « ali »distance«).

POTISNI tehnologija:
Če dalje analiziramo »potisni/povleci« tehnologije, vidimo, da postaja »potisni« tehnologija na spletu vedno bolj priljubljena. Ta tehnologija avtomatsko dostavlja določene podatke ali informacije uporabniku in sicer na podlagi predhodno definiranih informacijskih profilov ali filtrov. Večino časa je bila ta tehnologija znana pod imenom »trenutna zavest« (ang. current awareness) ali SDI storitve (Selective Dissemination of Information) in je kot dostavni medij uporabljala faks ali elektronsko pošto [POWIS04]. Vendar, s časom se je pokazalo, da je splet kot medij za večino organizacij bolj primeren. Kakorkoli, danes je zelo razširjen model, ki ima predvsem to slabost, da zavzame večino zelo vredne pasovne širine, še posebno, ko se podatki širijo po internetu in ne samo znotraj korporativnega intraneta (med drugim za urnike ali opomnike za dostavo projektnih izdelkov ali za potrebna nova opravila).

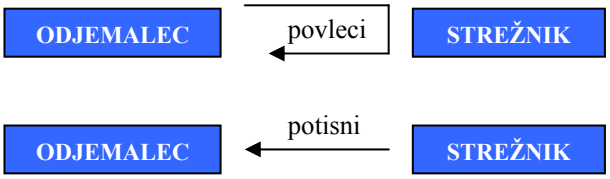
Potisni tehnologija ima običajno podobne pomanjkljivosti kot splet. Filtrirni sistemi še vedno ne zagotavljajo potrebnih informacij znotraj časovnih omejitev uporabnikov. Uporabniki si želijo, da jim obveščanje o novostih ne bi vzelo več kot 10 min dnevno. Tehnologija je trenutno odvisna od profilov, ki so še nezreli (omogočajo samo polnjenje e-poštnih predalnikov s podatki) [POWIS04]. Vendar navkljub pomanjkljivostim, uporabnikom omogočajo ažurne, časovno realne podatke. Na primer, uporabniku ni potrebno čakati na jutranji časopis, da bi lahko prebral dogodke današnjega dne.
Primer uporabe potisni tehnologije je na primer t.i. spletni dnevnik (ang. Blog ali WeBlog) [WHITE03], ki predstavlja spletno stran izbrane vsebine, ki jo lastnik spletne strani ali uporabniki pogosto ažurirajo [iSlovar05]. Vsem poznani primeri potisni tehnologije so tudi elektronska pošta, neposredno sporočanje in intranet (predvsem za objavljanje, uporablja pa tudi povleci tehnologijo).

POVLECI tehnologija
Čeprav je »potisni« tehnologija tako zelo popularna v sklopu spletnih tehnologij in še posebno pri korporativnih intranetih, se tradicionalne iskalne metode, danes pod izrazom »povleci« tehnologija, hitro širijo po spletu. Številne organizacije si za svoje korporativne intranete razvijajo iskalne mehanizme, ki so zmožni iskati več kot le HTML in tekstovne datoteke [POWIS04].

Primer uporabe povleci tehnologije so t.i. hitre strani (ang. Wiki ali WikiWikiWeb). Wiki pomeni »hitro« po havajsko. To so spletne strani, ki jih lahko uporabniki obiskovalci kar hitro spreminjajo z uporabo enostavnih pravil oblikovanja. Izdelane so bile z namenom zagotavljanja skupinskih diskusij. Na trgu obstaja že kar nekaj orodij, ki omogočajo izdelavo takšnih strani [TECHENC04].

Glede na to, da so danes potisni tehnologije popularnejše od povleci tehnologij, bi se morali vprašati, katero kje in kdaj uporabiti in ne samo katero je boljše uporabiti. Uporabniki potisni tehnologije lahko obdržijo sledi prejetih informacij in nato iščejo podrobnejše informacije kjerkoli v omrežju, povleci tehnologija pa zagotavlja uporabnikom iskanje informacij v podrobnosti, ki so pomembne za organizacijske ali osebne odločitve. Pomanjkljivost obeh tehnologij je to, da mora uporabnik vedno vedeti kje nadalje iskati relevantne informacije [POWIS04].

Bolj nazorno nam oba pristopa prikazuje slika 1 [RAJOSI+00]:



SLIKA 1: Povleci/potisni pristop

Povleci/potisni tehnologije lahko zelo dobro izkoristimo tudi v poslovnem svetu. Predvsem potisni pristop je največkrat uporabljen pri prodajalcih raznih izdelkov in storitev. Danes nas večina to občuti že prevečkrat kot nadlegovanje, ko brez prijave na določen poštni seznam dobimo elektronska sporočila, ki nas v večini sploh ne zanimajo. Če pa že najdemo tako virtualno skupnost, ki se nam že na prvi pogled zdi zanimiva in nujno potrebna za npr. poslovanje naše organizacije ali pridobivanje znanja o

določeni temi, se lahko vanjo včlanimo in imamo s pomočjo takšnih tehnologij prav gotovo določeno korist.

6. ZAKLJUČEK

Sodelovati virtualno že dolgo ni več nemogoče ali nedosegljivo. Virtualne skupnosti nam omogočajo, da kot člani sodelujemo in komuniciramo na več različnih načinov. Dejansko se lahko v virtualno skupnost vključimo kot aktivni ali pasivni člani. Lahko izmenjujemo lastne izkušnje in znanja, svoje podatke ali dokumente ali samo koristimo druge funkcionalnosti skupnosti, kjer ne potrebujemo aktivno sodelovati (na primer, vpišemo se v seznam za prejemanje informacij po elektronski pošti). Kakorkoli, kot uporabniki ali člani virtualnih skupnosti, izkoriščamo funkcionalnosti za katere je potrebna tehnologija, ki predstavlja ključni element za vzpostavitev in delovanje virtualne skupnosti ali drugih portalov. Brez tehnologije v ozadju, virtualna skupnost ne more delovati, sama tehnologija pa še ne predstavlja skupnosti. Za to so potrebni člani in njihova želja po povezovanju in sodelovanju.

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INDICATORS OF INFORMATION SOCIETY

Dijana Močnik
University of Maribor, Faculty of Electrical Engineering and Computer Science
Smetanova 17, 2000 Maribor, Slovenia
Tel.: +386 2 220 7389; fax: +386 2 251 1178
e-mail: dijana.mocnik@uni-mb.si

ABSTRACT

In the paper, we present some indicators of the information society that were proposed as statistical indicators of information society in EU. EU has taken up the challenge of developing innovative information society indicators by which the rapidly changing nature of modern societies can be established. Proposed indicators have been tested in EU countries and the US. The results enable the comparison of the progress between countries. Although we already know that the US is the most prosperous country in information society, the results show for how much and in which areas the EU lags behind the US. The gap in the values of different indicators of the newly associated states to the EU, among which we expose the indicators for Slovenia if applicable, is even greater.

1 INTRODUCTION

High-technology revolution of the 1990s, computers, television, the Internet, and allied information technologies are changing our lives, just as steam power, electricity, and the internal combustion engine transformed our lives in the past [1, 2, 3]. Today, the emphasis is on information gathering, processing, and distribution [4]. Because of the great possibilities of information technologies and its related information industries the discussions have been part of many people's lives for more than 40 years [5]. All of them suggested that modern telecommunication and information technologies would be the front-runners of the information era. It is expected that the twenty-first century will be dominated by information technology and allied technologies [3, 6]. Therefore, to define the progress of a country, the formation of proper indicators is needed.

The information society is one in which information is used intensively as an aspect of economic, social, cultural and political life [7]. An information society originates from two interrelated developments: first, long-term economic development, and second, technical change. In long-term economic development, the source of strength of an economy changes from the primary sector to an already-growing secondary sector, and from the secondary sector to a rapidly expanding tertiary sector [8]. During technical change, the major emphasis is on information technology, which has three advantages: 1) wide applicability, 2) exponentially increasing capacity over the last 15 years, and 3) the rapidly declining costs over the same period – and it appears that this trend will continue at least for one or two more decades [5, 9, 10].

The paper is organized as follows. Indicators of information society are presented in the next section. In the third section we present the results for the EU and the newly associated states (NAS) to the EU in comparison with the US. The final section presents a conclusion.

2 INDICATORS OF INFORMATION SOCIETY

To define the progress of information society, the formation of indicators that incorporate technological, social, political and economic dimensions is needed. Mansell and When [3] propose to use eight indicators based on infrastructure, experience, skills, and knowledge (i.e. personal computers per capita, main telephone lines per capita, share of electronic revenue in GDP, per capital consumption of electronics as share of GDP per capita, total graduates per 1000 population, percentage of literate population, internet hosts per 1000 population, number of TV sets per 100 population). OECD categorizes a country's information economy into five sub-sectors: 1) knowledge producing, 2) search coordination and risk management industries, 3) information distribution and communication industries, 4) consumption and intermediate goods, and 5) investment goods [in 5].

According to proposed indicators above, Statistical Indicators Benchmarking the Information Society (SIBIS), a project in the Information Society Programme of the European Commission, has taken up the challenge of developing innovative information society indicators by which the rapidly changing nature of modern societies can be established [11, 12, 13].

In 2000, the strategic goal of the EU-15 was to become the most competitive and dynamic knowledge-based economy in the world. For the realization of this goal, the EU decided that it needs the roadmap for accelerating reforms and modernization of the European economies. The three main objectives are: a cheaper, faster, and secure Internet; investing in people and skills; stimulate the use of the Internet. According to these main objectives, indicators are divided into five broad categories: Internet indicators, modern online public services comprising e-government, e-learning and e-health services, a dynamic e-business environment, broadband and security [11, 12, 13].

In the next section we discuss, because of the space limit, only some indicators that have been tested in EU-15 (member states before the enlargement), NAS-10, Switzerland and the US.

3 THE RESULTS FOR THE EU-15, NEWLY ASSOCIATED STATES AND UNITED STATES

The indicators were tested and applied in two benchmarking surveys. The general population survey was undertaken in all EU Member States, in the US and Switzerland. The survey fieldwork was carried out in April – May 2002, and involved a total sample of 11,832 respondents. The second survey, focused on enterprises, was undertaken in seven member states, including the five largest Member States (Germany, UK, France, Italy and Spain) as well as Finland, expected to be an information society frontrunner, and Greece, expected to be less well advanced. The second survey was also undertaken in April – May 2002, the survey involved 3,139 respondents. The survey for the NAS-10, Bulgaria, Czech Republic, Estonia, Hungary, Lithuania, Latvia, Poland, Romania, Slovenia and Slovakia was conducted in January 2003. The population for this study is all persons aged 15 years and older. There were 10,379 interviews.

The results show, on most indicators the EU lags behind the US. Europeans are less likely to have home access to the Internet, to use it regularly and to do things online. Even the frontrunners in Europe lag behind the US on most indicators. The gap between NAS and the EU is even greater. In the following paragraphs, we briefly discuss Internet connection, e-learning, e-commerce, security and trust, and broadband and access. All the data are taken out of reports [11, 12, 13], therefore we do not repeat the sources.

3.1 Internet connection

SIBIS confirms the continuation of a core trend towards increasing penetration of the Information Society in everyday activities. More than half (54%) of the EU population aged 15 years and older used the Internet within the 12 months prior to the survey, up over 4% from 2001. Also, just under one half (46%) of the population used it in the 4 weeks prior to the survey. Citizens accessing the Internet at home rises from 18% in March 2000 to 44% in May 2001. This is still someway behind the US (63.5%), although there are some leading countries in the EU-15 which surpass the US penetration rates, such as the Netherlands and Sweden, with Denmark closing the gap. Intensity of usage is particularly interesting: distinguishing between regular, occasional, offline PC users and non-users produces an encouraging trend that users access the Internet in most EU-15 regularly. Nevertheless, there are still nearly 40% of EU-15 citizens who do not access the Internet at all (compared to the US's 22%).

Overall, for most indicators of Internet connection on the population the average NAS-10 value is approximately half of the corresponding one for EU-15 countries. Slovenia emerges as aligned with mid-ranking EU-15 countries in terms of access and intensity of Internet usage. At the other extreme, Bulgaria and Romania suffer from a severe gap in information networks diffusion. The other countries are positioned somewhere in a middle ground between these extremes, with Poland pending towards the low values and Czech towards the high values.

The analysis shows that structural factors of telecom networks insufficient diffusion, as well as the level of access and usage costs represent constraining factors. Liberalization is expected to bring benefits in terms of lower tariffs and better conditions, such as the introduction of flat rate unlimited access formulas. The increase of foreign capital flows, consolidation and rationalization should contribute to increase investments in information networks.

There is also a great gap in awareness and understanding of the potential of the Internet to be overcome. Approximately 15% of the NAS population claims to have never heard of the Internet, many more in Bulgaria and Romania. The Digital Divide Index shows a deep gap for the population with lower education and lower income.

3.2 E-Learning

A central element of the e-Learning action plan is to develop systems to train students and pupils as well as adults to become digitally literate. The indicator of digital literacy measures the status of digital literacy in the population as confidence in communicate via the Internet, download and install software, search wanted information at the Internet and to question the information from the Internet.

A student's use of e-learning materials is an indication of the integration of ICT in education seen from the student's perspective. The e-learning materials are divided in two groups of technologies: offline learning materials (CD-ROMs or other medias such as diskettes, audio or video tapes etc.) and online learning materials (provided on the internal computer system of the school/university or through the Internet). The use of e-learning among European students is at almost the same level as students from US. Among all persons still studying, 45% in the EU-15 have used e-learning within the last 4 weeks. Of the students, 33% have used on-line e-learning materials, while this seems to be a little higher in US. Only 5% of the NAS population has been recently involved in e-learning versus 20% of the EU-15.

The index of digital literacy, which is based on a self-evaluation of main digital skills, indicates at a scale from 0 to 3 the level of digital literacy, with 0 for not being "very confident" or "fairly confident" in any of the four skills and 3 being "very confident" in all the four skills. Digital literacy indicates the readiness of the population to use the Internet for work and as active participant in the information society. Main digital skills scores 0.35 in the NAS-10, much lower than the 0.8 measured for the EU-15, not to speak of a US score as high as 1.5 (on a scale from 0 to 3). A few northern member states are near the level of US.

However, the young generation does feel more comfortable with the Net. NAS Internet users under 24 are three times more likely to have a range of skills compatible with the goals of the information society. It is worthwhile noticing that the EU-15 young present the same digital literacy score as the general population of the US today, while the NAS-10 young are where the EU general

population is today. This promises well for the future growth of digital skills. Unfortunately, since demographic trends are similar to Western Europe, the young are not so numerous to be able to change the balance in the near term. The Net must conquer a greater share of the 24 to 50 years old population to become a real factor in social and economic development, from the minority where it is now.
The share of the labor force that uses e-learning is 15% on average in the EU and 23% in the US, making the US the benchmark for European countries. Acquisition of skills increasingly takes place throughout the working life. Therefore "Participation of individuals in work-related training courses" is the SIBIS indicator used to shed some light on the training activities by companies. A threefold higher share of individuals participating in work-related training in Finland and 2.5 times higher share in countries like Denmark and the Netherlands compared to Greece and Portugal. The US (23%) again ranges at the top together with Finland (19%). ICT user skills can be provided via more or less formal training measures but experience shows that in any case, user experience is needed. This is usually being acquired through regular working with these applications as a working tool. An important indicator, therefore, is the share of the workforce, which has access to ICTs at their working place. SIBIS data show that between 40% (Greece) and 91% (Finland) of EU employment is in companies, which grant their staff free access to the Internet. As we can see, the competent use of the ICT has become more and more important. Therefore, there is a need for generic, statistical information on citizen and employee behavior when working and learning in the information society as well as indicators outlining the availability of competencies in the information society.

3.3 E-Commerce

European enterprises wish to improve the competitiveness through raising productivity and growth through new business models (through e-commerce), and providing a private and secure e-business environment. E-commerce is the sale or purchase of goods or services, whether between businesses, households, individuals, government, and other public or private organizations, conducted over computer mediated networks (broad definition) or Internet (narrow definition). Payment and ultimate delivery may be conducted offline [14].
The ability to negotiate, plan and manage the production and delivery of goods through an integrated ICT system has the potential for the enterprise to be connected in a virtual chain of supply, production and delivery. Potentially reducing transaction costs, and increasing the speed of delivery enables significant commercial advantage [14, 15]. The results revealed that the online management of capacity and inventories and the negotiation of contracts have between 7% and 27% uptake across the economic activities. These appear to be very limited applications, illustrating that enterprises have a long way to go before more complex interaction/negotiation can be undertaken electronically. It is possible that security fears, the value added of such activities, and the compatibility of differing systems still poses significant barriers.
Only 5% of the NAS population buys online, versus the 20% of the EU-15 population. The diffusion of these services is correlated with intensity of usage and online tenure, which are generally lower in NAS-10 because of the later start of development of the Internet market. But there is also a gap in the overall development of the market economy infrastructures, particularly of the retail and distribution sector. The experience of the EU countries shows that it takes time for the development of a supply and delivery system suitable for e-Commerce and able to deliver real benefits to customers (Močnik 2002).

3.4 Security and Trust

SIBIS found that citizens across the EU are strongly concerned both about privacy, confidentiality and about data security, although there is a slightly higher inclination to be concerned about privacy. SIBIS also found that the number of enterprises (those online), which suffered from security breaches correlated to the comprehensiveness of the security policy and infrastructure employed.
Concerns over data security and privacy protection are compounding the low inclination towards online shopping. Overall, 24% of NAS Internet users are very concerned about security and 39% are somewhat concerned, a level comparable to that of the EU-15 (respectively 26% and 47%). The countries leading in Internet culture seem to show a higher level of awareness of the problem, but many other factors can influence these perceptions.
There is certainly a need for the NAS countries to step up efforts to build trust and confidence in market mechanisms and online interactions, either commercial or not. This means to develop a favorable regulatory framework and boost the creation of those complex social infrastructures and behaviors sustaining the growth of the civil society. Online data security and privacy protection issues are a part of this more general context and should not be considered as a technical problem only.

3.5 Broadband and Access

The diffusion of broadband networks and services is a key objective of the EU. It is the enabler for the provision of more interactive services, across the four domains e-government, e-learning, e-health, and e-business, and as such is considered to have a significant economic impact. In driving the diffusion of broadband, the Commission recommends that Member States and the NAS-10 should increase competition in the local loop, driving prices lower and generating innovation.
The average percentage of broadband users from home on the population is barely 0.4% in the NAS-10, versus 7% in the EU-15 countries. Only Estonia reaches the EU average, with more than 5%. Midband connections are prevalent in Slovenia, Hungary and Slovakia. For all countries narrowband dial-up is by far the prevalent access mode. The average broadband penetration as a share of Internet users from home in the NAS-10 rises to 3%, with a peak of 28% in Estonia. Narrowband modem dial-up remains the

preferred access technology, with on average 5 fold more users connecting this way. It is likely that users in the NAS will leapfrog the midband stage (ISDN and the like) to pass directly to broadband from simple dial-up. In comparison to the EU-15, there is still some way to go for the bulk of the NAS, not only in terms of broadband penetration but in terms of longer online tenure, which concerns only about 13% of Internet users in the NAS. As the Internet users population grows in experience and tenure, it is likely that the demand for higher speed connections will increase fast.
On-line tenure was found to be the highest in the US, Scandinavian countries, Germany and the UK, and generally lower in the Mediterranean countries.

4 CONCLUSION

As we can see to measure a country's progress, researchers and institutions have proposed various indicators that provide an insight into how technological infrastructures, skills, and experience contribute to a country's economic growth and development. In the paper, we presented indicators of information society that were proposed by the EU in order to compare the development in information society among countries.
To define the progress of information society, the formation of indicators that incorporate technological, social, political and economic dimensions is needed.
EU decided that it needs the roadmap for accelerating reforms and modernization of the European economies to become the most competitive and dynamic knowledge-based economy in the world. For the realization of this goal, the three main objectives are set: a cheaper, faster, and secure Internet; investing in people and skills; stimulate the use of the Internet. According to these main objectives, indicators of information society are divided into five broad categories: Internet indicators, modern online public services comprising e-government, e-learning and e-health services, a dynamic e-business environment, broadband and security.
The results show that the EU lags behind the US and that the newly associated states lag behind the EU. There is certainly a need for the European economies to step up efforts to develop a favorable regulatory framework and boost the creation of those complex social infrastructures and behaviors sustaining the growth of the civil society.
At the end, it should be mentioned that discussion relates only to calculated indicators. However, indicators alone do not bring the progress. They can be used just to assess if the proper actions that will create GDP growth and improve overall competitiveness have been taken.

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CHANNELS FOR E-INVOICING SERVICES

Kornélia Pupáková, Dr. Ali Saravirta, Kari Korpela
Dept. of Computer Science, Faculty of Technology
University of Vaasa
P.O.Box 700, 65101 Vaasa, Finland
Tel: +358-40-876 8934
e-mail: kornelia.pupakova@tuke.sk

ABSTRACT

Many companies realized that making business in nowadays condition of preferring Internet applications and approaches of Information Technologies developments is no longer the same as it used to be. There is a need for re-design of companies' business processes and implementation of newly improved application into company's internal information system.

The main scope of this paper is to present some results of previously done researches in the area of e-Invoicing service implementation. The research was carried out in South-Karelia region in Finland for 4 months since 12.1.-12.5.2005.

The main aim of the research was to make companies aware of what and how to change when converting their business operations and processes into e-Invoicing. The main part of the research included determination of reasons for slow adoption of this service and testing of interoperability among involved stakeholders, concretely 10 SMEs and big companies using 3 banks and 6 operators. The testing was carried out in two parts, within each time 90 real invoices were sent and received. The technological connectivity is now 80 %. The used interoperability measurement was "the number of e-Invoices that go without problems from seller via banks and operators to the buyer". Interoperability was 30…100 % depending on other than technology factors.

The adoption and real usage of e-Invoicing service requires adjustments in several core business processes of a particular company. By enabling these business processes for e-Invoicing, the final cost savings could scale up to 50% or even more. With the possible 20 € savings per invoice through converting to e-Invoice and with 25 billion invoices per year, this would means huge cost savings potential. [2]

Key words: *e-Business processes, e-Invoicing service, information flows*

1 INTRODUCTION

Actual trends are more oriented on the usability of Information Systems with the support of ICTs in every-day business processes. This fact requires implementation of new ICT into the internal information systems of companies, through which company provides services or products. This is a fact that happened according to the development of new services for companies of individual customers as outcome of requirements set by them and new conditions at market environment. There is a need for new service development and further deployment.

Changes within the business processes oriented towards e-Business applications require changes in several business processes of the company willing to venture this. Implementing e-Business application does mean the changes in starting to use electronic documents for some of the business operation and that way getting rid of paper work and that way to reduce the administrative burden.

2 E-INVOICING SERVICE

The service presented is an e-Invoicing service for cost-efficient and paperless method of processing invoices. It suits both SMEs and other organizations that issue invoices for goods, services and all other types of expenses. The main target groups are SMEs selling and purchasing products and services in B2B and B2G relationships. The purpose of e-Invoicing is to achieve cost by reducing the cost of dealing with invoices. Converting financial transactions from paper invoiced into e-Invoices increases the efficiency of information and payment flows as well as reduces the administration burden related to the paper work.

The nowadays situation in Finland is monitored by research and tests done. The results show that e-Invoicing is a successfully running service within one bank - Nordea, and very recently, since 13.9.2004 among three Finnish banks.

The e-Invoicing Service has two ways for service delivery:

1. Net-Banking e-Invoicing Service - suitable for SMEs that want to send and receive electronic invoices without a separate financial management application (FM).
2. e-Invoicing File Transfer Service - suits SMEs who want to use the built-in FM applications for sending and receiving e-Invoices. The latter version of e-Invoices generates them directly in companies' own ERP / FM system and transfers them between the FM application and the bank.

The service is delivered to the clients by the bank and its specialized network of service partners. Raising the penetration of the service demands easy access through web and mobile connections.

The e-Invoicing service runs in Finland by Nordea Bank with which corporate customers can conveniently draw up invoices for their own customers. The bank delivers electronic invoices to all those companies who receive electronic invoices and have made an agreement with the bank. Invoices will be delivered to the invoice receiver by post if no electronic invoice address is given and invoice sender has such agreement with Nordea.

e-Invoices can be received either through Net-bank or file transfer. The seller chooses the delivery method of the invoice. The recipient (buyer) makes an agreement with Nordea on reception of Invoices and notifies the suppliers on its e-Invoice address.
E-Invoices can be delivered

- with an IBAN account number in Net-bank
- to an e-Invoice address via file transfer.

Invoices are delivered to another bank or to another intermediary of e-Invoices if Nordea has an agreement on intermediation services with the intermediary. In such a case the recipient notifies the issuer of the invoice of the e-Invoice address it has received from the intermediary in question.
If the issuer of the invoice does not notify the bank of the recipient's account number or e-Invoice address, an invoice on paper may be delivered to the recipient by mail to the address stated by the issuer of the invoice. [1, 6]

3 NOWADAYS' STATUS

e-Invoicing is a successfully running service among three Finnish banks (Nordea, Osuuspanki and Sampo). The service has about 15 000 clients, who can send e-Invoices within one bank and between the above mentioned banks. The predicted growth rate is about 700-1000 new SMEs and other clients each week.

Concerning the service fee, the costs for the user of the Net-Banking service include start-up fee for SMEs, which is about 200 – 300 € per company, often subsidized by the operating bank, monthly fee for the e-Invoicing service vary from 10 – 20 € per month, transaction fee for sending and receiving e-Invoices is 0,1 – 0,5 € per e-Invoice.
The transaction costs for sending and receiving e-Invoices for the users will to integrate the e-Invoicing and financial management software is 0,1 – 0,5 € per e-Invoice and software cost are determined by the application provider.

Most of these available e-Invoice solutions are limited to domestic invoicing. Finnish Nordea's e-Invoicing Service aims to enable the cross-border e-Invoicing service. That requires a format of such an e-Invoice, which would be suitable for both the sender and the recipient. Nowadays, Nordea enables to send and receive e-Invoices in all Scandinavian countries. This is due to a fact, that Nordea bank has its local offices in the Nordic countries. [1]

The current status of e-Invoicing usability and deployment within regions bases mainly on obstacles related to the adoptions of this service. It is necessary to deal with them, so it would be possible to prepare the conditions and environment for service and application implementation.

4 RESEARCH METHODOLOGY

This paper mostly focuses on the first part of the methodology, which are the project phases. As a pre-stage to this step, a mail survey has been done, detecting the current situation of using the e-Invoicing service within SMEs. The aim of the survey was trying to answer the question of how long it will take to the companies to adopt this service, and if they decide for non-adoptions, what are the reasons.

Discovered was, that the most impact on the adoption of e-Invoicing service has the demand of the market. Also the high level of uncertainty and lack of knowledge about this service cause the slow adoption of the e-Invoicing service.
Results from this survey served the needs of an input into the steps of the research, focusing on the increase of penetration and deployment of the e-Invoicing service. [3, 5]

1. following the project framework:
   a) *project phases*
      - Focus on companies' internal processes and systems
      - Focus on inter-company processes, messages and channels
      - Focus on product data integration to electronic documents
      - Focus on digital control of business networks
   b) *key stakeholders*
      - Regional: SMEs, ePioners, Service Providers, Regional Developers & eB-Project
      - National: Legislators, Regulators
      - International: eBusiness Regional Project Network, EU/Research
   c) Measurable gates for each stakeholder perspective
      - "Hard Gates" after each phase to argue further financial resources to proceed (Go/No go)
      - "Soft Gates" within each project phase based on the best regional practices
   d) Information on the regional status by phase
      - Initial regional status of each stakeholder (in the beginning of the 1. phase)
      - Follow-up status (between two phases)
2. communicating the goals and needed steps (process) to each individual stakeholder from his own perspective
3. supports the best practice transfer between regions
4. providing a framework for coordination of research work
   - horizontally, i.e. focusing on particular stakeholders

- vertically, i.e. providing either initial or follow-up information on regional eBusiness-competencies before and during the project phases
- cross-regionally, i.e. benchmarking different regions

5 RESEARCH PHASES AND RESULTS

To be able to deploy the capability of SME for adopting and using the e-Invoicing service in order to carry out a successful implementation, it must follow a stepwise process, which has been tested in South-Karelia region in Finland.

5.1. Companies' readiness

The main issue at the very beginning is to motivate the key SMEs to adopt e-Invoicing. The key stakeholders were those SMEs that represented the highest volume of the invoices. This is why large companies and public organizations (often called ePioneers in Finland) have a greatest interest in receiving e-Invoices. Due to this fact, the first step that large companies should demand from cooperating SMEs is that they start implementing e-Invoices.
The users' acceptance of the e-Invoicing Service plays an essential role for its success. In Finland one of the key factors has been the fact that the e-Invoicing Service manages to speed up the work flow of handling invoices.
As mentioned in previous part of this paper, initial is the motivation and capability of SMEs for e-Invoicing, their "readiness" for converting the paper invoicing into e-Invoicing. Figure 2 presents the obstacles found in South-Karelian testing as the main reasons for slowing down the deployment of e-Invoicing service; it also shows the results of analyses made within the testing.

OBSTACLES	RESULTS
Lack of ePlans	Over 700 ePlans
Lack of Applications	749 new Applications
Lack of Knowledge	726 educated SME's employees
Lack of Integration	Over 60% Integrated Operators

Figure 2. The main obstacles for the adoption of e-Invoicing and the results of South-Karelian e-Invoicing test [2].

Companies willing to convert their invoices must also fulfill the pre-requisite criteria, which aim to adjust the core business processes to the e-Invoicing service. These core business processes are: 1) CRM – Customer Relationship Management; 2) SCM – Supply Chain Management and 3) ERP – Enterprise Resource Planning.

According to the source information of Procountor (2004) and Elma (2004), there are enormous cost savings obvious in business processes of handling sale and purchase invoices, as shown in table 1.

	Sale invoices	Purchase invoices
Paper invoices	Time of handling 13 minutes	Time of handling 26,50 minutes
	Employee costs 34 € 1000 invoices **Final costs 7 366 €**	Employee costs 34 € 1000 invoices **Final costs 15 016 €**
e-Invoices	Time of handling 6 minutes	Time of handling 9 minutes
	Employee costs 34 € 1000 invoices **Final costs 3 400 €**	Employee costs 34 € 1000 invoices **Final costs 5 100 €**

Table 1. : Example of analysis of the work flow.

5.2. Carried out testing of interoperability

The interoperability testing has been studied between banks, between operators, between banks and operators. The main focus will be given to the existing cooperation (interoperability) channels.
The players as well as the functionality of created channels are needed for the regional as well as for the cross-regional e-Invoicing Service testing. As a starting point in the framework is the one used in South-Karelia in May 2005 (Figure 1).

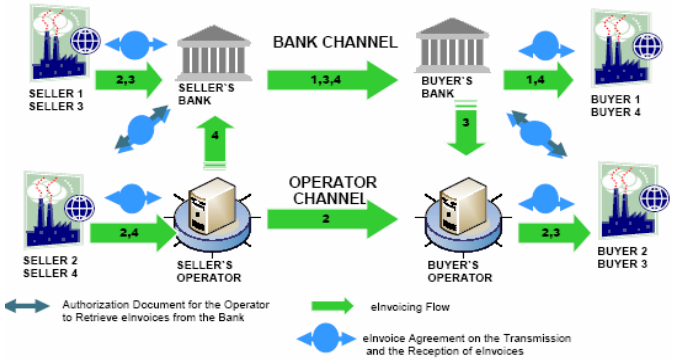

Figure 1. Framework for interoperability testing [4].

In the first stage of deployment the e-Invoicing service operates within one bank or operator. The second stage of deployment is to ensure the interoperability of the e-Invoicing service between different banks and operators. This is necessary to raise the penetration of e-Invoicing among the critical mass of SMEs.

South-Karelia was the first region where the interoperable e-Invoicing Service was tested. Since 13.9.2004 two successful tests have been completed. The main result of the test was that the technically there are no more obstacles for interoperable e-Invoicing. The obstacles were related to other than technical factors.

5.3. Necessary steps to follow

The deployment of already running e-Invoicing service in Finland is simple to be followed according to the tests of interoperability between participating and involved stakeholders: banks, operators, SMEs and FM applications creators.

The main issue to be deal with is the creation of communicating channels, of which functionality will be tested be following the sequences shown in Figure 3.

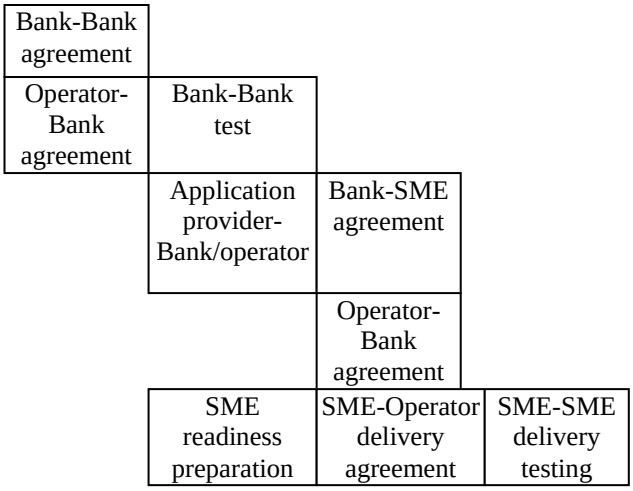

Figure 3. Sequences of communication channels creation process

1. the agreement between banks (and operators) provides the background for the testing and know-how transfer
2. the interoperable e-Invoicing service between banks and operators is mutually tested
3. the integration of FM application to the e-Invoicing service
4. the SME's selection of the e-Invoicing service alternative and e-Invoicing agreement between bank - SME is done
   4a) the Net-banking agreement between the bank and SME
   4b) the File Transfer agreement between the bank and SME
5. the sellers and the buyers are trained to the use of e-Invoicing
6. the e-Invoices are sent and received between SMEs and their big clients in real-life

6 CONCLUSION

The topic of implementing e-Invoicing service into companies' business processes has started in Finland 5 years ago. But the process of deployment of this service has not been very successful so far.

The research done in South-Karelia region in Finland at the beginning of the year 2005 has helped to clear out the questionable parts of implementing e-Invoicing service into every-day business lives of companies, mostly focusing on SMEs.

Results from this research, which are presented in this paper, have shown the sequences of steps, which each company would need to follow, when deciding to enable the e-Invoicing.

The first step for a company would mean the changes in the business processes of that particular company, followed by implementation of electronic documents and last, creating the channels (agreements with operating banks, service providers and if needed also with financial management application creators).

By enabling e-Invoicing service, which represents the cost-saving and efficient form of payment transactions, each company can gain from rapid speed-up of workflow as well as saving in handling and processing costs. These savings can rise up to 50% or even more, as this research has shown.

The future opens up more challenges for concentrating on finding the solutions for adoption of e-Invoicing service in cross-border scale. Recently all Scandinavian banks signed the contract about starting to use the same e-Invoice standard and process guidelines in all four countries.

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EFFECTS OF SECURITY FLAWS IN HASH ALGORITHMS WITH RESPECT TO SLOVENIAN LEGISLATION

Marko Hölbl, Boštjan Brumen, Tatjana Welzer
Data technology laboratory
Faculty of electrical engineering and computer science
Smetanova ulica 17, 2000 Maribror, Slovenia
Tel: +386 2 2355129
e-mail: marko.holbl@uni-mb.si

ABSTRACT

Today's society is becoming more and more what we call an information society. More and more people are using information-communication technologies. As a part, e-services are becoming more popular. In order to be able to use e-services, some preliminary demands have to be fulfilled. In this position digital signatures and digital certificates play an essential role. On the other hand also legislation has kept up with the time and legal acts, which enable e-commerce and e-services, were passed on. In Slovenia the Electronic Commerce and Electronic Signature Act of Slovenia [6] and its novel, the Act Amending the Electronic Commerce and Electronic Signature Act [15], was passed on in 2000 respectively 2004. Tightly linked with digital signatures and certificates are hash algorithms. The contribution of this paper is an analysis of how security flaws violate established computer security principles and how they violate legislation acts. For this reason we explain basic facts about digital signatures, digital certificates and hash algorithms. We state security flaws and attacks on digital certificates and hash algorithm which have been discovered and make an analysis of impacts of security flaws in legal sense with respect to Electronic Commerce and Electronic Signature Act of Slovenia and its novel.

1 INTRODUCTION

E-commerce and e-services provided by companies, organizations and governments are establishing their way into the market. Many different administrative, bank or business services are provided in electronic form. A very vital part of e-services are digital signatures and digital certificates, which are both tightly connected with hash algorithms. Persons and corporate bodies are able to perform different e-services with the help of digital signatures and certificates. In many countries (also in Slovenia) digital signatures can be used in the same manner as traditional signatures. For this reason The Electronic Commerce and Electronic Signature Act of Slovenia [6] was passed on in 2000. Later in 2004 a novel to the existing act was passed on [15]. It is a legal basis for e-commerce and e-services and equalizes digital signatures with traditional signatures. But all is not as fine at it looks.

Several security flaws and attacks have been discovered, which shook the expert public [14]. These flaws were discovered in numerous hash algorithms and consequentially digital certificates, which use hash algorithms, are affected by these flaws too. This paper discuses the violation of well established computer security principles [5] and legal issues (with regard to [6]), because of these security flaws.

The paper consists of six chapters. The next chapter deals with principles of computer security. The third chapter explains the facts about digital signatures, digital certificates and hash algorithms. It presents technical issues and gives security flaws and possible attacks, which have been discovered. The fourth chapter, discuses what impact these security flaws have on principles of computer security. Legal consequences, which these flaws may have, are discussed in chapter five. A conclusion is made in chapter six.

2 PRINCIPLES OF COMPUTER SECURITY

When we are taking about computer security there are a number of facts that are either directly or indirectly connected with it. Many people see only the technical issues of computer security and neglect other issues. The main goal of computer security is to achieve some basic principles in order to secure data.

These basic principles are [5]:

- *Integrity:* The first principle, integrity, means that data can not be altered without the user noticing. The user who creates some data has control over the data being modified. This is vital because we need to assure that data which are sent from one user to another is not altered during the transfer. A person signing a message must have confidence that data can not be changed after she/he has signed them. Otherwise a digital signature would not be applicable. A third user could change data and by doing so influence a decision, make some financial or personal damage. This principle is covered by digital signatures and hash algorithms.

- *Confidentiality:* The second principle, confidentiality, covers the field of insight. We want to assure that only people who are authorized can read the data – in order to be bale to read data, a person must be authorized for doing so. The principle of confidentiality is very important in the IT field. To read confidential data is very and can be accomplished very fast in the IT world. This topic is mainly what cryptography is handling. It is vital in many government, military and business environments.
- *Availability:* The next, third, principle, is availability. It is very important mainly in business and government. Data which are not available at the right time looses all their meaning and/or value. This issue is covered by many techniques and processes in computer security. Usually it is a problem in computer networks and on the internet. For many companies and individuals availability is a major factor for their business and the loss of availability can have serious consequences.
- *Non – repudiation:* The fourth principle, non repudiation, plays a very significant role when it comes to electronic business (either B2B, B2C, G2C and all other combinations). It is tightly linked with sending and receiving messages. The principle assures that the person, who sent/received the message can not deny that she/he has not sent/received it. In electronic commerce nowadays this principle is essential.

Each of these principles addresses a topic in computer security. For the purpose of this article these principles are applied in the field of e-services and network security.
The usage and application of the four principles is very much dependent on the field or domain we are taking about. Because this article focuses on hash algorithms and the role they play in digital signatures, we focus on the principles integrity and non-repudiation. Digital signing, hash algorithms and digital certificates, which are tightly connected with each other, must fulfill the principles of integrity and non-repudiation. The security flaws, which were recently discovered in both digital certificates [1] and hash algorithms [2], [3], [7], [4] shook the IT society. What is their impact on the computer security principles is described later in the article.

3 DIGITAL SIGNATURES, DIGITAL CERTIFICATES AND HASH ALGORITHMS

E-business, e-government and other e-services are very much bounded to three security techniques – digital signatures, digital certificates and hash algorithms. It is impossible to imagine the use of e-services in different levels without the use of certified digital signatures. Certified digital signatures are supported by digital certificates and hash algorithm. Each of these play an important role in certified digital signing. Hash algorithms are used for fingerprinting messages that have to be signed. This is done because of the fact that digital signature algorithms are not fast enough for digitally signing the whole message. If we want to sing large amounts of data, we would not be able to do so if we would not use hash functions. Thus, digital signatures and hash algorithm are almost inseparable.
On the other hand, digital certificates are the technique which is not directly connected with the process of digital signing, but which assures that digital signatures really belong to a person. This assurance is very important. It allows digital signatures to be used in the same way as traditional signatures.
In continuation we will deal with basic principles of all three techniques.

3.1 Technical issues of digital signatures, hash algorithms and digital certificates

Digital signatures
Digital signatures are widely used for signing electronic material as are traditional signatures used in everyday life. The process of digital signing in depicted in figure 1.

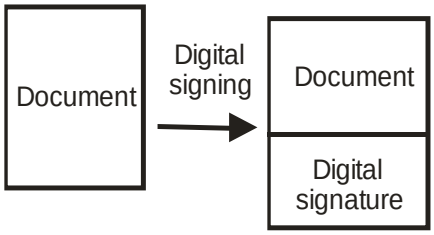

Figure 1: *Digital signing*

A digital signature is made by two keys, which are used for signing document. We call them private key and public key. The private key is only known to the owner of the signature and must not be revealed to any other person. The public key, on the other side, can be published in a public directory or repository and is publicly known. A person signing a document uses her/his private key to do so. When another person wishes to verify the signatures she/he uses the public key of the signer. More is explained later in this chapter.

Hash algorithms
Another part of the whole digital signing procedure is the hash algorithm. The hash algorithm is a vital part of the digital signature scheme. It is used for fingerprinting documents. The fingerprint is a string of bits of fixed length (128 or 160 bits are widely used today). The length of the hash value is independent from the length of the document. A 5 kb document and a 50 GB document have a hash value of the same length (e.g. 160 bit). Some other properties of hash algorithm [8]:

1. They are one way functions - given the hash value it is hard (close to impossible) to compute the original message
2. Its easy to compute the hash value

3. Given the original message is hard to find another message (also a random message) with the same hash value

All these properties of hash algorithms must hold in order to fulfill the security principles of integrity and non-repudiation.

The most widely used hash algorithms today are MD5 (Message Digest 5) [10] and SHA1 (Secure hash algorithm) [11]. They use a hash value of 128 bits and 160 bits, respectively.

The procedure of digital signing is as follows:

- First the document which has to be digitally signed is fingerprinted with the help of a hash algorithm
- then it is signed using the private key. The private key assures that only its owner is able the use it, because it is known only to the owner.
- when the signature is generated it is appended to the document being signed.

The whole procedure of digital signing is represented in figure 2 (generation of the signature) and figure 3 (appending the digital signature).

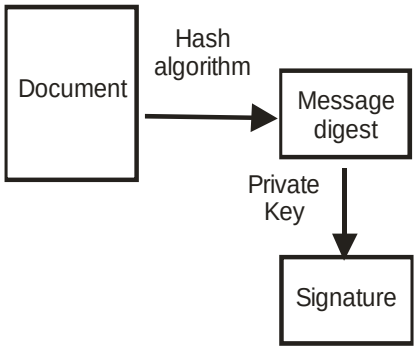

Figure 2*: Generation of the signature*

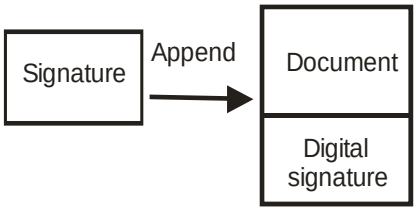

Figure 3*: Appending the signature to the document*

When another person wishes to verify the signatures, she/he has to do the following:

- Get the signer's public key
- Decrypt the message using the public key
- Make a message digest using the same hash algorithm as the signer
- Check if the decrypted message digest and the generated message digest match

If the two message digests match, the verification is completed successfully; otherwise the verification fails. The procedure is illustrated in figure 4.

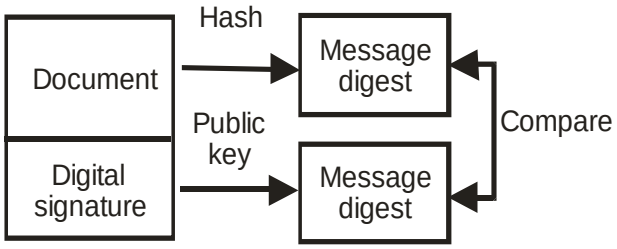

Figure 4*: Signature verification*

The digital signature scheme is complete, when we add digital certificates. They are described in the following section.

Digital certificate

A digital certificate is a digital document which connects a digital signature with the owner. The most used standard for digital certificates is X.509 [12]. It is a part of the PKI infrastructure [9]. In order to be able to use digital signatures equally as traditional signatures a digital certificate is required.

Digital certificates are issued by a Certification authority or CA. The CA is an agency which keeps the certificates of persons, organizations and companies. It also manages so called revoked certificates. Revoked certificates are certificates which are invalid; either because they are expired, or a person made a claim to revoke a certificate.

3.2 Security flaws in digital certificates and hash algorithms

Recently a serious security flaw was discovered in X.509 digital certificates when MD5 as the hash algorithm is used. It is possible to craft certificate which have all fields, except the public key, arbitrary. For these reason specially crafted keys are mandatory. The flaw is explained in detail in [1].

The consequence of the attack is that we are able to generate X.509 certificates, by which it is possible to transfer digital signatures from one certificate to another, because signatures have the same MD5 hash value. Luckily, there are some limitations which must be fulfilled and are described in [1]. Despite the fact that the attack is not easy to carry out, abuse is possible.

The flaw is a consequence of weaknesses in hash algorithms. Most hash algorithms (like MD4, MD5, SHA0, SHA1, RIPEMD and HAVAL-128) were already identified to have weaknesses. In most cases special conditions are necessary and the attacks are not so critical. The problem lies in the fact that algorithms like MD5 and SHA1 are widely adopted today. The attack encourages further research in the field. The consequences are various new security weaknesses and attacks discovered. In [3] Xiaoyun Wang et. all show that a collision attack on MD5 is possible. The attack can find many real collisions which are composed of two 1024-bit messages with the original initial value of the initialization vector. Researchers Magnus Daum and Stefan Lucks have recently generated two everyday messages (one being an order, the other a letter of

recommendation) with the same hash value [7]. The same authors have recently posted an article in which a technique for searching collisions in SHA1 is described [2]. Bruce Schneier, a recognized security expert, wrote in his Crypto-Gram Newsletter [13] "One-way hash functions are a cryptographic construct used in many applications. They are used in conjunction with public-key algorithms for both encryption and digital signatures. They are used in integrity checking. They are used in authentication. They have all sorts of applications in a great many different protocols. Much more than encryption algorithms, one-way hash functions are the workhorses of modern cryptography."
Many security techniques and procedures depend on hash algorithms. For now it is hard to use the flaws and attacks in real life situation, but countermeasure should be made a soon as possible. When a real life attack will be possible, we will already have missed the train.

4 IMPACTS OF SECURITY FLAWS ON THE VIOLATION OF COMPUTER SECURITY

Digital signatures are one of the vital parts of doing e-business (by e-business we mean a wide spectrum of e-services). They are used in administrative issues, business issues, e-banking and so on. Many Slovenian banks use digital signatures for transferring money, making payments or just looking at accounts. The Slovenian government uses digital signatures for performing administrative services. The use of digital signatures and digital certificates is growing. Because the services, which are performed with use of digital signatures and certificates, are very sensitive, security should be at the highest possible level. But security flaws and attack show a different picture. If we can craft X.509 certificates and are able to generate two different parts of data with the same hash value, we can start to question how secure we are.
As mentioned in the beginning of the article we tend to fulfill the four computer security principles (for digital signatures two of them). The flaws cause the principles to be violated. There is no integrity of data, because it is possible to change data without the receiver noticing it. Making two different, but reasonable, messages with the same hash value, makes the integrity principle invalid. Furthermore, the principle of non-repudiation can be avoided. Let us demonstrate this with the following example:
Person A signs message M_1, sends it to person B. Person B receives the message. Later person A can claim that she/he has not sent message M_1, because it is possible to generate another message $M_1^{'}$, which has the same hash value. Hence it follows that person B cannot prove that person A really sent message M_1 . As we can see both, integrity and non-repudiation are not fulfilled. These facts can also have legal consequences as we will describe in the next chapter.
In real life situation the abuse of these security flaws depends very much on a specific situation. If we use hash algorithms just for checking integrity of downloaded files, there is little chance that an abuse will take place. On the other hand, if we use digital signatures to transfer money or to perform important administrative services, then we get into the risk of abuse. The risk of abuse depends on the sensitivity or value of data which are signed. A simple file integrity check of downloaded shareware software files does not get into risk of abuse, whereas the signing of cash transfer does.

5 LEGAL CONSEQUENCES

The Electronic Commerce and Electronic Signature Act of Slovenia [6] states in article 2/IV that for doing e-business a secure digital signature is required. Later in the novel of the act this part of the article wasn't changed. But as we have stated in the previous chapter digital signatures do not fulfill the computer security principles. Further, the article describes what the term secure digital signature means [6]:

1. The signature is connected only with the signer
2. It is possible with reliability to determine the signer
3. That the signature is generated with means, which are under the signer's control
4. That the signature is tightly linked with the data, which it signs and that it's possible to determine every change of the data

As we can see, none of these demands is fulfilled. If we are able to transfer signatures from one X.509 certificate to another, requests of the first and second demand are violated. Any of the attacks presented violate the third demand, because the user cannot control an action which she/he does not know about. The fourth demand, which addresses integrity, is violated when it comes to attacks against hash algorithms.
From the legal point of view, these flaws make the digital signature questionable in legal sense. The current algorithms are not able to fulfill the demand for digital signature made by The Electronic Commerce and Electronic Signature Act of Slovenia. This is a serious problem if we consider that e-commerce is growing and establishing its role in the market. Legal acts are a basis in order to be able for e-commerce to work. The Electronic Commerce and Electronic Signature Act of Slovenia also equalized the digital signature with the traditional one, but only if the digital signature fulfills the demands stated in the act. As a consequence of security flaws and attack, it is at least questionable if not barely legal to use digital signature.
The problem lies in technical aspects, not in legislation. Furthermore, in the future, researchers will be able to improve these attacks. What will happen if it will be possible to craft two arbitrary document or messages with the same hash value? Then, not only integrity would not be satisfied but, because of the fact that hash algorithms are a part of digital certificates, also digital certificates could have been falsified. Still, the techniques are limited with special parameters and special conditions.

6 CONCLUSION

The security flaws not only violate the established computer security principles, but are also doubtful from the legal perspective. The Slovenian legal act [6] which covers e-commerce, clearly states demands for secure digital signatures, which are supported by the law. It is vital that new and improved hash algorithms are developed or existing, more secure algorithms (like SHA2) are used, if we want to assure computer security. We saw that algorithm used today do not fulfill the demand of computer security principles. As they have impact on digital signatures and certificates, they establish security risks. When it comes to money matters, one's personal data or privacy, it is inadmissible to have questionable security. Sooner or later, also companies, organizations and government will have to realize that we need digital signatures and certificates, which comply at least with the computer security principles. We must not wait for a serious attack to happen in order to start improving existing digital certificates and signatures. The problem lies not in legislative acts, but in the technology, which is used. The Certification authority of the Slovenian government for example uses the SHA-1 algorithm [16]. Alternative algorithms, which do not have these flaws, are already available. The most probable and promising successor of the existing algorithms is the SHA2 family of algorithms (SHA.256, SHA-384 and SHA-512). The SHA2 family of algorithms does not have flaws or attacks, which were discovered in SHA-1 and MD5. For this reason it would be correctly to change existing digital signatures and certificates in order to use new hash algorithms. This not only holds true for the Slovenian region, but for the whole globe.

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VARNOST V INFORMACIJSKI DRUŽBI

Boštjan Kežmah
Inštitut za informatiko
Fakulteta za elektrotehniko, računalništvo in informatiko Univerze v Mariboru
Smetanova ulica 17, 2000 Maribor
Tel: (02) 235 51 11; fax: (02) 235 51 34
e-mail: bostjan.kezmah@uni-mb.si

POVZETEK

Med najpomembnejša varnostna tveganja razvijajoče se informacijske družbe lahko štejemo pomanjkljive mehanizme za ugotavljanje identitete ponudnikov informacij in storitev ter uporabnikov. Zaradi tega ponudniki težko zavarujejo svoje dobro ime, medtem ko uporabniki težko preverijo vir informacij oziroma ponudnika storitve. Ta značilnost interneta predstavlja za vse vpletene pomembno varnostno tveganje, ki bi ga lahko s pomočjo infrastrukture javnih ključev zadovoljivo omejili, če bi uporabili celovit pristop. V nasprotnem primeru tvegamo, da se bodo uporabniki zaščitili tako, da določenih tehnologij ne bodo uporabljali, s tem pa so lahko ogroženi tudi nekateri ekonomski modeli, ki vzpodbujajo razvoj informacijske družbe.

2 UVOD

Čeprav pojem "varnost" v vsakdanjem življenju velikokrat uporabljamo, je definicija pojma precej zapletena, kar je povezano predvsem z merjenjem ravni varnosti. Težko bi npr. rekli, da smo 80% varni.

Z iskanjem po spletnih straneh katerega od dnevnikov ali časnikov dobimo vtis o tem, kako večina javnosti dojema varnost. Z iskanjem po spletnih straneh časnika Večer 13.9.2005 (www.vecer.com) najdemo naslednjo strukturo zadetkov: od prvih 20 zadetkov je 12 zadetkov ali 60% povezanih z vojsko in vojno, 4 zadetki ali 20% je povezanih z varnostjo v prometu in vozilih in le 1 zadetek ali 5% je povezan z varnostjo interneta.

Ne glede na aktivnosti IT panoge v smeri zagotavljanja varnosti torej mediji še ne obravnavajo prednostno varnosti informacijske družbe. Iz tega lahko sklepamo, da tudi javnost še ni primarno zaskrbljena z varnostnimi vidiki informacijske družbe, torej bomo morali definicijo poiskati drugje.

Da bi lahko definirali pojem varnosti, bomo zato uporabili definicijo standarda BS 7799:1998 [1]. Ta opredeljuje ožji pomen varnosti, informacijsko varnost, kot:

- zaupnost, to je sposobnost varovanja informacij pred neavtoriziranim razkritjem ali prestrezanjem,
- integriteto, ki zagotavlja točnost in popolnost informacij ter
- dostopnost, kar pomeni, da so informacije dostopne avtoriziranim uporabnikom, kadar jih ti potrebujejo.

V nadaljevanju bomo predstavili, zakaj sta zaupnost in zasebnost tesno povezana pojma. Prikazali bomo, da je v internetu zaupnost neposredno povezana z integriteto.

Dostopnost bomo obravnavali le z vidika povezanosti z zaupnostjo in zagotavljanje integritete informacij. Omejili se bomo na vidike, povezane le z uporabo interneta v informacijski družbi.

2 IDENTIFIKACIJA UPORABNIKOV INTERNETA

Internet je bil zgrajen brez mehanizma, ki bi uporabnikom omogočal identificirati napravo ali uporabnika, s katerim se povezujejo. Ker ta mehanizem ni bil vzpostavljen, so mnogi uporabniki in ponudniki storitev poiskali rešitve, s katerimi se trudijo premostiti to pomanjkljivost.

Z vzponom uporabe interneta se povečuje tudi izpostavljenost tem premostitvam. Čeprav za to težko koga krivimo, je rezultat škodljiv.

Stotine milijonov ljudi je navajenih ali še slabše, priučenih, da sprejmejo katerokoli vsebino, ki jo ponudi spletno mesto, saj to razumejo kot "normalno" poslovanje. Naučeni so bili, da vpišejo svoje ime, skrivna gesla in druge osebne podatke v skoraj vsak obrazec, ki se pojavi na njihovem zaslonu.

Ne obstaja splošno priznano ogrodje, ki bi omogočalo uporabnikom, da zanesljivo identificirajo spletno mesto in zato tudi ne morejo ugotoviti kdaj razkrijejo osebne podatke neupravičeni stranki. Razen tega ni ogrodja, ki bi uporabnikom pomagalo nadzorovati njihov digitalni obstoj.

Nezmožnost zanesljive identifikacije naprav in uporabnikov ima v prvi vrsti nekaj pozitivnih posledic. Uporabnikom, ki imajo sicer težave s socializacijo, omogoča, da vzpostavijo stik z drugimi uporabniki in s tem pospešuje komunikacijo, kar ima pozitiven vpliv tudi na razvoj demokracije.

Ugodna posledica je tudi, da je težko slediti osveščenemu, skrbnemu uporabniku in tako ugotoviti njegove navade in zbrati njegove osebne podatke, kar ima pozitiven vpliv na varovanje zasebnosti.

S stališča poslovanja ima naslednje negativne učinke:

- Ponudniki storitev ne morejo zanesljivo identificirati uporabnika storitev, zato se pojavljajo številne možnosti zlorabe pri plačilu in uporabi.
- Zavira razvoj storitev, ki so povezane s spremljanjem navad uporabnikov in personalizacijo.

Države imajo zaradi anonimnosti uporabnikov težave pri sledenju ponudnikov in kupcev, kar otežuje pobiranje davkov in boj proti kriminalu.

Raziskava, ki jo je maja 2005 opravil Choicestream [2] po elektronski pošti in je vključevala 923 anketirancev, je pokazala, da si spletni potrošniki želijo prejemati bolj lastnim potrebam prilagojene vsebine, vendar se bojijo za svojo zasebnost.

Uporabniki ne želijo izdajati informacij o sebi. 59 % jih ni pripravljenih izdati demografskih informacij in informacij o svojih zanimanjih. Le 32 % sodelujočih je pripravljenih dovoliti spletnim stranem, da sledijo njihovim klikom in nakupom z namenom, da jim ponudijo bolj prilagojeno vsebino. Delež se je glede na leto 2004 zmanjšal za 9 odstotnih točk.

80 % vprašanih je izjavilo, da si želi vsebine bolj prilagojene lastnim potrebam. 60 % jih je zato pripravljenih odgovarjati na različna vprašanja vsaj dve minuti. 26 % bi jih bilo pripravljeno odgovarjati vsaj 6 minut. Le 12 % jih ne bi bilo pripravljeni odgovarjati na kakršnakoli vprašanja.

Rezultati raziskav nakazujejo, da se uporabniki vse bolj zavedajo problemov neupravičenega izkoriščanja zbranih osebnih podatkov. Vzrok za potencialne zlorabe lahko ponovno iščemo v pomanjkljivih mehanizmih identifikacije ponudnikov storitev in v verodostojnosti izjav o varovanju zasebnosti. Internet ne pozna teritorialnih meja, zato je težko ugotoviti kakšni so običaji in zakonodaja glede varovanja osebnih podatkov v državi ponudnika storitev.

Nezaupanje uporabnikov je toliko večje, ker represivni organi ne uspejo slediti razvoju informacijske družbe in še vedno niso učinkovito rešili problemov prenosa pristojnosti. Podjetja in posamezniki, ki imajo namen zlorabiti podatke se tega dobro zavedajo.

3 IDENTIFIKACIJA IN ZLONAMERNA PROGRAMSKA OPREMA

Raziskava organizacije Pew Internet Project [3], ki je zajela vzorec 1.336 uporabnikov interneta, je pokazala, da je zaradi vohunske programske opreme (angl. “spyware”) kar 91 % uporabnikov interneta v ZDA spremenilo vedenje na spletu, ker se bojijo, da bi postali žrtve zlonamerne programske opreme.

Ugotovitve niso presenetljive, saj je kar 68 % Američanov, ki uporabljajo internet, imelo v zadnjem letu težave zaradi vohunskih programov in virusov. 60 % teh ni vedelo od kod izvira težava, 25 % uporabnikov je na računalniku našlo programe, ki jih niso namestili in 18 % anketirancem se je spremenila nastavljena domača stran.

Ukrepi, ki so jih navedli uporabniki v boju proti zlonamerni programski opremi so bili naslednji:

- 81 % uporabnikov interneta je prenehalo odpirati priponke v e-pošti, če niso prepričani, da so dokumenti varni,
- 48 % uporabnikov interneta je prenehalo obiskovati spletne strani, ki bi lahko namestile neželene programe,
- 25 % uporabnikov interneta je prenehalo pretakati glasbene in video datoteke z omrežij za neposredno komuniciranje (angl. “peer-to-peer”),
- 18 % uporabnikov je zamenjalo internetni brskalnik.

Osnovni izziv, ki ga predstavlja zlonamerna programska oprema se ponovno skriva v identifikaciji. S tem povezane probleme lahko razdelimo v dve skupini:

- Nezmožnost identifikacije avtorja spletnih strani oz. ponudnika storitev onemogoča uporabniku, da bi lahko zaupal programski opremi, ki jo je možno prenesti iz spletnih strani ponudnika.
- Nezmožnost identifikacije avtorja programske opreme onemogoča, da bi uporabnik zanesljivo identificiral avtorje in s tem programsko opremo, ki ji zaupa, ne glede na njen vir.

Problematiko identifikacije avtorjev potrjuje dejstvo, da uporabniki zamenjajo brskalnik, če izgubijo zaupanje v programsko opremo. Če bi uporabniki lahko zanesljivo identificirali avtorja oz. distributerja programske opreme, bi lahko sprejeli informirano odločitev o tem, kateri programski opremi zaupajo in kateri ne, tako pa je njihovo odločanje zaradi pomanjkanja informacij oteženo.

V posameznih primerih bi bila morda celo bolj smiselna identifikacija posamezne programske opreme. S tem bi avtorji zavarovali svoje ime, saj je sicer mera (ne)zaupanja vezana na avtorja in ne na posamezen izdelek. Če bi avtor izdelal en sam izdelek slabše kakovosti bi lahko bilo to dovolj, da bi uporabniki izgubili zaupanje tudi v ostalo programsko opremo istega avtorja.

4 IDENTIFIKACIJA KOT GONILO SPLETNEGA OGLAŠEVANJA

Težav z identifikacijo nimajo samo uporabniki temveč tudi ponudniki. Da je lahko splet vsaj navidez brezplačen, torej da lahko tako veliko število ponudnikov storitev nudi te storitve končnemu uporabniku brezplačno, so ponudniki morali poiskati alternativne vire financiranja. Vzdrževanje infrastrukture običajno vključuje visoke stalne stroške, ki jih skušajo ponudniki čim bolj enakomerno porazdeliti med obiskovalce.

Med najbolj razširjenimi viri financiranja je gotovo oglaševanje. Nekateri ponudniki storitev zgradijo lastno infrastrukturo, večina, predvsem manjši, pa kmalu ugotovijo, da je zunanje izvajanje bolj primerna oblika oglaševanja. Razen infrastrukture je namreč potrebno vzpostaviti tudi prodajne aktivnosti, ki pa se lahko že bistveno razlikujejo od osnovne dejavnosti podjetja.

Ena ključnih lastnosti dobrega ponudnika oglaševalskega prostora je sposobnost identifikacije uporabnikov oz. „bralcev” oglasov.

Identificiranje ima dva namena:

- zagotoviti korektno štetje prikaza oglasov različnim uporabnikom, saj je od tega običajno odvisna tudi cena oglasa oz. sistem zaračunavanja in
- spremljati navade uporabnikov in jim prikazati oglase, ki čimbolj ustrezajo njihovim potrošniškim navadam.

V osnovi bi lahko uporabnikom sledili s pomočjo IP naslova iz katerega prihajajo zahteve za prikaz spletnih strani. Zaradi uporabe spletnih posrednikov, dinamičnega dodeljevanja IP naslovov in zaradi skupne uporabe računalnikov je ta metoda, če je ne kombiniramo z drugimi, nenatančna.

Prav zato so ponudniki oglaševalskih storitev pričeli uporabljati piškotke kot enolični identifikator uporabnikov. Zaradi zasnove piškotkov in možnosti zlorabe njihove vsebine se je z ozaveščanjem uporabnikov tudi zanesljivost te metode močno zmanjšala.

Jupitermedia [4] je opravil raziskavo o zanesljivosti merjenja števila obiskovalcev preko piškotkov (cookies). V letu 2004 je 58 % uporabnikov interneta brisalo piškotke.

Če uporabniki brišejo piškotke, je ogrožena zanesljivost meritev navad obiskovalcev posameznih spletnih strani na dolgi rok, če pa piškotke onemogočijo, so ogrožene meritve na kratki rok, ki izkazujejo večje število anonimnih uporabnikov.

39 % uporabnikov briše piškotke redno vsak mesec. 52 % uporabnikov interneta kaže veliko zanimanje za zgodbe in članke o varnosti in zasebnosti na internetu. 38 % uporabnikov meni, da so piškotki vdor v njihovo zasebnost. 44 % uporabnikov meni, da jih brisanje piškotkov ščiti pred nevarnostmi.

Zmanjšana učinkovitost merjenja obiskov oziroma spremljanja identitete obiskovalcev ima neposreden vpliv na ponudbo oglaševalcev. S tem, ko se zmanjšuje natančnost meritev, se zmanjšuje konkurenčna prednost elektronskega medija pred tiskanimi, kar lahko resno ogrozi spletno oglaševalno industrijo in s tem brezplačen dostop do informacij.

5 INTEGRITETA IN DOSTOPNOST INFORMACIJ

Integriteto in dostopnost informacij je morda na prvi pogled težje povezati z ugotavljanjem identitete kot zaupnost, vendar sta prav to temeljni značilnosti, ki sta nujni, da lahko suvereno določimo identiteto vira informacij ali uporabnika.

Vsaj v Sloveniji je po zaslugi širitve e-uprave najbolj razširjen način zagotavljanja integritete informacij infrastruktura javnih ključev. V tej infrastrukturi so najpomembnejša kvalificirana digitalna potrdila, ki jih v skladu z Zakonom o elektronskem poslovanju in elektronskem podpisu (ZEPEP) [5] posredno nadzoruje država.

S pomočjo kvalificiranega digitalnega potrdila lahko zanesljivo ugotovimo kdo je lastnik digitalnega potrdila, s katerim so bili podatki elektronsko podpisani. Različne programske knjižnice in programska oprema omogočajo, da lahko podpišemo množico različnih dokumentov, od besedila, dokumentov XML (angl. „eXtensible Markup Language") in elektronskih sporočil. Če sledijo uveljavljenim standardom, je elektronski podpis možno preveriti na različnih platformah.

Če zanemarimo težave z infrastrukturo javnih ključev, nova odkritja glede ranljivosti zgoščevalnih funkcij, ki se sicer uporabljajo pri elektronskem podpisovanju ter nejasnosti ZEPEP glede priznavanja elektronskega podpisa, ugotovimo, da se naslednja skupina težav pojavlja v povezavi z dostopnostjo.

V okviru dostopnosti sta najbolj izraziti dve prepreki, s katerima se sreča uporabnik, ki npr. želi potrditi identiteto strežnika ali podpisnika informacij.

Prvo predstavlja problem distribucije javnih ključev vrhnjih overiteljev. Čeprav so nekaterim operacijskim sistemom in programski opremi privzeto priloženi javni ključi vrhnjih overiteljev, predvsem pri tujih ponudnikih programske opreme med njimi ne najdemo v Sloveniji priznanih kvalificiranih overiteljev. To pomeni, da morajo digitalna potrdila z javnimi ključi teh overiteljev na nek način pridobiti uporabniki sami. Če želimo, da je ta postopek varen, mora vključevati mehanizem preverjanja pristnosti. V praksi ga izvajamo tako, da pri zaupanja vredni osebi ali na drug zaupanja vreden način preverimo zgoščevalno vrednost, zapisano v kvalificiranem digitalnem potrdilu, ki ga nameravamo namestiti v zbirko digitalnih potrdil. Šele, ko se uporabnik prepriča v pristnost digitalnega potrdila, ga sme namestiti v sistem.

Če želimo npr. preveriti kvalificirano digitalno potrdilo vrhnjega overitelja Pošte Slovenije, bomo kmalu naleteli na omejitev, da poslovalnice Pošte Slovenije ne poslujejo brez prekinitve. To pomeni, da izven uradnih ur vsaj ene od poslovalnic ne bomo imeli možnosti preveriti pristnosti digitalnega potrdila, kar zmanjšuje dostopnost, s tem pa varnost in se oddaljuje od pojma informacijske družbe. Način, da bi lahko pristnost preverili v celoti elektronsko, ni poznan.

Naslednji problem, povezan z dostopnostjo, je preverjanje seznama odpoklicanih digitalnih potrdil (angl. „Certificate Revocation List"). Sezname odpoklicanih potrdil vzdržujejo overitelji sami. Zakon in pravilniki ne predpisujejo posebnih pogojev glede dostopnosti strežnikov vrhnjih overiteljev, kar pomeni, da tudi ni določena minimalna dostopnost seznama odpoklicanih potrdil, prav tako v zvezi s tem niso določene sankcije.

Če uporabnik ali pa ponudnik storitev nima dostopa do seznama odpoklicanih potrdil, ne more preveriti, ali je digitalno potrdilo, ki ga preverja, še veljavno. To pomeni, da ne more potrditi identitete podpisnika.

6 POSLEDICE NEUSTREZNIH MEHANIZMOV IDENTIFIKACIJE

Kot smo uvodoma ugotovili, je eden poglavitnih varnostnih problemov, s katerim se srečujejo uporabniki, pomanjkanje mehanizmov identifikacije ponudnikov spletnih vsebin in storitev.

Posledica tega je vrsta tveganj, ki so jim uporabniki izpostavljeni. Že z uporabo informacij, katerih avtorja ne morejo zanesljivo identificirati, so izpostavljeni različnim tveganjem. Zlonamerni ponudnik vsebin bi lahko npr.

uporabnike s prirejenimi informacijami zavedel tako, da bi jih s tem na kakršenkoli način oškodoval.
Temu modelu sledijo elektronska sporočila in ponarejena spletna mesta, ki od uporabnikov pridobivajo osebne informacije, ki jim jih uporabniki sicer ne bi posredovali. S tem gradijo lastno podatkovno bazo za prevzemanje identitete uporabnikov, zlorabo njihovih uporabniških imen in gesel, številk plačilnih kartic ipd. Za ta model se je uveljavil angleški izraz "Phishing".
Problem identifikacije je razen nizke cene pošiljanja tudi eden od poglavitnih vzrokov za veliko količino nezaželene pošte v elektronskih nabiralnikih. V Sloveniji je pošiljanje elektronskih sporočil brez posredovanja človeka prepovedano z Zakonom o varstvu potrošnikov. Žal naše izkušnje kažejo, da se tržni inšpektorat, ki ima sicer pripravljen spletni obrazec za pošiljanje pritožb, na elektronsko vložene pritožbe ne odziva. K sreči se domači uporabniki interneta tega zavedajo, na kar kaže zanemarljiv odstotek domačih nezaželenih sporočil.

7 ALTERNATIVNE REŠITVE

Z namenom izboljšanja stanja vsaj v lokalnem okolju lahko zakonodajalcu, uporabnikom, ponudnikom storitev ter ponudnikom informacijskih rešitev ponudimo nekaj smernic.
Zakonodajalec bi moral odpraviti pomanjkljivosti zakonodaje (predvsem ZEPEP) ter popraviti model zaupanja, ki se sedaj uporablja za kvalificirane overitelje. Tega je treba s spremembo hierarhije infrastrukture javnih ključev zastaviti tako, da se bo poenostavil način vzpostavljanja zaupanja med kvalificiranimi overitelji. Prav tako bi bilo smiselno, da zakonodajalec od ponudnikov informacijskih rešitev, ki rešitvam prilagajo digitalna potrdila in jih prodajajo na domačem trgu, zahteva, da priložijo digitalna potrdila kvalificiranih overiteljev v Republiki Sloveniji. To velja predvsem za ponudnike operacijskih sistemov in brskalnikov.
Uporabniki in ponudniki bi morali bolj osvojiti in bolj aktivno uporabljati infrastrukturo javnih ključev. Na strani uporabnikov v smislu preverjanja digitalnih potrdil, ki se uporabljajo pri dostopu do spletnih strani z varno povezavo ter uporabi elektronskega podpisa pri pošiljanju elektronskih sporočil. Če bi pošiljatelji striktno podpisovali elektronska sporočila, bi bilo npr. filtriranje nezaželene pošte veliko bolj enostavno. Lastnost ozaveščenega uporabnika bi morala biti tudi, da zaganja le elektronsko podpisane programe, ki jih je prejel preko internetne povezave.
Ponudniki informacijskih rešitev, ki bi se morali še posebno dobro zavedati prikazane problematike, bi morali povečati svoje napore, da uporabnike prisilijo v varno uporabo informacijskih rešitev. Ni dovolj, če po načelih varnega razvoja ob namestitvi samo izključimo tiste možnosti, ki lahko za uporabnika predstavljajo določeno varnostno tveganje. Informacijska rešitev bi morala ob namestitvi delovati tako, da npr. od uporabnika zahteva, da elektronsko podpiše elektronska sporočila, preden jih lahko pošlje. Če bo uporabnik moral pri pošiljanju znova in znova potrjevati, da želi poslati nepodpisano sporočilo, bi ga že s tem usmerjali k varni uporabi elektronske pošte.
Iz prikazanih smernic lahko ugotovimo, da je problematika zagotavljanja varnosti v informacijski družbi prepletena med vsemi elementi varnosti, zato s parcialnimi rešitvami ne bo možno doseči pravega učinka. Na ravni države je najpomembnejša vzpodbuda, vizija in reguliranje s strani države in ne oglaševanje o pomembnosti uporabe protivirusnih programov.

8 SKLEP

Za določanje identitete internetnih ponudnikov, informacij in uporabnikov nimamo na voljo pravih tehničnih rešitev. Še najbližja je uporaba infrastrukture javnih ključev. Kljub nekaterim pomanjkljivostim te tehnologije bi jo lahko s pridom izkoristili za zmanjšanje najpomembnejših varnostnih tveganj, če bi uporabili bolj celovit pristop pri urejanju tega vprašanja.
Že s kratkim pregledom zgodovine in trenutnega stanja na področju varnosti se lahko strinjamo z mnenjem večine strokovnjakov s področja varnosti, da popolne varnosti ni. Zakaj bi torej čakali na popolno tehnično rešitev, če bi lahko z malo več truda z obstoječimi tehničnimi rešitvami dosegli stopnjo varnosti, ki bi bila glede na trenutno stanje več kot zadovoljiva?

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CO-ORDINATED COLLABORATION IN DISTRIBUTED SOFTWARE ENGINEERING

Adel Taweel
School of Computer Science, University of Manchester, Manchester, M13 9PL, UK;
a.taweel@manchester.ac.uk

ABSTRACT

With organisations becoming more distributed across several sites and countries, and with the shortage and the need for better utilisation of skills resulting in team members unavoidably distributed across sites. These factors are forcing organisation to develop strategies and enabling technologies in need for more successful collaborative working.

The paper reports on a case study of such collaborative working focusing on the distributed software engineering teams. It studies three teams but looks particularly at one of these teams whose members are separated by distance and culture, and outlines the undertaken co-ordination and collaboration activities and sheds light on factors considered important to its successful multi-site collaboration.

Keywords: global software development, collaborative working, distributed software engineering

1 INTRODUCTION

The highly competitive software market forces many software organizations to become increasingly separated by distance, time and cultural boundaries [1, 2, 6, 12, 3]. These boundaries add obstacles and challenges on the software development processes and organizations due to fewer direct communication and interactions between team members. They make it harder to use traditional team building measures, add more constrains on co-ordination between sites and members, and introduce even greater possibilities for miscommunication and misunderstandings of technical and common objectives and goals [1, 6, 3, 5, 13, 7].

This case study describes the collaboration and co-ordination processes in the software development life cycle of a project whose team members distributed across the UK and Europe. Although there are no time differences between the team members, but they are separated by distance boundaries, nationality and cultural differences.

The one of the main purposes of this case study is to identify factors that contribute for successful team collaboration across geographical and cultural boundaries, and to study the impact of the co-ordination processes, team building and management strategy, and effective use of collaboration tools in the different stages of the software development process, focusing on requirements capture, design and implementation stages.

The study followed a number of main steps to establish and outline the main contributing factors to this successful collaboration, these include: determining what the teams did during their work on the project, identifying the used collaboration tools and determining what was seen a successful team and identifying the factors that contributed to creating successful collaborating teams.

Section 2 of the paper gives an overview of the study and the study project, its organizational and geographical structure. Section 3 discusses the details of the followed software development process focusing on requirement specifications and design and coding phases outlining the development process and the used collaboration tools. Section 4 discusses the main identified contributing factors to this successful collaboration working. The detailed discussion of the study, detailed analysis of the data and its evaluation is beyond the scope of this paper. Finally, section 5 summarises the conclusion.

2 OVERVIEW OF THE STUDY PROJECT

The study project is a 3 year programme funded to accomplish a set of pre-determined objectives and goals. These objectives include research and software outputs and products. The project includes 20 members distributed across five separate locations with individuals located at each site. The project team includes five sub-teams: three software development team, one scientific and one management team. The focus of this study is on the software development teams.

The development teams are made up of mainly new staff employed or brought in specifically for this project with some members have application domain knowledge and some others with experience in the legacy products in the project. The main two characteristics of the development teams are the problems of geographical and cultural separation. The five sites are separated geographically by long distance boundaries. The official language of the project is English, however cultural differences range from different languages (five languages), to different work cultures (three different cultures) and institutional work regulations. From the recorded data, the project suffered a number of usual start-up problems: new people that are not used to working together, not well defined or understood processes, and new yet to be established management style.

The study has looked at the project from its starting phases, although very early parts were studied retrospectively. Since we are focusing on the co-ordination and collaboration tasks, used technologies and activities undertaken in the project, the study aimed to collect data about the critical factors contributed to the success of the software multi-site development team. Data were collected from various sources including the project historical log, the project management team, the project evolving documents, and the project development teams.

One particular advantage was the structured documentation of the project and the collaboration tools used in the project, where significant amount of information was recorded about the development team activities, discussions, actions, co-

ordination activities and so forth, from which factors were studied as to what made the software development team a successful multi-site collaborating team. This recorded information provided a good indication of what have been considered co-ordinated or done well and achieved their objectives and those co-ordinated or done poorly and partially or failed to achieve their objectives.

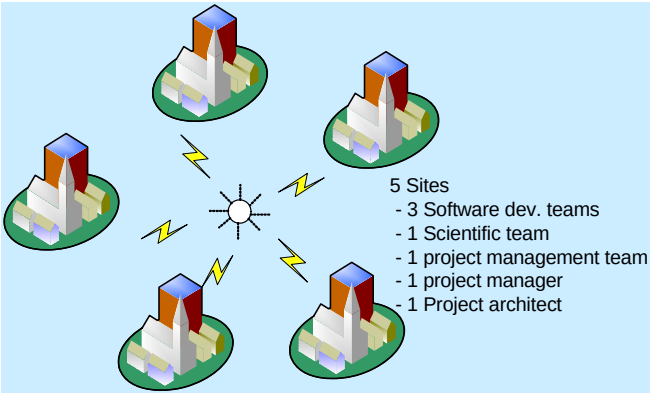

Figure 1: Project Configuration

3 SOFTWARE DEVELOPMENT PROCESS

The following describes briefly the followed development process in general, with a focus on the requirements capture, design and implementation phases.

3.1. Requirements capture

One of the major tasks of the project was to establish and capture requirements (more specifically the functional requirements). The main source for the preliminary set of requirements was from the scientific team and the immediately involved users. However, due to distance and geographical separation traditional requirement engineering methods, such as face-to-face interviews, focused meeting etc., were not easily possible [11, 13]. The development team initially started experimenting with different methods of eliciting requirements to overcome these difficulties until a general methodology was established. The general approach was based on an a well co-ordinated iterative cycle that begins from a generic and moves towards a more specific and refined requirement specifications. It follows three main stages to achieve outcomes: 1) preliminary general set, 2) defined and filtered (and prioritised) sets and 3) finally refined, well-understood and confirmed sets of requirement specifications. Initially, these (sub) milestones were co-ordinated with the main contributors and stakeholders and a collaboration strategy is established. To overcome the geographical separation, the first stage was done using collaboration tools, e.g. web-based Wiki pages, with web forms that were specifically designed that allow users and scientific team members to input their requirements. Although, this stage resulted in a long list of requirements, after studying them in some detail the software development team found more than 26% were repeated requirements, 10% included partial repetition and 15% were spurious (too futuristic or beyond the objectives).

In the 2nd stage a sub-team made up from senior members of the studied development teams, the project manager and the scientific team filtered and classified the initial set of requirements into prioritised sets of categories. Because of the small size of this team and there is not a major time difference between members of the team, this step was done using collaborative teleconferences with traditional web-based presentation tools. With flexible co-ordination plans and because contributions in web-based discussion forums are in written forms and are asynchronous, these had the advantage for the involved members to think about responses on their own pace and minimise potential misunderstandings. This also has noticeably helped to reduce the impact of language and cultural barriers [1, 6, 14, 5, 13, 11]. On the other hand, it took longer than initially anticipated to complete this stage, mainly due to the nature of the asynchronous responses but also due to absence or busy schedules of relevant users.

In the 3rd stage on the other hand it was required to refine, well-understand and to confirm each of the requirements, especially the functional requirements, to carry forward to the software development teams to start the design and implementation. The aim of this stage was to take separate categories of requirements and discuss them in details sufficient for implementation. Two main types of collaboration tools were used in this stage: video and teleconferences. However, it was realised early on, in fact from the first few sessions that large distributed teams are not particularly productive for this type of activity using these tools, especially when disagreements arise. To overcome this problem, similar to the 2nd stage above, requirements were re-categorised in terms of domain and functionality for the work of focused smaller sub-teams. As noted, having a smaller team has helped to allow greater interaction between team members and create more comfortable collaborative environment and noticeably greater contribution from (especially less confident or shy) members [3, 6, 14, 13].

Using available presentation tools, teleconferences or videoconferences, the software development team produced prototypes for up-coming sessions, mainly using rapid prototyping tools [16], to illustrate and confirm understanding. Occasionally e-mails, and regularly both teleconferences and videoconferences were used in this stage, however wherever and whenever possible videoconferences (such as Access Grid tools [17]) were used to allow greater interaction between members. This experience was also noted by other research reported in [1, 2, 15, 3, 13].

3.2. Design and Implementation

After the completion of the first cycle of the requirement specifications process, software development teams with the system architect started the design and the implementation processes. Three components in the project are based on legacy products and one was created from scratch. These four components are partially dependent however each distributed software development team was working on a vertical sub system made up of at least two or more sub-components, with interdependency kept to minimum where possible. The initial phase of allocating tasks to teams was therefore straight forward. Tasks, in this phase, were allocated to teams based on the logical understanding of the system. This was made easier because of the existence of the

legacy components which their dependency pattern was known and not complicated. The main dependency was with the fourth component. The general architecture of the system was initially created by the system architect and iteratively refined and agreed with the development teams, however the detailed design of each vertical sub system was done by the members of the respective development team as per the allocation. As mentioned above, in the 3rd stage of eliciting requirements, the requirements were re-classified on domain and functionality which relatively coincided with each vertical sub system, this resulted in members of each development team to engage early on in understanding and prioritising the requirements, which greatly helped to facilitate the design stage.

Co-ordinating design and implementation (sub) milestones defining the critical path and cross points helped to establish a known co-ordinated pattern of team expectations and (needed) collaboration points. In addition to set general implementation guidelines for the three teams, each team had defined the details of their own individual conventions, their working patterns, their collaboration mechanisms per se.

4 CONTRIBUTING FACTORS

Several factors were identified as contributing factors to the success of the collaboration of the distributed software development teams including the pre-planned flexible co-ordination of development (sub) processes as outlined above, the choice and the effective use of collaboration tools and commitment of the team members. The following discussion concentrates on another two main factors that had significant effect as noted by the team.

4.1. Team building and management strategy

With most members of the development teams employed or brought in new, it was essential to establish a working relationship between them, at least in each individual team. An important factor that contributed significantly in establishing a successful working of teams is setting up a pattern of initial face-to-face meetings. These working meetings helped to bridge gaps between members and establish social and working knowledge between them, and set the seeds for trust in the teams [6, 10]. Other factors in building the teams, such as, selecting complimentary skills, domain knowledge, and minimizing cultural barriers have also been taken into account [9, 1, 6]. Also because there were no immediate software deliverable deadlines, this gave sufficient start-up time for the software teams to form a trustful working relation. The importance of such factors in the team building process has been noted elsewhere [9, 1, 6, 4, 13].

The impact of team building and managerial strategy factors on determining the successful working of the team was clearly visible in the teams' responses. One advantage was the experience of the management team and their awareness of the literature on virtual and distributed software teams' geographical and cultural issues. This helped the management team generally to avoid some of the pit falls that can be easily ignored in traditional co-located teams, some of the team building measures, assuming trust, or ad-hoc discussions for example [9, 1, 4].

One of the noted factors that contributed to facilitating co-ordination and successfully working together in such a setup is establishing a pattern of "self lead or manage" for each team and at each site. For example, for each of the team leaders the objectives have been outlined at the beginning and each was given the context in which they are expected to work and use their own initiative to derive the team to get the work completed. This approach has given the team the freedom and flexibility to derive their own work in the best way they see suitable for their own team working pattern, as noted from teams' responses. It also has allowed higher flexibility for teams to co-ordinate between themselves well in advance on the development path deliverables and meeting points. Thus the teams ended up with their own agendas but agreed on shared critical path (e.g. for dependent components), critical resources (e.g. video/teleconferencing facilities, or shared staff) and meeting (intermediate and end) points. Team leaders took the initiative to proactively work and plan ahead rather than wait to react when crises arose. This strategy has not only a positive effect on teams' self esteem and productivity, but also on greatly contributing to having a successful distributed team, as noted by the management team.

Another important factor for successfully co-ordinating the design and implementation processes was the bringing in of a system architect that brought the systems various technologies and development threads together and in away kept the system with a common vision. The architect was a common point of contact for team leaders that helped to reduce frictions and the otherwise amount of interactions needed for interdependent components.

4.2. Co-ordination, Collaboration and collaboration tools

Pre-planed co-ordination between teams on the main (sub) milestones and deliverables helped to bring the project and teams together and refined their expectations. The project manager and the system architect were two effective co-ordination actors with different focus and at different levels. Although co-ordination tasks were numerous and needed significant effort, they were essential to plan and undertake for the distributed teams to collaboratively work together, and in reducing teams wasted effort and frustration, especially at intermediate and end points [13,14,15, 18]. To establish, it involved direct communication with individuals or teams to obtain general consensus as well establish an acceptable degree of co-ordination

Various collaboration tools were used in the project at various stages of the development process. Initially, the focus was on using face-to-face meetings, mainly for the teams and team members to know each others and help establish a working relation and trust - these factors have been seen essential by the management team. During this period however, a limited combination of video and teleconferences and web-based collaborations were used. As the project advanced, the use of these collaboration tools became more common. Wiki pages and discussion forums were used as the main web-based collaboration tools to share documents, information, open discussion pages and discussion forums. Video and teleconferences tools were used to substitute face-to-face meetings. Also e-mails, shared repositories and other tools were also often used.

The importance of using suitable collaboration tools was realised early on in the project by the management team. Their function has not only been seen to facilitate collaboration between team members, but also, if effectively used, to create a common hub of information that in a way provides transparency in the project of all its components and teams' (including the management team) actions, activities, output, work plans and so forth. This transparency was seen to at least partly substitute for some of the activities that commonly exist in non-distributed teams, such as ad-hoc discussions, social or informal face-to-face meetings etc, which are important factors for the team building process [1, 6, 4].

One of the reported important factors for using these collaboration tools effectively is that the team will need to have established working relationship, perhaps through previous experience or through a number of face-to-face meetings. The –ve effect of this experience has been noted on its contribution to the performance of one of the software development teams compared to the other two software development teams [9, 1, 6, 11, 10]. On the other hand, the occasional breakdown of the communication networks or in the collaboration tools resulted, in few cases, in cancelling meetings, which caused significant delay. Therefore, it was essential to set up a long series of meetings as a contingency measure to help overcome this problem.

5 CONCLUSION

Employing co-ordination and collaboration tools, the effectiveness of the tools, the way and how the tools are deployed or used, the teams' effectiveness of planning and co-ordinating their activities, the teams' ability of self manage, the working relation between teams or team members, how well done and the quality of the output product, and the team's ability to overcome the geographical and cultural problems are the main factors that indicate successful collaboration, as derived from the recorded information or the interviews of the software development team.

The management team on the other hand, although generally agree with the above factors, had less emphasis on the first three factors. While they realise their importance, but they believe their importance is more as contributing factors rather than essential to achieve the latter factors. The followed managerial and team building measures also were identified as contributing factors to a successful working distributed team.

Although the above give clear indication of some of the main contributing factors to creating a successful collaboration in distributed software engineering teams, there remains a number of issues and questions that still need further investigation. For example, team building measures do not clearly show methods of retaining successful teams, or rebuilding a team after it has failed, or indicate the effect on the distributed team when staff leave or join in the middle or towards of the task. One such example was recorded in one of the teams, although a slow productivity was indicated this case was not sufficiently documented to analyse. But this does not only depend on the new staff abilities and experience but also on the timing, the critical and dependency paths of development.

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COMBINING LOCAL AND GLOBAL APPROACHES IN A WEB SERVICE DEVELOPMENT PROCESS

Arto Lanamäki
South Ostrobothnia Telemedical Service Center & University Of Tampere
Koskenalantie 16, 60220 Seinäjoki, Finland
Tel: +358 50 3811431
e-mail: arto.lanamaki@uta.fi

ABSTRACT

In this paper I go through three different kinds of global web services that have multiple localized versions. I construct a new method of combining local and global approaches in web service development processes. The method is derived from Orlikowski's [1] practice lens model. Also I present a forthcoming project where this new method will be implemented.

Google [2], Apple Store [3] and Wikipedia [4] are different kinds of global web services that have localized versions for different languages and countries. All three have solved the question of global and local differently. My contribution to localization comes from Orlikowski's [1] article where she advances the view that structures are not located in organizations or in technology, but are enacted by users.

1 INTRODUCTION

One of the hot topics in information systems (IS) research at the moment is the combination of global and local in information system development. On the other hand it is cost-effective to build systems that are put in the use world-wide as it is. On the other hand many aspects - social, economical, institutional, political and strategic [5] - vary dramatically in all countries and even within countries. There varying aspects must be considered to achieve success.

This topic has been studied from both global perspective and local perspective. For example Rolland and Monteiro's "pragmatic balance" [6] represents the global perspective and Lie & Sørensen's (1996) "IT domestication" [7] represents the local perspective.

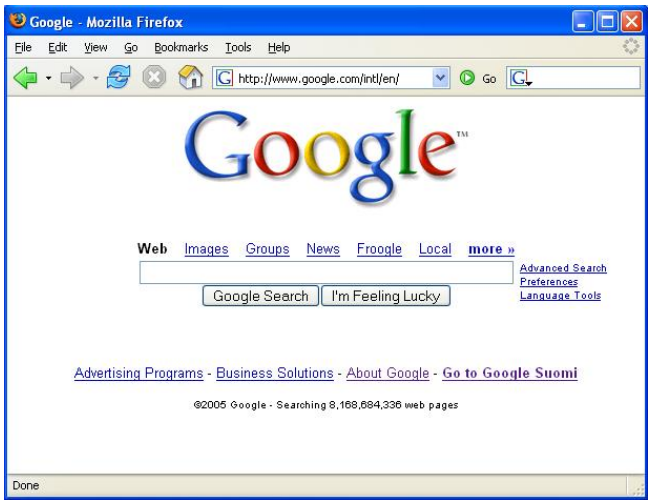
The challenge of developing information systems or services that provide benefits in both global and local level can be approached using Orlikowski's [1] practice lens model for studying technology in organizations. According to Orlikowski structures are not embodied in the technological artifacts but are enacted by the recurrent social practices of community of users. To my mind Orlikowski's findings provide a basis for combining the local and global perspectives in information systems development. In a successful global IT development project a common prototype should be given for users worldwide, carefully analyze what meanings the users make for the technology and further develop the software to meet local needs while keeping the global requirements in mind.

2 EXAMPLES OF LOCALIZED GLOBAL WEB SERVICES

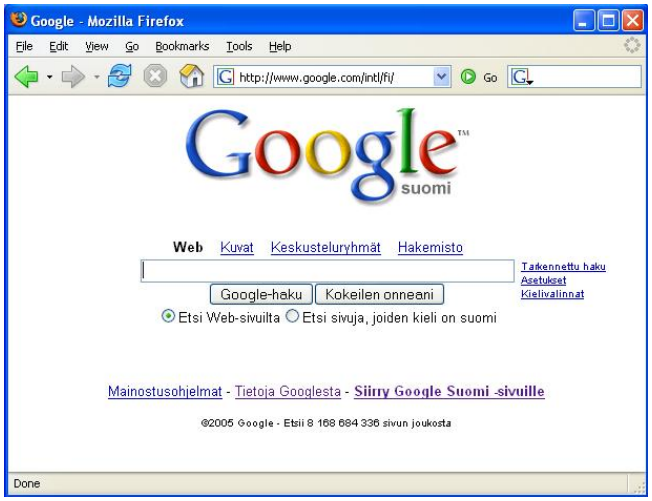
2.1. Google

Google [2] is the most popular search engine on the web. It is familiar to maybe all internet users and might be the most popular web site on the whole internet. According to Google [8] the search engine is localized for 112 different country domains and 120 languages.

Google search engine is localized the way that when you enter www.google.com it automatically redirects you to your own country's domain where all text is in your own language. This is done by automatically analyzing the user's host name (or IP address). For example when you enter www.google.com from Finland, you are automatically redirected to www.google.fi. Therefore users worldwide have to know only the main URL, www.google.com, and they get their localized Google.



Picture 1 - Google.com (English)



Picture 2 - Google.fi (Finnish)

The global English-language Google and the local Finnish Google share the familiar stripped-down look.

The only difference is that in global Google there are more links to “sub-Googles”. This is most probably because of Google’s way of developing new services and features first for the English “core”. They start making localized versions only after the “core” is ready. While this might be a safe approach, it does not benefit from innovative differencies of different cultures, languages and countries. One example of this is that Google search does not contain conjucation of words, because such thing does not exist in English language. However a lot of other languages do have word conjucation – Finnish and Swedish for example – and therefore googling in these languages does not provide as good results as googling in English does.

2.2. Apple Store

Apple Store [3] is a shop on the internet that sells official Apple products. One can buy all Apple equipment there – computers, mp3 players and accessories.

Picture 3 - Apple Store USA (English)

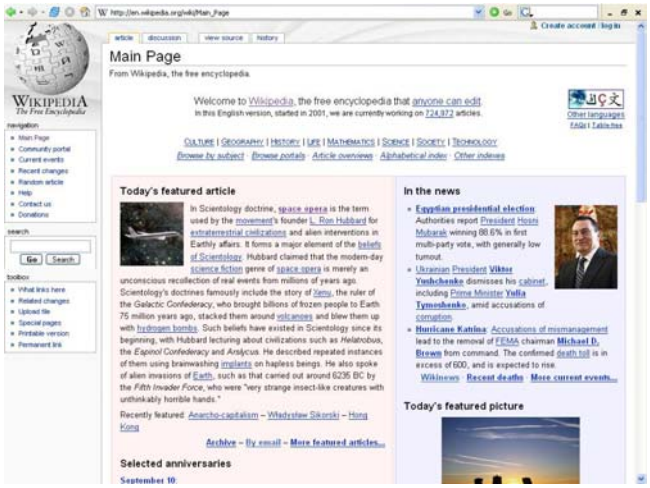
Picture 4 - Apple Store Finland (Finnish)

Apple Store’s American core and its Finnish version are almost identical. Finnish version is not even in Finnish, but in English language. This is maybe because of that Apple sees Finland as such a small market area that it would be waste of time and money to make a translation. The biggest differences of these global and local versions are pricing (USD vs. EUR) and the phone number of the support phone line. The products on front page are exactly the same ones.

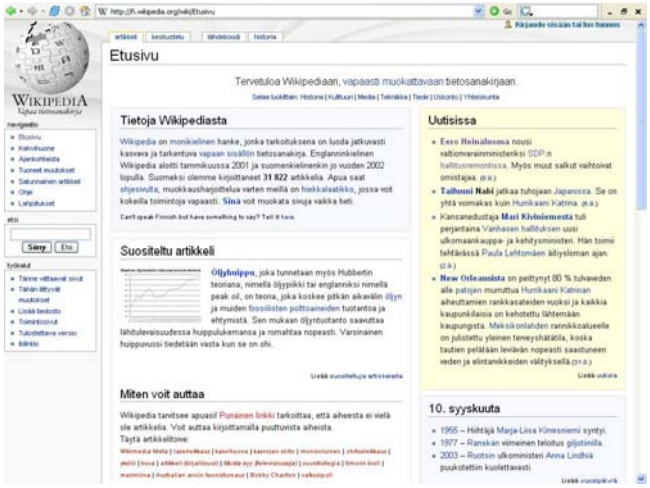
2.3. Wikipedia

Wikipedia is a Web-based, multi-language, free-content encyclopedia written collaboratively by volunteers and sponsored by the non-profit Wikimedia Foundation. It has editions in about 180 languages (about 100 of which are active) and contains entries on traditional encyclopedic topics and on almanac, gazetteer, and current events topics.

Its purpose is to create and distribute a free, reliable encyclopedia in as many languages as possible —indeed, the largest encyclopedia in history, in terms of both breadth and depth. [10].



Picture 5 - Wikipedia (English)



Picture 6 - Wikipedia (Finnish)

In Wikipedia the line between a user and a content-creator is very blurry. Everyone can contribute, even without registration. This ultra-distributed model suits well for Wikipedia's free ideology.

The Finnish and the English Wikipedia front pages have the same look and structure. That is where the similarities end. The ultra-distributed content-creation model makes it possible for all local versions of Wikipedia to have very unique content. Of course there are some similarities in content because people around the world share interests to similar topics and they translate Wikipedia pages from other languages to their own.

3 A NEW ADDITION TO WEB SERVICE LOCALIZATION

In Wanda J. Orlikowski's 2000 article [1] in Organization Science journal she advances the view that structures are not located in organizations or in technology, but are enacted by users.

She studies technologies-in-practice in three companies – using code names Iris, Alpha and Zeta. What she finds out is that the same technology is used in many different ways in different places by different people. Therefore it is not the technology that determines the proper way to use, it is the people that create a meaning and context to it.

To my mind, this is a fascinating idea which can be used also in software development. If people find their own ways of using a technology, then this can be taken into account in software development processes. It might be rewarding to listen to people's interpretations of the technology in the *middle* of the development process and then further develop the technology according to these interpretations. This way a lot of unexpected points-of-views could be found to create successful multi-local technology.

4 HEALTH PROMOTION WEB SERVICE DEVELOPMENT CONCEPT FOR FINLAND

In Finland (and many other countries as well) it has been broadly noticed that public investments into health promotion should be a lot bigger than it is at the moment. Health care costs are growing a lot faster than Finnish gross domestic product (GDP) does. This problematic equation could be at least partially solved, if people would find self-empowerment in more healthy ways of living – increasing more sports activities, eating healthier food and quitting smoking. Health promotion is always cheaper than health care.

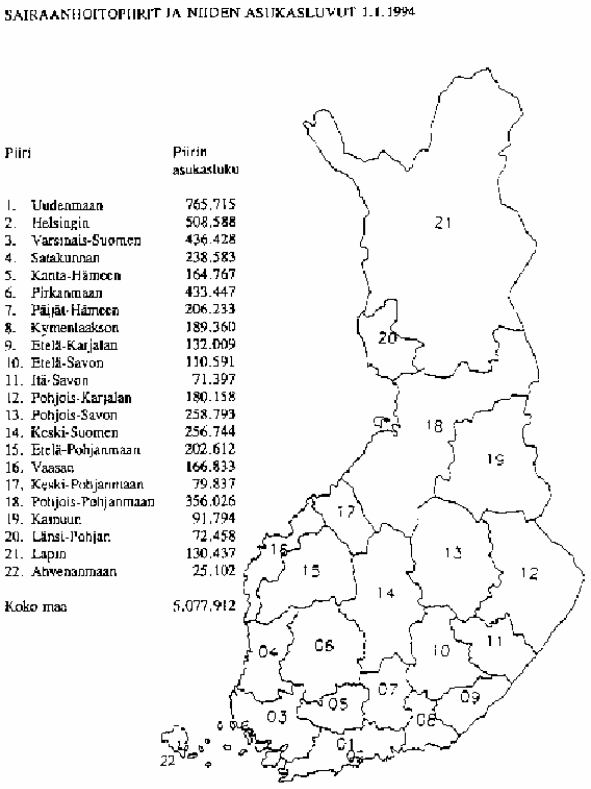
For efficient health promotion, internet can provide a lot of help. We have made plans about developing a Finland-wide health promotion internet service where is both generally valid information and information that is important especially in local (regional) scale.

How to get the message of health promotion to a potential "customer"? Of course, at least the appearance and content of the web service should be as appealing as possible. One big part of this is localization. The user should be able to receive valid information in his/her own local, regional context.

The challenges for health promotion are different in different regions of Finland. For example in my region Etelä-Pohjanmaa, type 2 diabetes is a very wide-spread problem. These types of things must be taken into account in regional localization. To properly find out all the different regional needs, a general prototype must first be developed for all regions. Then comes the essential part of listening to people's thoughts in different regions and further multi-regionally develop the web service according to different interpretations. To my mind this is Orlikowski's

[1] idea that people make the (social) structures and decide the meaning and use for technology – it is not embedded in the technology. For me it is important to overcome technological determinism and let the people have the power to have what is needed.

The development project for Finland-wide multi-regional health promotion web service starts in the beginning of 2006. Regional division is made using the 22 hospital districts of Finland. When the service is ready in 2008, the result is that all these 22 regional web services will share a common structure and look, but differ on content.



Picture 7 - Finland and its hospital districts [10]

6 CONCLUSION

In this paper I have investigated three different global web services that have multiple localized versions. These three were Google, Apple Store and Wikipedia. Then I took Orlikowski's 2000 article [1] and used its idea in a new way for global web service localization. Third part of my paper presents a forthcoming project where this idea will be implemented. The project is a health promotion web service development process starting in Finland in 2006. In this project Finland is seen as the "global" development level with 22 different hospital districts as "local" development levels. All these 22 regional web services will share a common structure and look, but differ on content.

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SODELOVANJE PRI AGILNEM RAZVOJU INFORMACIJSKIH REŠITEV

Andrej Kline
FJA OdaTeam d.o.o.
Titova cesta 8, SI-2000 Maribor
URL: http://www.fja-odateam.com
e-pošta: andrej.kline@fja-odateam.com

POVZETEK

Agilne metodologije obravnavajo proces razvoja drugače od konvencionalnih metodologij. Proces je manj definiran, »lažji« za natančne specifikacije pred samim kodiranjem, ter naravnan k čimprejšnjemu rezultatu in s tem povratni informaciji na opravljeno delo. V ospredje postavlja človeka, pred proces kot tak, in skuša usmerjati človekove sociološke, pa tudi psihološke prvine k ekstremnemu sodelovanju in usklajenosti, lahko bi rekli k harmoniji. Torej agilen način razvoja nadomešča številne formalne mehanizme (zapise, smernice, prijeme) v razvoju programske opreme z vrednotami, kot so: pogum, komunikacija, preprostost in odziv. Takšne vrednote je možno postaviti kot vodilo pri vsakdanjem delu le v »dobro uglašeni skupini«.

1 PA SODELUJMO …

Programska oprema je neločljivo povezana s človekom. Ustvarja jo človek, da služi človeku in da mu kot delujoče orodje olajša življenje. No, vsaj naj bi bilo tako! V idealnem primeru sta zadovoljna oba, avtor in uporabnik programske opreme. Ker pa – vsaj ponavadi – v nakazani relaciji sodeluje več ljudi na vsaki strani, znajo biti nivoji komuniciranja precej kompleksni. Kompleksni v smislu kompromisa, kako na zabaven in ustvarjalen način ustvariti programsko opremo, ki da uporabniku s svojim delovanjem ne le poslovno vrednost, ampak tudi konkurenčno prednost in sredstvo za dosego novih ali višjih ciljev.
In zabavno je ljudem takrat, kadar se družijo – komunicirajo. Kakor je v drugih panogah človeškega ustvarjanja, tako je tudi pri razvoju programske opreme.

2 AGILNOST IN NIVOJI SODELOVANJA

Sodelovanje posameznikov v projektu, ki ga izvajamo po agilnih smernicah, mora biti v vsakem trenutku v vsakem delu projekta maksimalno možno prisotno. Tako morajo med seboj tesno sodelovati naslednje skupine oz. dvojice:

- Skupina razvijalcev med seboj, vključujoč testerje
- Razvijalci in vodje razvoja (produktov)
- Razvijalci in projektni vodje
- Projektni vodje in projektni managerji
- Razvijalci in stranka – končni uporabnik sistema (ali t.i. »proxi stranka« kot vmesni uporabnik sistema - opisana je v nadaljevanju)
- Management na strani stranke in management na strani dobavitelja sistema

Nivojev komuniciranja je torej v osnovi kar nekaj. Seveda niso ograjeni vsak zase, ampak se tudi kombinirajo. S tem postane sodelovanje zelo kompleksno in zelo se je potrebno potruditi, da v projektu ne nastopi zmeda. Vloge in odgovornosti posameznikov morajo biti jasno definirane, porazdeljene v kolektivu in posameznik mora svoje obveznosti poznati, jih spoštovati in jih dosledno izvajati. Definirani morajo biti tudi mehanizmi nadzora vse naštete komunikacije.
V nadaljevanju je navedenih nekaj praks, ki so se izkazale v projektih kot koristne na posameznih nivojih sodelovanja.

Razvijalci
Komunicirajo med seboj s programsko kodo in s testi (enot), ki jih napišejo sami. Da zmanjšajo strah v smislu »Ali sem zgradil sistem / del sistema, ki ustreza zahtevam naloge«, »Ali sem se držav standardov kodiranja v podjetju«, »Ali sem s testi zajel vse robne pogoje delovanja«., ipd. agilne metodologije največkrat priporočajo:

- Testiranje pred implementacijo; testi enot in testi sprejemljivosti
- Pregled programske kode, s strani vodje razvoja (XP metodologija ga imenuje »coach« ali trener razvojne skupine ali podskupine)
- Programiranje v parih

Seveda razvijalci izdatno sodelujejo tudi s stranko ali proxi stranko, vkolikor strana no direktno vključena v razvoj. **Proxi stranka** je izkušen projektni vodja ali skrokovnjak znotraj razvojne skupine, ki se spozna na posel, ki ga razvijana programska oprema abstrahira.

Projektni vodja
Sodeluje prav z vsemi sodelujočimi v projektu; z razvojno skupino, s stranko, s projektnim managementom. Njegove odgovornosti so zbrati vse zahteve stranke, jih urejene prinesti razvoj na analizo in implementacijo, nato spremljati napredek razvoja in ga nenehno poročati projektnemu managementu. Prav tako je odgovoren za

poslovne koncepte, ki jih razvojna skupina – skupaj s proxi stranko – izdela in pošlje stranki v potrditev, validacijo.
Njegovo sodelovanje z razvojem je v testih sprejemljivosti, ki jih napiše bodisi s stranko ali s proxi stranko.

Projektni management
Ima v osnovi eno samo pomembno odgovornost v agilnih projektih: imeti zmeraj pred očmi transparenten napredek projekta in takoj ukrepati ob vsaki spremembi načrta.

Od vseh naštetih nivojev sodelovanja je morda najbolj ekstremno, vsaj za zunanje opazovalce, delo v paru. Par razvijalcev namreč dela za enim računalnikom, v enem razvojnem okolju, v istem »vrtičku« programske kode. Tudi teste enot pišeta razvijalca skupaj. Vsak zlog produkcijske kode razvijalca skupaj integrirata v skupinski repozitorij.

Prilagodljivost na spremembe metodologije ali načina dela je Je zelo pomembna vrlina. Ne samo za posameznika, ampak za celotno ekipo ali celo organizacijo podjetja.
Spremembe so konstantne, tudi v agilni igri. Tu ni nobene utvare.
Psihološki učinki pred/med/po spremembah v timu so lahko močni. Ljudje različno reagirajo na spremembe; v projektu, v timu, v paru, v področju razvoja. Možen vzrok je s strahom ali negotovostjo zmanjšana samozavest.
Najboljše zdravilo je pogum in skupna zaveza celotne skupine, da bo s sinergijskim učinkom dosegla spremenjene cilje.

3 PASTI AGILNEGA RAZVOJA

Agilni razvoj odpove, če v projektu ni podpore s strani managementa – na strani stranke in izvajalca. Če niso vrednote, navedene v začetku prispevka, vsem udeleženim v projektu skupne, potem bo v projektni skupini nastal razdor in ne-konstruktivno delo. Sodelovanje pade!
Naslednja nevarnost so slabi koncepti, ki jih razvojna skupina napiše, a ne odgovarjajo realnosti. Zato jih mora stranka nujno potrditi!
Nerealistični termini projekta, ki silijo posameznike v nekakovostno delo. Nezmožnost prilagajanja na spremembe je smrt agilnih projektov, saj v takem primeru izgubimo pojem agilnosti!
Programiranje v parih ima naslednjo psihološko nevarnost: Razvijalci želijo vsako nalogo, še tako trivialno ali rutinsko, izvršiti v paru z drugim sodelavcem / sodelavko. V ozadju je zmanjšana samozavest posameznika, pa ne v smislu bojazni pred ne-zmožnostjo lastnega dela, vendar nesigurnost v smislu celostne rešitve, zajetih pogledov pri testiranju ipd. Možna rešitev, ki jo pogosto narekuje tudi »časovna stiska« razvijalske skupine, je občasno »solo«programiranje, vendar mora ostati pravilo: Integracijo kode v skupen sistem opravi par razvijalcev!
Prav tako je nevarno slepo sledenje smernicam oziroma praksam, ki jih podajaj literatura ali »misijonarji«. Potrebno je pretehtati, kaj skupini koristi in kaj ne. Potrebno si je prikrojiti načina dela, si ga »napisati na kožo«.

4 AGILEN RAZVOJ BREZ SODELOVANJA

Je utopija. Tako kot bi bilo npr. spoznavanje drugih kultur brez direktnega komuniciranja.
V skupini OdaTeam že več kot šest let uporabljamo ekstremno programiranje (XP) kot metodologijo dela, še več, življenja celotne ekipe. Prešli smo mnoge spremembe, ki smo jih kot potrebne bodisi uvideli sami, bodisi so nam jih komunicirali ljudje, s katerimi delamo; naše stranke, prijatelji iz drugih razvojnih ekip (podjetij). Brez pripravljenosti na spremembe in na možnost reagiranja nanje bi pogoreli. Svet poslovnih aplikacij, v katerem delamo, se nenehno spreminja. S tem se spreminjamo tudi člani OdaTeam-a. Spreminjamo se kot posamezniki in kot celota. Edina stvar, ki se vsaj v osnovi ni spremenila tekom zadnjih let, je naše sodelovanje – to smo že v osnovi pripeljali do ekstrema!
…

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IMPLIKACIJE SODELOVANJA Z ODPRTO-KODNIMI PROJEKTI

Gregor Polančič
Fakulteta za elektrotehniko, računalništvo in informatiko
Univerza v Mariboru
Smetanova 17, 2000 Maribor, Slovenija
e-mail: gregor.polancic@uni-mb.si

ABSTRACT

Open source software (OSS) is computer software that has its source code made available under an open source definition (OSD) based license. Most of OSS is being developed in public accessible projects. Consenquently, this allows developers and users to adapt and improve the software.
This article presents open source software projects (OSP), their development model, design and characteristics. Additionally, different models of collaboration with open source projects are presented and implications evaluated.

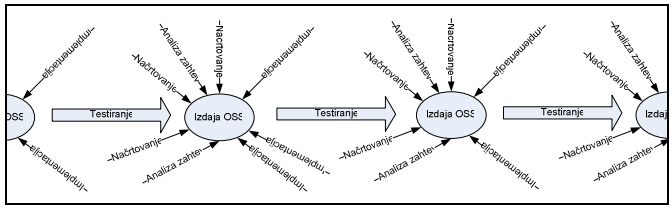
1 UVOD

Odprto-kodna programska oprema oziroma odprto programje[1] *(Open Source Software - OSS)* pridobiva na priljubljenosti vse od njenega pojava, konec devetdesetih let prejšnjega stoletja. Med indikatorja priljubljenosti, ki sta razvidna iz repozitorija Sourceforge [2], spadata rast števila projektov, v katerih se le ta razvija in rast števila udeležencev takšnih projektov.
Priljubljenost odprtega programja je med drugim posledica njegove osnovne značilnosti, dostopnosti izvornega koda. Licenca takšne programske opreme[2] namreč opredeljuje, da je izvorni kod, iz katerega je mogoče narediti funkcionalno delujoče programske produkte, dostopen vsem. Poleg tega, licenca dovoljuje še svobodno spreminje, prilagaje in distribuiranje odprtega programja za katerikoli namen, kar posledično vpliva tudi na njegov model razvoja in trženja.
Večina projektov, ki razvijajo odprto programje *(Open Source Projects - OSP)* je javnega značaja, kar pomeni, da se lahko v OSP vključi vsakdo z motivacijo in ustreznim znanjem. Vključevanje novih udeležencev v OSP je pravzaprav zaželjeno in nujno, saj največji delež k razvoju OSS prispevajo prav prostovoljci, ki za svoje delo ne prejemajo plačila. Na kakšen način se bo posameznik vključil v projekt in kaj so cilji takšega sodelovanja, je prav tako prepuščeno posamezniku.
V OSP se vključujejo še organizacije, ki imajo, za razliko od posameznikov, drugačne motive in pričakovanja takšnega sodelovanja. Njihovi nameni so najpogosteje zniževanje stroškov ali konkuriranje monopolnim komercialnim proizvodom.
Kakšna je tipična zasnova OSP? Kaj so njihove skupne značilnosti in v čem se OSP razlikujejo med sabo? Kakšni so osnovni modeli sodelovanja z OSP in kaj so njihove bistvene prednosti ter tveganja? Odgovori so podani v nadaljevanju.

2 PREDSTAVITEV ODPRTO KODNIH PROJEKTOV

2.1 Model razvoja

Za razliko od klasičnih, zaprto-kodnih modelov razvoja programske opreme (na primer: kaskadni, spiralni, iterativni model), kjer se faze razvoja odvijajo po predvidenem modelu (na primer zaporedno ali iterativno), temeljijo OSP na slabše opredeljenem, t.i. evolucijskem modelu razvoja *(evolutionary model)* [4] . V evolucijskem modelu razvoja, se faze razvoja prepletajo in prilagajajo nenehnem prilivu novih zahtev in idej.[3] Rezultati takšnega modela so t.i. »organski« projekti, ki ne sledijo striktnim načelom in vzorcem in posledično oscilirajo med posameznimi fazami življenjskega cikla razvoja programske opreme (Slika 1).



Slika 1: Evolucijski model razvoja programske opreme [5]

[1] Termin »odprto programje« je povzet po računalniškemu slovarčku Slovenskega društva Informatika [1].
[2] Licenc odprtega programja je veliko, vendar morajo biti vse skladne z definicijo odprte kode *(Open Source Definition - OSD)* [3].
[3] Razlike med zaprto-kodnim in odprto-kodnim modelom razvoja so podrobneje predstavljene v viru [4].

Posledica takšnega modela razvoja je edinstvena zasnova odprto-kodnih projektov.

2.2 Zasnova odprto-kodnih projektov

Infrastruktura odprto-kodnih projektov temelji na konceptu virtualne skupnosti, na odprtih standardih in standardnih razvojnih in komunikacijskih orodjih, z namenom poenostaviti in poceniti sodelovanje ter si zagotoviti kar najširši krog uporabnikov (iz vrst uporabnikov izhajajo tudi razvijalci). Pogosta zasnova OSP je naslednja:

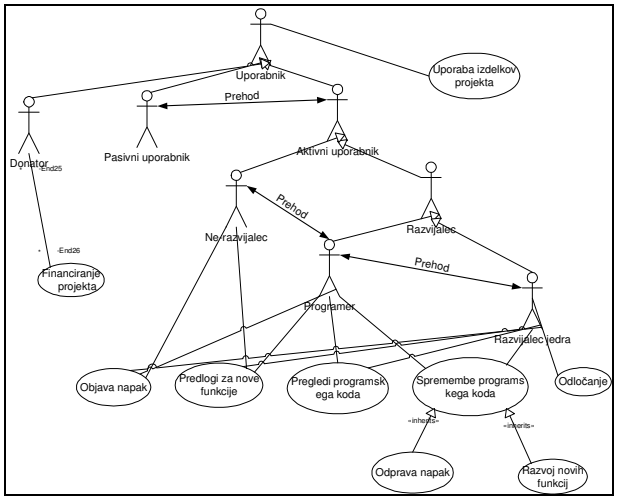
a. vodenje OSP je najpogosteje v domeni majhnega števila "razvijalcev jedra" (glej sliko 2), ki so odgovorni za arhitekturo in programsko jedro OSS. Odločajo o integracijah programskega koda, kakovosti, distribucijah in strategiji projekta;
b. razvijalce jedra obdaja širši krog razvijalcev, ki dodajajo manj tvegane funkcionalnosti (izboljšujejo uporabniški vmesnik, izdelujejo namestitvene programe ali specifične poslovne funkcije) in odpravljajo napake;
c. razvijalce obdaja krog aktivnih uporabnikov, ki ne prispevajo programskega koda, temveč pišejo uporabniško dokumentacijo, identificirajo napake in zagotavljajo pomoč preostalim uporabnikom.

2.3 Lastnosti odprto-kodnih projektov

Vsem OSP sta skupni naslednji lastnosti [6]:

a. privrženost oziroma skladnost projekta z definicijo odprte kode (OSD), ki opredeljuje, da je izvorna koda (vsaj zadnja stabilna različica) javno dostopna;
b. lastnost uporabnikov (ne vseh), ki so lahko istočasno tudi razvijalci (in obratno).

Uporabniki OSP se v osnovi delijo na pasivne uporabnike, to so uporabniki, ki samo uporabljajo OSS in na aktivne uporabnike, ki tudi prispevajo k razvoju OSS. Preostale, specialne vrste uporabnikov, kakor tudi poglavitne aktivnosti, ki jih izvajajo v OSP, so prikazane na Sliki 2.



Slika 2: Diagram vlog in pripadajoči primeri uporabe v OSP

Posamezni OSP se med sabo močno razlikujejo, zato je neprimerno več lastnosti takšnih projektov variabilnih. Med variabilne lastnosti spadajo [6]:

a. **velikost projekta** – število uporabnikov OSP spada med najbolj variabilne količine. V večini primerov se ohranjajo le razmerja med številom različnih vrst uporabnikov (glej Sliko 2 in poglavje 2.2);
b. **vzpostavitev projekta** – čeprav nastane večina OSP projektov iz "nič", imajo številni uspešni OSP korenine v lastniškem programju (na primer Eclipse);
c. **motivacija** za sodelovanje v OSP sega vse od povečevanja osebnega ugleda, do prepričanja v pravilnost filozofije odprtega programja. Organizacijam lahko odprto programje predstavlja način konkuriranja monopolnim lastniškim proizvodom. Motivacijo jim lahko predstavlja zagotavljanje prostora na tržišču ali preprosto uporaba OSS, na osnovi katere lahko razvijajo lasten proizvod;
d. **skupnost** – OSP projekt obdaja virtualna skupnost *(virtual community)*. Člane skupnosti združuje interes uporabe določene OSS. Poglavitna lastnost OSS skupnosti je, da se znanje in trud, ki ga uporabniki prispevajo v OSP, vrača v obliki zaslug in ugleda, kar pripomore k večjemu ugledu znotraj skupnosti *(meritocratic culture)*. Skupnosti so lahko urejene centralizirano ali decentralizirano. V centraliziranih skupnostih (skupnost Apache) obstaja hierarhija aktivnih uporabnikov, ki imajo različna pooblastila in naloge. Nasprotje je decentraliziran model, kjer imajo uporabniki enotnejša pooblastila in se odločajo na osnovi glasovanj;
e. **modularnost zasnove** - pomemben dejavnik, ki vpliva na učinkovit razvoj znotraj virtualnih skupin, je komponentna zasnova (jasno določeni vmesniki) in odprta arhitektura sistema (komponente, lastnosti, povezave). V splošnem velja, da so bolj modularni projekti in projekti, ki temeljijo na stabilni arhitekturi, tudi uspešnejši;
f. **razvojna in komunikacijska orodja** - OSP uporabljajo različna razvojna in komunikacijska orodja. Čeprav za upravljanje konfiguracuije prevladuje orodje CVS *(Concurrent Versions System)*, se za ostala komunikacijska orodja (objave napak, poštni seznami, forumi) uporabljajo različni izdelki;
g. **licenca** – z OSD je skladnih več licenc. Za uporabnike je pomembno predvsem, ali licenca vpliva na izpeljana *(derived)* dela (v primeru razvoja programske opreme na osnovi OSS) in ali se lahko programski kod »zapre« (Tabela 1).

Tabela 1: Poglavitne vrste OSD licenc

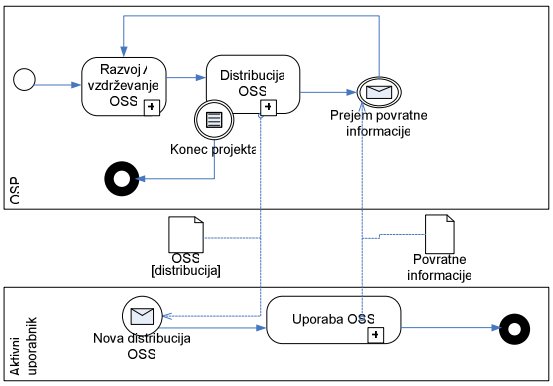
Licenca skladna z OSD	Vpliv na izpeljana dela	Dovoljuje zapiranje koda
GPL (GNU General Public License)	Da	Ne
LGPL (GNU Lesser GPL)	Ne	Ne
BSD (Berkley Software Distribution)	Ne	Da
IBM Public License	Ne	Da
MPL (Mozilla Public License)	Ne	Da

3 MODELI SODELOVANJ Z ODPRTO-KODNIMI PROJEKTI

Neodvisno, ali nastopamo kot posameznik ali kot organizacija, lahko z OSP sodelujemo na več načinov. Običajno se uporabnik odloči za model sodelovanja, ki mu ob najmanjšem vlaganju in tveganjih, prinese največ koristi. V nadaljevanju so predstavljeni trije najpogostejši modeli sodelovanj.
Predstavljeni modeli sodelovanja se med sabo razlikujejo po vlogi uporabnika OSS v OSP in namenu sodelovanja z OSP. Modeli so analizirani iz vidika prednosti, tveganj in vlaganj. Predstavljeni so primeri uporabe posameznega modela, namen sodelovanja in process sodelovanja, ki prikazuje poglavitne aktivnosti in informacijske tokove v posameznem procesnem modelu. Procesi so predstavljeni v notaciji BPMN *(Business Process Modeling Notation)*.

3.1 Model 1 – Uporaba odprtega programja

Namen takšnega sodelovanja je predvsem v uporabi obstoječe distribucije OSS in posredovanju povratnih informacij. Uporabnik je v vlogi ne-razvijalca (Slika 2). Izkušnje, ki jih pridobi uporabnik z uporabo OSS se preko spletnih komunikacijskih orodij posredujejo v OSP. Med povratne informacije spadajo: identificirane napake in pomanjkljivosti na OSS, pomoč drugim uporabnikom ali priporočila razvijalcem, ki se lahko upoštevajo ob razvoju nove različice OSS (Slika 3).

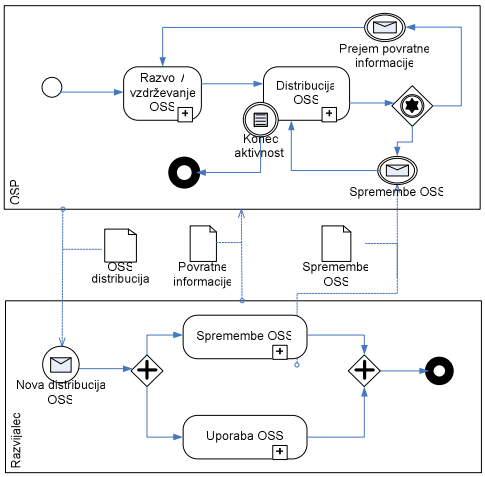


Slika 3: Uporaba OSS

Takšen model sodelovanja je najpogostejši pri zrelih projektih, ki pogosto razvijajo infrastrukturne rešitve, kot so: spletni strežniki, operacijski sistemi, razvojna okolja in podobni.
Poglavitna prednost aktivne pred pasivno uporabo (kjer samo uporabljamo programsko opremo) je, da se na takšen način povečuje baza znanja v okviru OSP, ki pripomore h kakovosti OSP in zagotavlja vzajemno pomoč med uporabniki. Povratne informacije vplivajo tudi na smernice nadaljnega razvoja OSS.
Poglavitno tveganje takšnega modela sodelovanja je, da takšen uporabnik nima neposrednega vpliva na razvoj in distribucije OSS, ki so v celoti v domeni drugih udeležencev OSP (podobno kot pri lastniških projektih).

3.2 Model 2 – Sodelovanje pri razvoju odprtega programja

Namen takšnega modela sodelovanja je aktivnejša vloga v okviru OSP, ki posledično prinese dodatne prednosti in obveznosti. Uporabnik je v vlogi razvijalca (Slika 2), saj poleg aktivnosti "modela 1", prispeva v OSP še izvorni kod (najpogosteje posreduje odpravljene napake), ki se lahko vključi v novo distribucijo OSS (Slika 4).



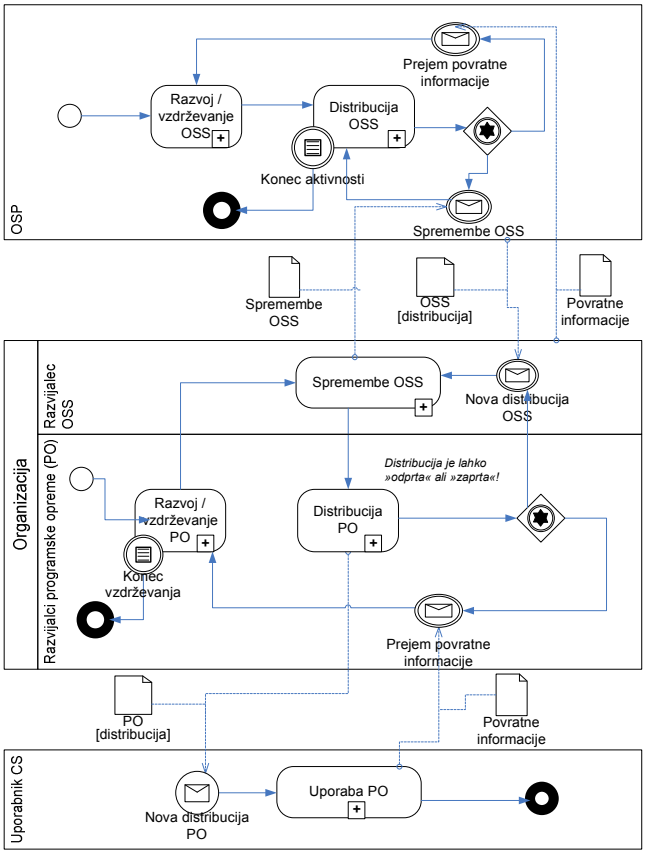
Slika 4: Sodelovanje pri razvoju OSS

Običajno sta kakovost in kvantiteta koda, ki se posredujeta v OSP, sorazmerni vplivu in ugledu, ki ga ima razvijalec v OSP. Tako so najaktivnejši udeleženci najpogosteje prav razvijalci jedra, ki pogosto predstavljajo še "vodje projekta".
Takšen model sodelovanja je med ostalim pogost pri uporabi rešitev, ki so namenjene ponovni uporabi (komponente in programska ogrodja), kjer je večina uporabnikov nadpovprečno seznanjena s programskim kodom oziroma zasnovo OSS.
Poglavitna prednost takšnega modela sodelovanja pred "modelom 1" je, da uporabnik lahko neposredno vpliva na kakovost in funkcionalnosti OSS. Na drugi strani so vlaganja večja, saj se mora uporabnik seznaniti z OSS, kakor tudi z razvojnimi orodji in procesi, na katerih temelji OSP.

3.3 Model 3 – Razvoj derivata na osnovi odprtega programja

V tem modelu se OSS ponovno uporabi s ciljem izdelati lasten programski derivat, ki je (odvisno od namena in licence OSS), lahko enake licence kot izvornik ali komercialen (Tabela 1). Uporabnik je podobno, kot v "modelu 2", v vlogi razvijalca le, da običajno dela v okviru organizacije. Poglavitna razlika glede na "model 2" je v cilju uporabnika (uporaba OSS napram razvoju derivata).

V modelu se OSS uporabi kot (pol) izdelek, ki se razširi s funkcionalnostmi ali z distribucijo v samostojen izdelek (Slika 5). Običajno se nekatere spremembe in nadgradnje OSS (običajno popravki) posredujejo v OSP, medtem, ko se druge obravnavajo kot lastnina organizacije ("know-how") in posledično ostanejo v njeni privatni lasti.



Slika 5: Razvoj derivata na osnovi OSS

Takšen model sodelovanja je pogost pri izdelkih, ki v derivatih predstavljajo pod-sisteme (podatkovne baze, strežniki) in priljubljenih generičnih izdelkih, za katere obstaja dovolj veliko povpraševanje tudi v primeru specializacije ali komercializacije. Primer takšnega modela je relacijska baza Hypersonic, ki bo med drugim integrirana v Open Office 2 ali spletni strežnik Apache, ki ga vključujejo številna komercialna okolja.
Prednost modela pred lastnim razvojem je, da v "modelu 3" zagotovi OSP del virov in znanja povsem brezplačno. Posledično je lahko razvoj derivata hitrejši in cenejši. Poglavitno tveganje je odvisnost derivata od OSS iz vidika kakovosti, smernic razvoja in "plana" izdaj.

4. ZAKLJUČEK

Prispevek je predstavil zasnovo in lastnosti projektov, ki razvijajo odprto programje. Predstavljeni so bili trije različni modeli sodelovanja s takšnimi projekti, ki se med sabo razlikujejo po vlogi sodelujočega in namenu sodelovanja. Predstavljene so bile implikacije posameznih modelov sodelovanj, predvsem iz vidika prednosti in tveganj, ki jih prinaša posamezni model. Povzetek lastnosti, posameznih modelov sodelovanj, je predstavljen v Tabeli 2.

Tabela 2: Lastnosti posameznih modelov sodelovanj z OSP

Vidik	*Model 1*	*Model 2*	*Model 3*
Najpogostejši namen	Uporaba OSS.	Ponovna uporaba OSS.	Razvoj derivata na osnovi OSS.
Vloga uporab.	Aktivni upo.	Razvijalec	Razvijalec
Aktivnosti sodelujočega	Uporaba.	Uporaba Spreminjanje	Uporaba Spreminjanje Distribuiranje.
Povratne informacije v OSP	Napake, pomoč, predlogi, itd.	Model 1 + programski kod.	Enako kot Model 2.
Poglavitna prednost	Brezplačna uporaba OSS.	Cenejši razvoj ponovno uporabnih izdelkov.	Cenejši razvoj derivatov.
Poglavitno tveganje	Slaba podpora.	Slaba kakovost.	Labilnost projekta.
Poglavitno vlaganje	Sodelovanje s skupnostjo OSP.	Model 1 + spremembe OSS, ki zahtevajo vključitev v razvojno okolje OSP.	Model 2 + lastne distribucije.
Najustreznejša vrsta licence OSS	Vse.	Licence ki ne vplivajo na derivate.	Licence ki ne vplivajo na derivate.
Prevladujoč tip OSS	Zrela OSS.	Ogrodja, komponente.	Pol izdelki, pod-sistemi derivatov.

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Izkopavanje znanja in podatkovna skladišča

Data-Mining and Data-Warehouses

Uredila / Edited by

Dunja Mladenić, Marko Grobelnik

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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 2005)

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

SECTION: Semantic WEB

VISUALIZATION OF TEXT DOCUMENT CORPUS

Blaž Fortuna, Dunja Mladenić, Marko Grobelnik
Department of Knowledge Technologies
Jozef Stefan Institute
Jamova 39, 1000 Ljubljana, Slovenia
Tel: +386 1 4773419; fax: +386 1 4251038
e-mail: blaz.fortuna@ijs.si

ABSTRACT

From the automated text processing point of view, natural language is very redundant in the sense that many different words share a common or similar meaning. For computer this can be hard to understand without some background knowledge. Latent Semantic Indexing (LSI) is a technique that helps in extracting some of this background knowledge from corpus of text documents. This can be also viewed as extraction of hidden semantic concepts from text documents. On the other hand visualization can be very helpful in data analysis, for instance, for finding main topics that appear in larger sets of documents. Extraction of main concepts from documents using techniques such as LSI, can make the results of visualizations more useful. For example, given a set of descriptions of European Research projects (6FP) one can find main areas that these projects cover including semantic web, e-learning, security, etc. In this paper we describe a method for visualization of document corpus based on LSI, the system implementing it and give results of using the system on several datasets.

1 INTRODUCTION

Automated text processing is commonly used when dealing with text data written in a natural language. However, when processing the data using computers, we should be aware of the fact that many words having different form share a common or similar meaning. For a computer this can be difficult to handle without some additional information -- background knowledge. Latent Semantic Indexing (LSI) [2] is a technique for extracting this background knowledge from text documents. It employs a technique from linear algebra called Singular Value Decomposition (SVD) and the bag-of-words representation of text documents for extracting words with similar meanings. This can also be viewed as the extraction of hidden semantic concepts from text documents.

Visualization of a document corpus is a very useful tool for finding the main topics that the documents from this corpus talk about. For example, given a set of descriptions of European research projects in IT (6th Framework IST), using document visualization one can find main areas that these projects cover, such as semantic web, e-learning, security, etc. Bag-of-words representation of text has very high dimensionality, so in order to visually represent text documents, the number of dimensions has to be reduced. This can be done by first extracting main concepts from documents using LSI and than using this information to position documents on a two dimensional plane that can be plotted on computer screen.

As a part of *Text Garden* software tools for text mining[1] we have developed a component that provides different kinds of document corpus visualization based on LSI and multidimensional scaling [3]. This paper is organized as follows. Section 2 provides a short description of LSI and multidimensional scaling, while its application to document visualization is given in Section 3. Description of the developed system implementing the method is given in Section 4. Section 5 provides conclusions and discussion.

2 BUILDING BLOCKS

2.1 Representation of text documents

In order to use the algorithms, which we will presented below, text documents must first be represented as vectors. We use the standard Bag-of-Words (BOW) representation together with TFIDF weighting [1]. In the BOW representation there is a dimension for each word; a document is encoded as a feature vector with word frequencies as elements. Elements of vectors are weighted, in our case using the standard TFIDF weights as follows. The i-th element of the vector containing frequency of the i-th word is multiplied with $IDF_i = \log(N/df_i)$, where N is total number of documents and df_i is document frequency of the i-th word (the number of documents from the whole corpus in which the i-th word appears).

2.2 Latent Semantic Indexing

A well known and used approach for extracting latent semantics (or topics) from text documents is Latent Semantic Indexing. In this approach we first construct term-document matrix A from a given corpus of text documents. This is a matrix with vectors of documents from a given corpus as columns. The term-document

[1] http://www.textmining.net/

matrix A is then decomposed using singular value decomposition, so that $A = USV^T$; here matrices U and V are orthogonal and S is a diagonal matrix with ordered singular values on the diagonal. Columns of matrix U form an orthogonal basis of a subspace in the bag-of-words space where vectors with higher singular values carry more information -- this follows from the famous theorem about SVD, which tells that by setting all but the largest k singular values to 0 we get the best approximation for matrix A of rank k). Because of all this, vectors that form the basis can be also viewed as concepts. The space spanned by these vectors is called the *Semantic Space*.

Each concept is a vector in the bag-of-words space, so the elements of this vector are weights assigned to the words coming from our documents. The words with the highest positive or negative values form a set of words that are found most suitable to describe the corresponding concept.

2.3 Dimensionality reduction

We are using linear subspace methods and multidimensional scaling as methods for reducing space dimensionality. They can be both applied to any data set that is represented as a set of vectors in some higher dimensional space. Our goal here was to lower the number of dimensions to two so that the whole corpus of documents can be shown on a computer screen.

Linear subspace methods, like Principal Component Analysis (PCA) or Latent Semantic Indexing, focus on finding direction in original vector space, so they capture the most variance (as is the case for PCA) or are the best approximation for original document-term matrix (as is the case for LSI). By projecting data (text documents) only on the first two directions we can get the points that live in the two dimensional space. The problem with this approach is that only the information from the first two directions is preserved. In case of LSI it would mean that all documents are described using only the two main concepts.

Another approach is called multidimensional scaling [3]. Here the points representing documents are positioned into two dimensions so they minimize some energy function. The basic and most common form of this function is

$$E = \sum_{i \neq j} \delta_{ij} - d(x_i, x_j))^2,$$

where x_i are two dimensional points and δ_{ij} represents the similarity between documents i and j. An intuitive description of this optimization problem is: the better the distances between points on the plane approximate real similarity between documents, the lower the value of the energy function. Function E is nonnegative and equals zero only when distances between points match exactly with similarity between documents.

3 VISUALIZATION USING DIMENSIONALITY REDUCTION

We propose combining the two methods (linear subspace and multidimensional scaling) as they have some nice properties that fit together. What follows is description of the proposed algorithm:

Input: Corpus of documents to visualize in form of TFIDF vectors.
Output: Set of two dimensional points representing documents.
Procedure:

1. Calculate k dimensional semantic space generated by input corpus of documents,
2. Project documents into the semantic space,
3. Apply multidimensional scaling using energy function on documents with Euclidian distance in semantic space as similarity measure.

There are two main problems to be solved to make the above algorithm work efficiently. First problem is how to determine the value of k. One way of doing this is by checking the singular values. Let $\Sigma_k = S_1^2 + S_2^2 + \ldots + S_k^2$, where S_i is i-th singular value. We know that $\Sigma_n = \text{Trace}(A^T A)$, where n is the number of the documents in the corpus and A is the term-document matrix. From this we can guess the k by prescribing the ratio Σ_k / Σ_n to some fixed value, for example 50%.

A more difficult problem is how to perform multidimensional scaling efficiently. One way is to use gradient descent. The problem with this approach is that the energy function is not convex: it usually has many local minima which are not that interesting for us. One could start this method more times with different initial state and than choose the results with the lowest energy. This energy function can also be reformulated in the following way. Given a placement of points, we calculate how to move each point so we minimize energy function. Lets denote the current positions of points with (x_i,y_i) and the desired position with $(x_i',y_i') = (x_i + \delta x_i, y_i + \delta y_i)$. Than we have

$$\begin{aligned} d_{ij}'^2 - d_{ij}^2 &= (x_i - x_j)^2 + (y_i - y_j)^2 - \\ &\quad (x_i + \delta x_i - x_j - \delta x_j)^2 + \\ &\quad (y_i + \delta y_i - y_j - \delta y_j)^2 \approx \\ &\approx (x_i - x_j)\,\delta x_i + (x_j - x_i)\,\delta x_j + (y_i - y_j)\,\delta y_i + (y_j - y_i)\,\delta y_j = \\ &= [(x_i - x_j), (x_j - x_i), (y_i - y_j), (y_j - y_i)][\,\delta x_i, \delta x_j, \delta y_i, \delta y_j]^T. \end{aligned}$$

By writing this down as a matrix we get a system of linear equations which has a vector of moves towards the minima (δx and δy) for the solution. This is an iteration which finds a step towards minimizing energy function and is more successful at avoiding local minima. Each iteration involves solving a linear system of equations with a sparse matrix (4 non-zero elements per row). We do this very efficiently using the Conjugate Gradient method. At the end, points are normalized to lie in the square $K = [0,1]^2$.

4 VISUALIZATION BEYOND DIMENSION REDUCTION

After the documents from corpus are mapped onto a two dimensional plane, some other techniques can be used to make the structure of documents more explicit for the users:

- ***Landscape generation***: landscape can be generated by using the density of points. Each point from square K is assigned height using the formula $h(x, y) = \sum_i \exp(-\sigma ||(x,y) - (x_i, y_i)||^2)$.
- ***Keywords***: each point from square K can be assigned a set of keywords by averaging TFIDF vectors of documents which appear within a circle with centre in this point and radius R.

We use these features when showing visualizations to make them more descriptive and to improve the overall user experience. In our system, called *Text Garden Document Atlas*, the documents are presented as points on a map and the density is shown as a texture in the background of the map. The most common keywords are shown for the areas around 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, from which these keywords are extracted, is marked with a circle). The user can also zoom-in to see specific areas in more details. By clicking on a document, more information about it is shown on the left side of the screen.

Two examples of the visualizations can be seen in Figure 1 and Figure 2. Figure 1 shows visauliation of the European IST 6th framework projects collected as follow up of 5th framework analysis [4]; here each document from the input corpus is a description of one research project. Figure 2 shows visualization of a corpus with questions from Spanish judges collected through interviews with judges [5]; here one question is treated as one document.

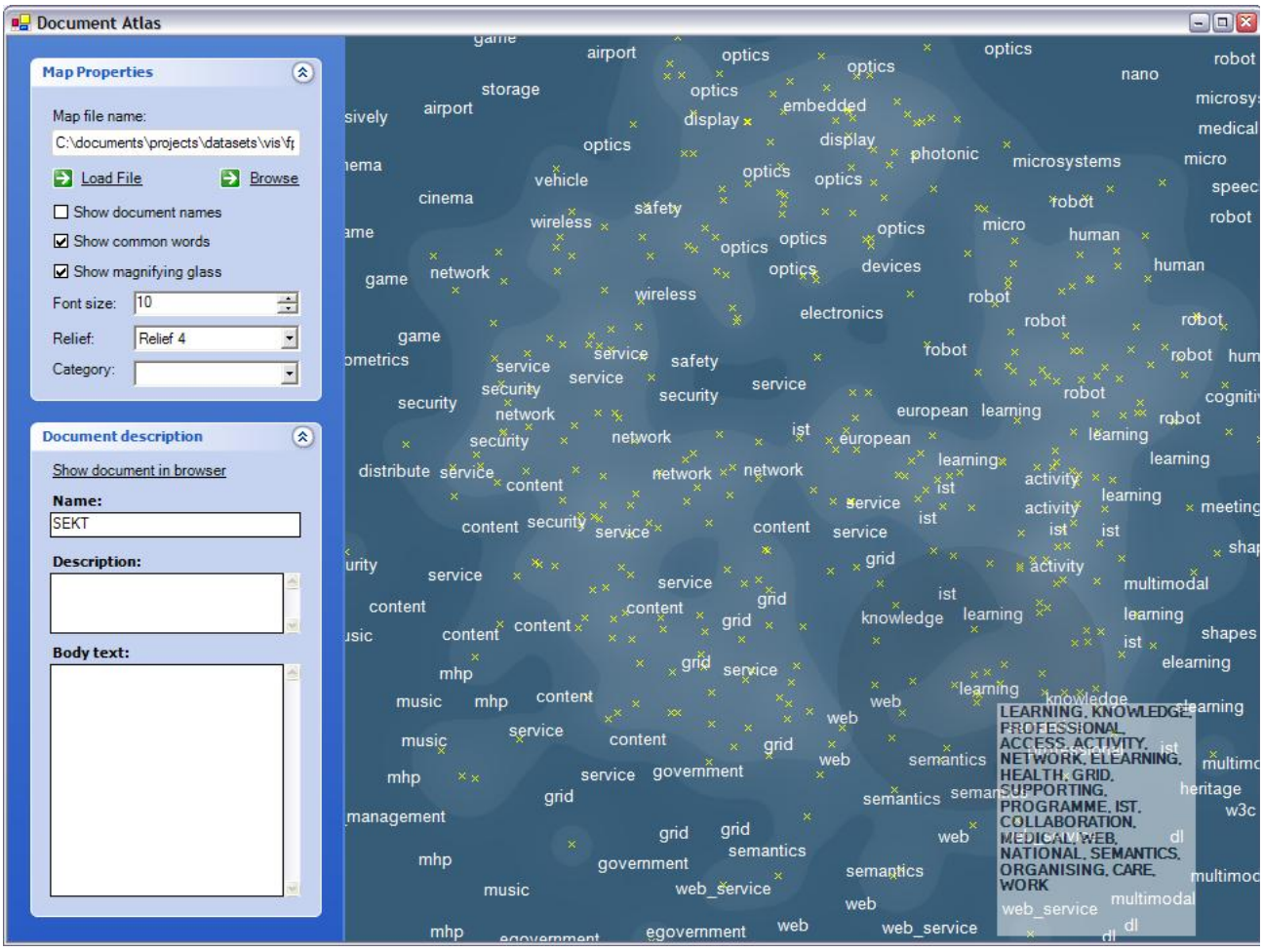

Figure 1. Visualization of European IST projects from 6th framework.

5 CONCLUSION AND FUTURE WORK

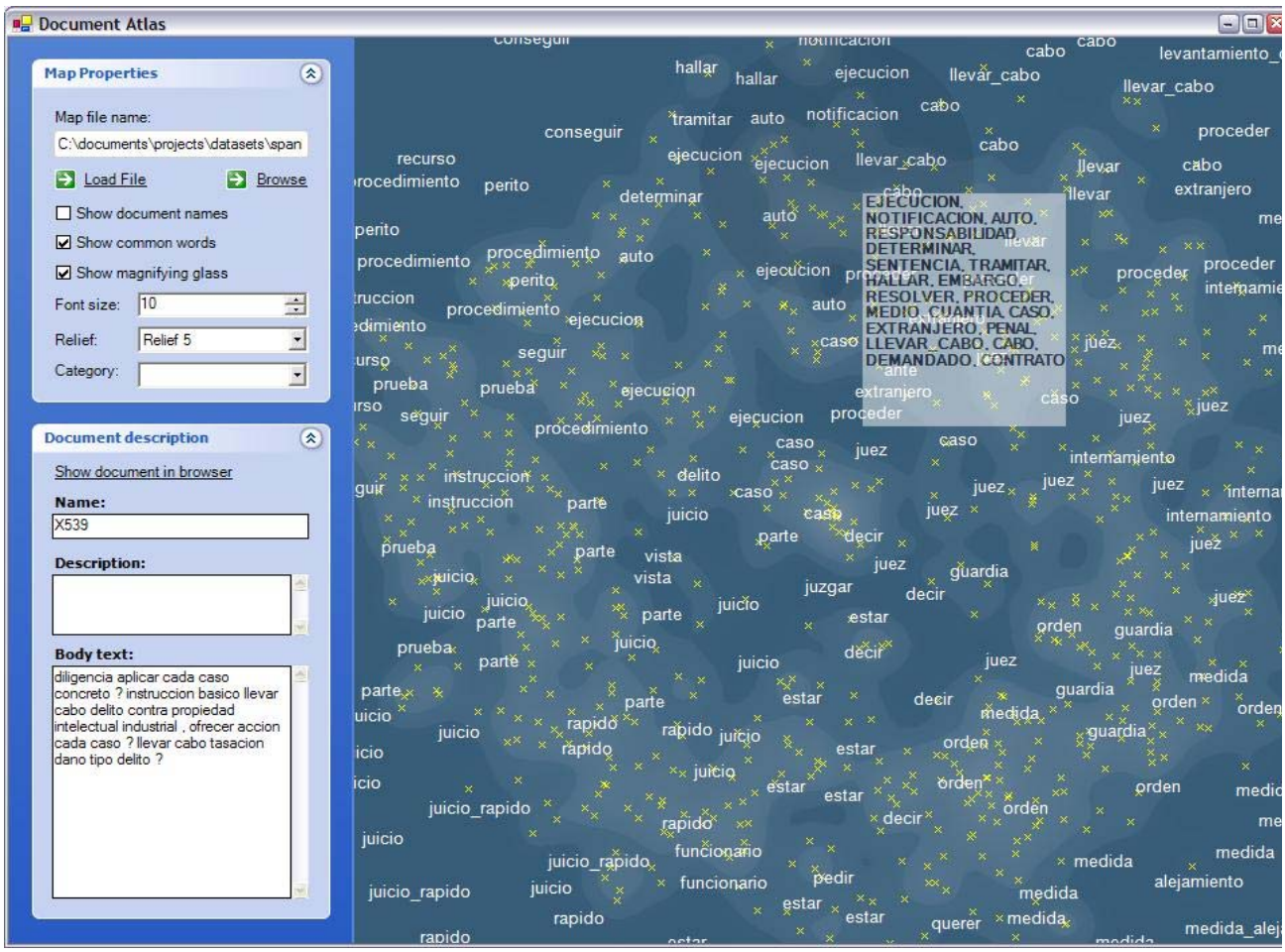

Figure 2 . Visualization of questions from Spanish judges.

We have proposed a method for efficient visualization of large data collections and describe the developed system implementing the method. The system was already successfully used for visualizing *different* kinds of document corpora – from project descriptions, scientific articles to questions and even clients of an Internet grocery store. We found that the system is very helpful for data analysis because it offers quick insight into the structure of the visualized corpus. We will continue to use the user feedback as a guide for adding new features, which would make this tool even more informative and useful. One area not fully explored yet is the use of background relief. Now we use it to show the density of documents but it can also serve for showing some other attributes.

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A SURVEY OF ONTOLOGY EVALUATION TECHNIQUES

Janez Brank, Marko Grobelnik, Dunja Mladenić
Department of Knowledge Technologies
Jozef Stefan Institute
Jamova 39, 1000 Ljubljana, Slovenia
Tel: +386 1 4773778; fax: +386 1 4251038
e-mail: janez.brank@ijs.si, marko.grobelnik@ijs.si, dunja.mladenic@ijs.si

ABSTRACT

An ontology is an explicit formal conceptualization of some domain of interest. Ontologies are increasingly used in various fields such as knowledge management, information extraction, and the semantic web. Ontology evaluation is the problem of assessing a given ontology from the point of view of a particular criterion of application, typically in order to determine which of several ontologies would best suit a particular purpose. This paper presents a survey of the state of the art in ontology evaluation.

1 INTRODUCTION

The focus of modern information systems is moving from "data processing" towards "concept processing", meaning that the basic unit of processing is less and less an atomic piece of data and is becoming more a semantic concept which caries an interpretation and exists in a context with other concepts. Ontology is commonly used as a structure capturing knowledge about a certain area via providing relevant concepts and relations between them.

A key factor which makes a particular discipline or approach scientific is the ability to evaluate and compare the ideas within the area. The same holds also for Semantic Web research area when dealing with abstractions in the form of ontologies. Ontologies are a fundamental data structure for conceptualizing knowledge, but we are generally able to build many different ontologies conceptualizing the same body of knowledge and we should be able to say which of them best suits some predefined criterion.

Thus, ontology evaluation is an important issue that must be addressed if ontologies are to be widely adopted in the semantic web and other semantics-aware applications. Users facing a multitude of ontologies need to have a way of assessing them and deciding which one best fits their requirements the best. Likewise, people constructing an ontology need a way to evaluate the resulting ontology and possibly to guide the construction process and any refinement steps. Automated or semi-automated ontology learning techniques also require effective evaluation measures, which can be used to select the "best" ontology out of many candidates, to select values of tunable parameters of the learning algorithm, or to direct the learning process itself (if the latter is formulated as a path through a search space).

2 A CLASSIFICATION OF ONTOLOGY EVALUATION APPROACHES

Various approaches to the evaluation of ontologies have been considered in the literature, depending on what kind of ontologies are being evaluated and for what purpose. Broadly speaking, most evaluation approaches fall into one of the following categories:

- those based on comparing the ontology to a "golden standard" (which may itself be an ontology; e.g. MAEDCHE AND STAAB, 2002);
- those based on using the ontology in an application and evaluating the results (e.g. PORZEL & MALAKA, 2004);
- those involving comparisons with a source of data (e.g. a collection of documents) about the domain to be covered by the ontology (e.g. BREWSTER *et al.*, 2004);
- those where evaluation is done by humans who try to assess how well the ontology meets a set of predefined criteria, standards, requirements, etc. (e.g. LOZANO-TELLO AND GÓMEZ-PÉREZ, 2004).

In addition to the above categories of evaluation, we can group the ontology evaluation approaches based on the level of evaluation, as described below.

An ontology is a fairly complex structure and it is often more practical to focus on the evaluation of different levels of the ontology separately rather than trying to directly evaluate the ontology as a whole. This is particularly true if we want a predominantly automated evaluation rather than entirely carried out by human users/experts. Another reason for the level-based approach is that when automatic learning techniques have been used in the construction of the ontology, the techniques involved are substantially different for the different levels. The individual levels have been defined variously by different authors, but these various definitions tend to be broadly similar and usually involve the following levels:

Lexical, vocabulary, or data layer. Here the focus is on which concepts, instances, facts, etc. have been included in the ontology, and the vocabulary used to represent or identify these concepts. Evaluation on this level tends to involve comparisons with various sources of data concerning the problem domain (e.g. domain-specific text corpora), as well as techniques such as string similarity measures (e.g. edit distance).

Hierarchy or taxonomy. An ontology typically includes a hierarchical *is-a* relation between concepts. Although various other relations between concepts may be also defined, the is-a relationship is often particularly important and may be the focus of specific evaluation efforts.

Other semantic relations. The ontology may contain other relations besides is-a, and these relations may be evaluated separately. This typically includes measures such as precision and recall.

Context or application level. An ontology may be part of a larger collection of ontologies, and may reference or be referenced by various definitions in these other ontologies. In this case it may be important to take this context into

account when evaluating it. Another form of context is the application where the ontology is to be used; evaluation looks at how the results of the application are affected by the use of the ontology.

Syntactic level. Evaluation on this level may be of particular interest for ontologies that have been mostly constructed manually. The ontology is usually described in a particular formal language and must match the syntactic requirements of that language. Various other syntactic considerations, such as the presence of natural-language documentation, avoiding loops between definitions, etc., may also be considered (GÓMEZ-PÉREZ, 1994).

Structure, architecture, design. This is primarily of interest in manually constructed ontologies. We want the ontology to meet certain pre-defined design principles or criteria; structural concerns involve the organization of the ontology and its suitability for further development (GÓMEZ-PÉREZ, 1994, 1996). This sort of evaluation usually proceeds entirely manually.

The following table summarizes which approaches from the list at the beginning of this section are commonly used for which of these levels.

Table 1. An overview of approaches to ontology evaluation.

	Approach to evaluation			
Level	Golden standard	Application-based	Data-driven	Assessment by humans
Lexical, vocabulary, concept, data	x	x	x	x
Hierarchy, taxonomy	x	x	x	x
Other semantic relations	x	x	x	x
Context, application		x		x
Syntactic	x[1]			x
Structure, architecture, design				x

[1] "Golden standard" in the sense of comparing the syntax in the ontology definition with the syntax specification of the formal language in which the ontology is written (e.g. RDF, OWL, etc.).

The next sections will present more details about the various approaches and the levels of evaluation.

3 EVALUATION ON THE LEXICAL/VOCABULARY AND CONCEPT/DATA LEVEL

An example of an approach that can be used for the evaluation of a lexical/vocabulary level of an ontology is the one proposed by MAEDCHE AND STAAB (2002). Similarity between two strings is measured based on the Levenshtein edit distance, normalized to produce scores in the range [0, 1]. A *string matching* measure between two sets of strings is then defined by taking each string of the first set, finding its similarity to the most similar string in the second set, and averaging this over all strings of the first set. One may take the set of all strings used as concept identifiers in the ontology being evaluated, and compare it to a "golden standard" set of strings that are considered a good representation of the concepts of the problem domain under consideration. The golden standard could be in fact another ontology (as in Maedche and Staab's work), or it could be taken statistically from a corpus of documents (see sec. 7), or prepared by domain experts.

The lexical content of an ontology can also be evaluated using the concepts of precision and recall, as known in information retrieval. In this context, *precision* would be the percentage of the ontology lexical entries (strings used as concept identifiers) that also appear in the golden standard, relative to the total number of ontology words. *Recall* is the percentage of the golden standard lexical entries that also appear as concept identifiers in the ontology, relative to the total number of golden standard lexical entries. A way to achieve more tolerant matching criteria (allowing synonyms, etc.) is to augment each lexical entry with its hypernyms from WordNet or some similar resource (BREWSTER *et al.*, 2004); then, instead of testing for equality of two lexical entries, one can test for overlap between their corresponding sets of words (each set containing an entry with its hypernyms).

The same approaches could also be used to evaluate the lexical content of an ontology on other levels, e.g. the strings used to identify relations, instances, etc.

VELARDI *et al.* (2005) describe an approach for the evaluation of an ontology learning system which takes a body of natural-language text and tries to extract from it relevant domain-specific concepts (terms and phrases), and then find definitions for them (using web searches and WordNet entries) and connect some of the concepts by is-a relations. Part of their evaluation approach is to generate natural-language glosses for multiple-word terms. These glosses can then be evaluated by domain experts, who therefore do not have to be familiar with formal languages in which ontologies are commonly described.

4 EVALUATION OF TAXONOMIC AND OTHER SEMANTIC RELATIONS

BREWSTER *et al.* (2004) suggested using a data-driven approach to evaluate the degree of structural fit between an ontology and a corpus of documents. (1) Given a corpus of documents from the domain of interest, a clustering algorithm based on EM is used to determine, in an unsupervised way, a probabilistic mixture model of hidden "topics" such that each document can be modeled as having been generated by a mixture of topics. (2) Each concept *c* of the ontology is represented by a set of terms including its name in the ontology and the hypernyms of this name, taken from WordNet. (3) The probabilistic models obtained during clustering can be used to measure, for each topic identified by the clustering algorithm, how well the concept *c* fits that topic. (4) At this point, if we require that each concept fits at least some topic reasonably well, we obtain a technique for lexical-level evaluation of the ontology. Alternatively, we may require that concepts associated with the same topic should be closely related in the ontology (via is-a and possibly other relations). This would indicate that the structure of the ontology is reasonably well aligned with the hidden structure of topics in the domain-specific corpus of documents. A drawback of this method as an approach for evaluating relations is that it is difficult to take the directionality of relations into account (e.g. we may know

that concepts c_1 and c_2 should be related, but we cannot really infer whether c_1 is-a c_2, or c_2 is-a c_1, or if some completely different relation should be used).

Given a golden standard, evaluation of an ontology on the relational level can also be based on precision and recall measures, comparing the ontology either with a human-provided golden standard, or with a list of statistically relevant terms. This was used by SPYNS (2005) to evaluate an approach for automatically extracting a set of lexons, i.e. triples of the form $\langle \text{term}_1, \text{role}, \text{term}_2 \rangle$, from natural-language text. Unfortunately preparing the golden standard requires a lot of manual human work.

A somewhat different aspect of ontology evaluation has been discussed by GUARINO AND WELTY (2002). They point out several philosophical notions (essentiality, rigidity, unity, etc.) that can be used to better understand the nature of various kinds of semantic relationships that commonly appear in ontologies, and to discover possible problematic decisions in the structure of an ontology (for example, is-a is sometimes used to express meta-level characteristics of some class, or is used instead of is-a-part-of, or is used to indicate that a term may have multiple meanings). A downside of this approach is that it requires manual intervention by a trained human expert familiar with the above-mentioned notions such as rigidity; the expert should annotate the concepts of the ontology with appropriate metadata tags, whereupon checks for certain kinds of errors can be made automatically.

MAEDCHE AND STAAB (2002) propose several measures for comparing the relational aspects of two ontologies. Although this is in a way a drawback of this method, an important positive aspect is that once the golden standard is defined, comparison of two ontologies can proceed entirely automatically. The *semantic cotopy* of a term c in a given hierarchy is the set of all its super- and sub-concepts. Given two hierarchies H_1, H_2, a term t might represent some concept c_1 in H_1 and a concept c_2 in H_2. One can then compute the set of terms which represent concepts from the cotopy of c_1 in H_2, and the set of terms representing concepts from the cotopy of c_2; the overlap of these two sets can be used as a measure of how similar a role the term t has in the two hierarchies H_1 and H_2. An average of this may then be computed over all the terms occurring in the two hierarchies; this is a measure of similarity between H_1 and H_2. Similar ideas can also be used to compare other relations besides is-a.

5 CONTEXT-LEVEL EVALUATION

Sometimes the ontology is a part of a larger collection of ontologies that may reference one another (e.g. one ontology may use a class or concept declared in another ontology), for example on the web or within some institutional library of ontologies. This context can be used for evaluation of an ontology in various ways. For example, the Swoogle search engine of DING *et al.* (2004) uses cross-references between semantic-web documents to define a graph and then compute a score for each ontology in a manner analogous to PageRank used by the Google web search engine. A similar approach has been used in the OntoKhoj portal of PATEL *et al.* (2003). Not all "links" or references between ontologies are treated the same. For example, if one ontology defines a subclass of a class from another ontology, this reference might be considered more important than if one ontology only uses a class from another as the domain or range of some relation.

Alternatively, the context for evaluation may be provided by human experts; for example, SUPEKAR (2005) proposes that an ontology be enhanced with metadata such as its design policy, how it is being used by others, as well as "peer reviews" provided by users of this ontology. A suitable search engine could then be used to perform queries on this metadata and would aid the user in deciding which of the many ontologies in a repository to use.

6 APPLICATION-BASED EVALUATION

Typically, the ontology will be used in some kind of application or task. The outputs of the application, or its performance on the given task, might be better or worse depending partly on the ontology used in it. Thus one might argue that a good ontology is one which helps the application in question produce good results on the given task. Ontologies may therefore be evaluated simply by plugging them into an application and evaluating the results of the application. This is elegant in the sense that the output of the application might be something for which a relatively straightforward and non-problematic evaluation approach already exists. For example, PORZEL AND MALAKA (2004) describe a scenario where the ontology, with its relations (both is-a and others) is used primarily to determine how closely related the meaning of two concepts is. The task is a speech recognition problem, where evaluation of the final output of the task is relatively straightforward (proposed interpretations of the sentences are compared with a gold standard provided by humans).

The application-based approach to ontology evaluation also has several drawbacks: (1) we see that an ontology is good or bad when used in a particular way for a particular task, but it's difficult to generalize this observation; (2) the ontology could be only a small component of the application and its effect on the outcome may be relatively small and indirect; (3) comparing different ontologies is only possible if they can all be plugged into the same application.

7 DATA-DRIVEN EVALUATION

An ontology may also be evaluated by comparing it to existing data (usually a collection of textual documents) about the problem domain to which the ontology refers. For example, PATEL *et al.* (2003) show how to determine if the ontology refers to a particular topic, and to classify the ontology into a directory of topics: one extracts textual data from the ontology (such as names of concepts and relations) and uses this as the input to a text classification model (trained using standard machine learning algorithms).

Similarly, BREWSTER *et al.* (2004) extracted a set of relevant domain-specific terms from the corpus of documents, using latent semantic analysis. The amount of overlap between the domain-specific terms and the terms appearing

in the ontology (e.g. as names of concepts) can then be used to measure the fit between the ontology and the corpus.

In the case of extensive ontologies incorporating a lot of factual information (such as Cyc, see e.g. *www.cyc.com*), the documents could also be used as a source of "facts" about the external world, and the evaluation examines if these facts can also be derived from the ontology.

8 MULTIPLE-CRITERIA APPROACHES

Another family of approaches to ontology evaluation deals with the problem of selecting a good ontology (or a small short-list of promising ontologies) from a given set of ontologies, and treats this problem as essentially a decision-making problem. To help us evaluate the ontologies, we can use approaches based on defining several decision criteria or attributes; for each criterion, the ontology is evaluated and given a numerical score. An overall score for the ontology is then computed as a weighted sum of its per-criterion scores. Similar strategies are used in many other contexts to select the best candidate (e.g. tenders, grant applications, etc.). A drawback is that a lot of manual involvement by human experts may be needed. In effect, the general problem of ontology evaluation has been deferred or relegated to the question of how to evaluate the ontology with respect to the individual evaluation criteria. On the positive side, these approaches allow us to combine criteria from most of the levels discussed in section 2.

BURTON-JONES *et al.* (2004) propose an approach of this type, with ten simple criteria: lawfulness (i.e. frequency of syntactical errors), richness (how many of the syntactic features available in the formal language are actually used by the ontology), interpretability (do the terms used in the ontology also appear in WordNet?), consistency (how many concepts in the ontology are involved in inconsistencies), clarity (do the terms used in the ontology have many senses in WordNet?), comprehensiveness (number of concepts in the ontology, relative to the average for the entire library of ontologies), accuracy (percentage of false statements in the ontology), relevance (number of statements that involve syntactic features marked as useful or acceptable to the user/agent), authority (how many other ontologies use concepts from this ontology), history (how many accesses to this ontology have been made, relative to other ontologies in the library/repository).

FOX *et al.* (1998) propose another set of criteria, which is however geared more towards manual assessment and evaluation of ontologies. LOZANO-TELLO AND GÓMEZ-PÉREZ (2004) define an even more detailed set of 117 criteria, organized in a three-level framework.

9 CONCLUSIONS AND FUTURE WORK

Ontology evaluation remains an important open problem in the area of ontology-supported computing and the semantic web. There is no single best or preferred approach to ontology evaluation; instead, the choice of a suitable approach must depend on the purpose of evaluation, the application in which the ontology is to be used, and on what aspect of the ontology we are trying to evaluate. In our opinion, future work in this area should focus particularly on automated ontology evaluation, which is a necessary precondition for the healthy development of automated ontology processing techniques for a number of problems, such as ontology learning, population, mediation, matching, and so on.

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SEMI-AUTOMATIC CONSTRUCTION OF TOPIC ONTOLOGY

Blaž Fortuna, Dunja Mladenić, Marko Grobelnik
Department of Knowledge Technologies
Jozef Stefan Institute
Jamova 39, 1000 Ljubljana, Slovenia
Tel: +386 1 4773419; fax: +386 1 4251038
e-mail: blaz.fortuna@ijs.si

ABSTRACT

In this paper, we review two techniques for topic discovery in collections of text documents (Latent Semantic Indexing and K-Means clustering) and present how we integrated them into a system for semi-automatic topic ontology construction. The system offers supports to the user during the construction process by suggesting topics and analysing them in real time.

1 INTRODUCTION

When working with large corpora of documents it is difficult to comprehend and process all the information contained in them. Standard text mining and information retrieval techniques usually rely on word matching and do not take into account the similarity of words and structure of documents within the corpus. We try to overcome that by automatically extracting the topics covered within the documents in the coprus and helping the user to organize them into a topic ontology.

Topic ontology is a set of topics connected with different types of relations. Each topic includes a set of related documents. Construction of such an ontology from a given corpus can be a very time consuming task for the user. In order to get a feeling on what the topics in the corpus are, what the relations between topics are and, at the end, to assign each document to some certain topics, the user has to go through all the documents. We tried to overcame this by building a special tool which helps the user by suggesting the possible new topics and visualizing the topic ontology created so far –- all in real time. This tool in combination with the corpus visualization tools [3] aims at assisting the user in a fast semi-automatic construction of the topic ontology from a large document collection.

We chose two different approaches for discovering topics within the corpora. The first approach is a linear dimensionality reduction technique, known as Latent Semantic Indexing (LSI) [2]. This technique relies on the fact that words related to the same topic co-occur together more often than words related to the different topics. The result of LSI are fuzzy clusters of words each describing one topic. The second approach we used for extracting topics is a well known k-means clustering algorithm [6]. It partitions the corpus into *k* clusters so that two documents within the same cluster are more closely related than two documents from different clusters. We used this two algorithms for automatic suggestion of topics during the construction of the topic ontology.

This paper is organized as follows. Section 2 gives a short overview of the related work on building ontologies. Section 3 gives an introduction to the text mining techniques we used. Details about our system are presented in Section 4, followed by the conclusions in Section 5.

2 TEXT MINING TECHNIQUES

2.1 Representation of text documents

In order to use the algorithms we will describe later we must first represent text documents as vectors. We use standard *Bag-of-Words* (BOW) approach together with the TFIDF weighting [8]. This representation is often referred to as a *vector-space model*. The similarity between two documents is defined as the cosine of the angle between their vector representations – *cosine similarity*. Note that the cosine similarity between two exactly the same documents is 1 and the similarity between two documents that share no common words is 0.

2.2 Latent Semantic Indexing

Latent Semantic Indexing (LSI) is a technique for extracting this background knowledge from text documents. It uses a technique from linear algebra called Singular Value Decomposition (SVD) and bag-of-words representation of text documents for extracting words with similar meanings. This can also be viewed as extraction of hidden semantic concepts or topics from text documents.

Most well known and used approach is Latent Semantic Indexing as described in [2]. First term-document matrix A is constructed from a given set of text documents. This is a matrix with bag-of-words vectors of documents as columns. This matrix is decomposed using singular value decomposition so that A = USVT where matrices U and V are orthogonal and S is a diagonal matrix with ordered singular values on the diagonal. Columns of matrix U form

an orthogonal basis of a subspace in bag-of-words space where vectors with higher singular values carry more information (this follows from theorem that by truncating singular values to only biggest k we get the best approximation for matrix A with rank k). Because of all this, vectors that form the basis can also be viewed as concepts or topics. The space spanned by these vectors is called Semantic Space.

2.3 K-Means clustering

Clustering is a technique for partitioning data so that each partition (or cluster) contains only points which are similar according to some predefined metric. In the case of text this can be seen as finding groups of similar documents, that is documents which share similar words.
K-Means [6] is an iterative algorithm which partitions the data into k clusters. It has already been successfully used on text documents [9] to cluster a large document corpus based on the document topic and incorporated in an approach for visualizing a large document collection [4].

2.4 Keyword extraction

We used two methods for extracting keywords from a given set of documents: (1) keyword extraction using centroid vectos and (2) keyword extraction using SVM [1]. We used this two methods to generate description for a given topic based on the documents inside the topic.

The first method works by using the centroid vector of the topic (centroid is the sum of all the vectors of the document inside the topic). The main keywords are selected to be the words with the highest weights in the centroid vector.

The second method is based on the idea presented in [1] which uses Support Vector Machine (SVM) binary classifier [7]. Let A be the topic which we want to describe with keywords. We take all the documents from the topics that have A for a subtopic and mark these documents as negative. We take all the documents from the topic A and mark them as positive. If one document is assigned both negative and positive label we say it is positive. Then we learn a linear SVM classifiers on these documents and classify the centroid of the topic A. Keywords describing A are the words, which's weights in SVM normal contribute most when deciding if centroid is positive.

The difference between these two approaches is that the second approach takes into account the context of the topic. Let's say that we have a topic named `computers'. When deciding, what the keywords for some subtopic A are, the

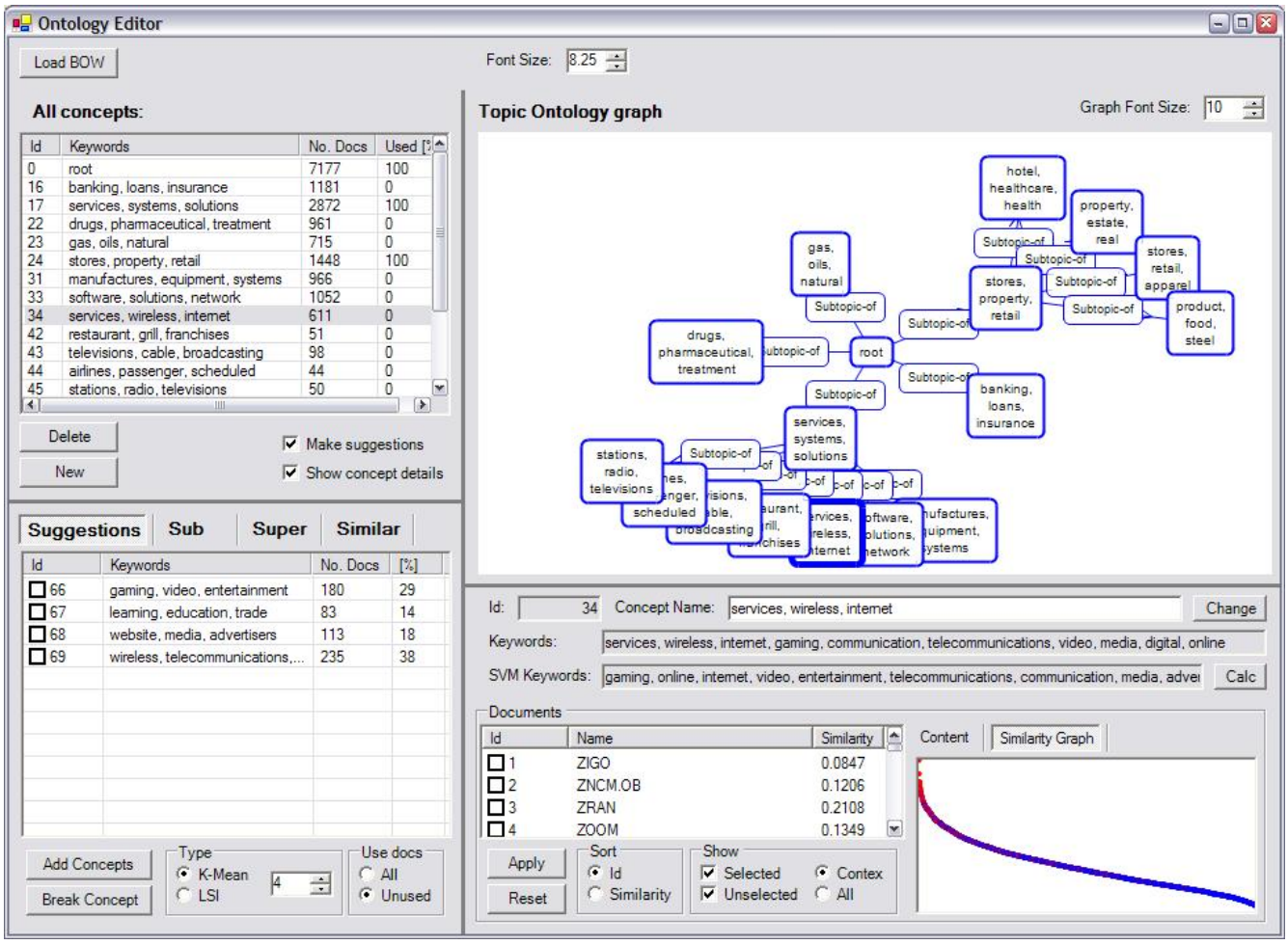

Figure 1 *Screen shot of the interactive system for construction topic ontologies.*

first method would only look at what the most important words within the subtopic *A* are and words like `computer' would most probably be found important. However, we already know that *A* is a subtopic of `computers' and we are more interested in finding the keywords that separate it from the other documents within the `computers' topic. The second method does that by taking the documents from all the super-topics of *A* as a context and learns the most crucial words using SVM..

3 SEMI-AUTOMATIC CONSTRUCTION OF TOPIC ONTOLOGY

We view semi-automatic topic ontology construction as a process where the user is taking all the decisions while the computer only gives suggestions for the topics, helps by automatically assigning documents to the topics, helps by suggestiong names for the topics, etc. The suggestions are applied only when the users decides to do so. The computer also helps by visualizing the topic ontology and the documents.

In Figure 1 you can see the main window of the interactive system we developed. The system has three major parts that will be further discussed in following subsections. In the central part of the main window is a visalization of the current topic ontology (Ontology visualization). On the left side of the window is a list of all the topics from this ontology. Here the user can select the topic he wants to edit or further expand into subtopics. Further down is the list of suggested subtopics for the selected topic (Topic suggestion) and the list with all topics that are in relation-ship with the selected topic. At the bottom side of the window is the place where the user can fine-tune the selected topic (Topic management).

Figure 2 *Example of topic ontology visualization.*

3.1 Ontology visualization

While the user is constructing/changing topic ontology, the system visualizes it in real time as a graph with topics as nodes and relations between topics as edges. See Figure 2 for an example of the visualization.

3.2 Topic suggestion

When the user selects a topic, the system automatically suggests possible subtopics of the selected topic. This is done by LSI or k-means algorithms applied only to the documents from the selected topic. The number of suggested topics is supervised by the user. Then, the user selects the subtopics s/he finds reasonable and the system automatically adds them to the ontology with relation `*subtopic-of*' to the selected topic. The user can also decide to replace the selected topic with the suggested subtopics. Figure 3 shows this feature implemented in our system.

3.3 Topic management

The user can manually edit each of the topics s/he added to the topic ontology. The user can change which documents are assigned to this topic (one document can belong to more

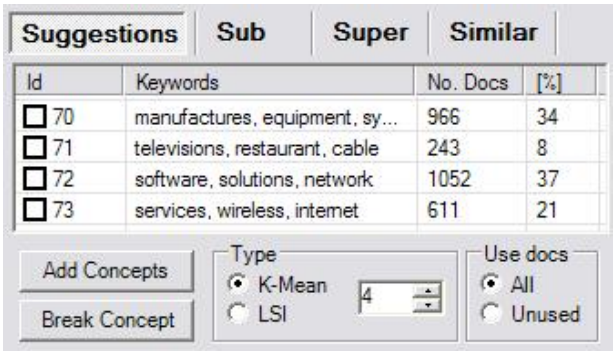

Figure 3 *Example of suggested subtopics.*

topics), the name of the topic and relationship of the topic to other topics. The main relationship is *subtopic-of* and is automatically added when adding subtopics as described in the previous section. The user can control all the relations between topics by adding, removing, directing and naming the relations.

Here the system can provide help on more levels (see Fgiure 4 for details):

- The system automatically assigns the documents to a topic when it is added to the ontology.
- The system helps by providing the keywords describing the topic using the methods described in Section 3. This can assist user when naming the topic.
- The system computes the cosine similarity between each document from the corpus and the centroid of the topic. This information can assist the user when searching for documents related to the topic. The similarity is shown on the list of documents next to the document name and the graph of similarities is ploted next to the list.
- The system also computes similarities between the selected topic and all the other topics from the ontology. For the similarity measure between two topics it uses either the cosine similarity between their centroid vectors or the intersection between their documents.

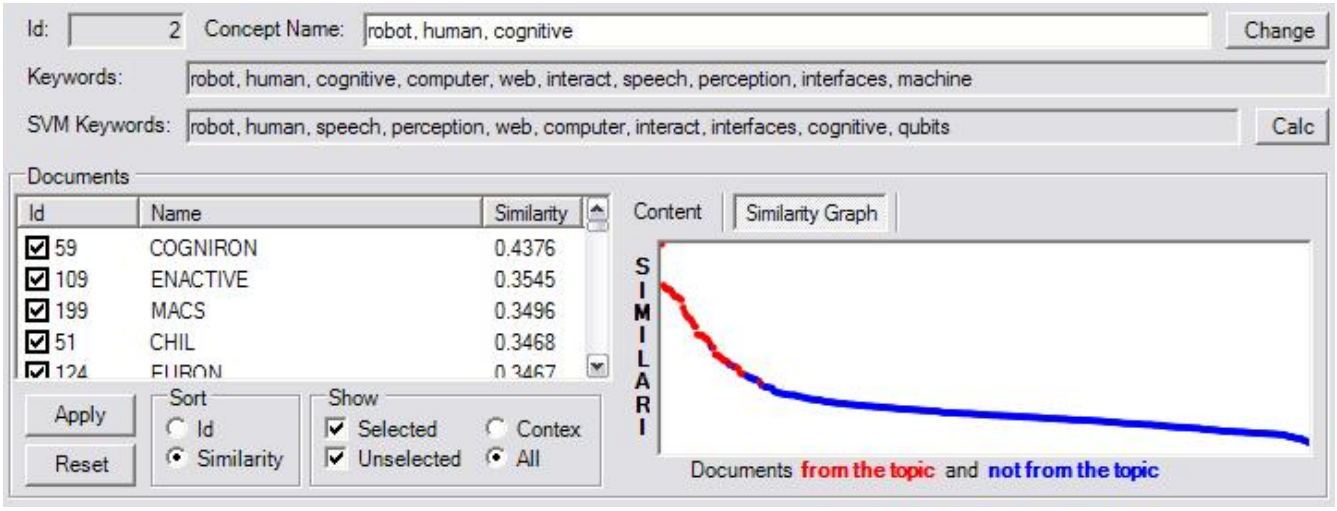

Figure 4 *Topic management.*

4 CONCLUSION

In this paper we presented our approach to the semi-automatic construction of topic ontologies. In the first part of the paper we presented text mining techniques we used: two methods for discovering topics within the corpus, LSI and K-Means clustering, and two methods for extracting keywors. In the second part we showed how we integrated all these methods into an interactive system for constructing topic ontologies.

Since this is work-in-progress there is a large area of possible improvements. The most important next step is to evaluate the proposed system in some practical scenarios and see how it fits the needs of the users and what features are missing or need improvement. Another possible direction is making the whole process more automatic and reduce the need for user interaction. This involves things like calculating the quality of topics suggested by the system, more automated discovery of the optimal number of topics, more support for annotating the documents with the topics, discovering different kinds of relations between topics etc.

We would also like to explore other techniques for concept/topic discovery (for example Probabilistic Latent Semantic Analysis [5] and its derivates) and are considering possible integrations with other tools for ontology building and management.

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ONTOLOGY GROUNDING

Aleks Jakulin, Dunja Mladenić
Department of Knowledge Technologies
Jozef Stefan Institute
Jamova 39, SI-1000 Ljubljana, Slovenia
Tel: +386 1 4773900; fax: +386 1 477 31 31
e-mail: aleks.jakulin@ijs.si

ABSTRACT

An ontology is a structured semantic model, composed of concepts, relations and instances. Data is a more primitive but concrete assembly of instances described by their attributes. An example of topic ontology is Open Directory of Web documents used in Google organizing documents into topics and subtopics, such as "Science", "Arts", etc. However, many ontologies are originally manually developed without making an explicit connection to the data. We hereby introduce the concept of ontology grounding, where the concepts and relations from the ontology become associated with the data. This enables us both to explain concepts in more concrete terms and to recognize them in the data.

1 INTRODUCTION

In this paper we introduce the process of ontology grounding, whereby a concept of the ontology becomes recognizable in the underlying data (such as database records and text). This process is especially suitable for problem domains where extensive data is available, and where it would be time consuming to manually convert unstructured data into structured metadata.

Although the key technology that underlies ontology grounding is machine learning, ontology grounding should be seen as a process which also involves knowledge engineering and information extraction. For example, an ontology might be excessively abstract, and as such ungroundable in data; it would be very hard to recognize all instances of the concept "event" or "object" from text: such concepts can only be built upon lower levels of abstraction. On the other hand, the data itself must be conceptualized in some way, through information extraction. For example, the text can be represented using the standard bag-of-words representation, or we could parse it and identify different grammatical entities. Therefore, ontology grounding is the process of associating abstract concepts to the concrete data. The task of knowledge engineering is to provide groundable concepts, and the task of information extraction is to extract supporting concepts. Machine learning merely connects these efforts from both directions.

In the remainder of the paper we will elaborate upon the definition of ontology grounding, and relate to similar problems that have been discussed primarily in philosophy. A more concrete approach follows in section 3, with the description of machine learning methodology. Finally, we will report our experience on a practical application of ontology grounding, and take a look into the future.

2 GROUNDABLE AND CONCEPTUALIZABLE

The notion of grounding is an old question, which has been elaborated in the context of artificial intelligence by S. Harnad [1], but the concepts have been around in philosophy already in the times of C. S. Peirce [3]. The fundamental notion is that the higher-level abstract concepts are grounded in lower-level concrete concepts, which, in turn, are grounded in perceptions.

Association goes in two ways: there are well-defined concepts that are not grounded in data ("unicorn"), and there are patterns in the data that are not yet captured by a dedicated concept ("the eating of pizza while watching a sunset"). The concept of a unicorn is *groundable*, however: we would recognize a unicorn had we seen one, we could even generate hypothetical data.

Similarly, the eating of pizza while watching the sunset is *conceptualizable* and could be denoted by a new hypothetical concept "sunspizaing". Of course, only a sufficient amount of data is unambiguously conceptualizable: having been given a single picture of "a female with a child eating the pizza during the sunset on a street with a red sports car passing by", and told to learn the concept of this single picture, we could identify a number of possible concepts: "a person", "sunset", "street", "car", "junk food". We would thus be unsure about what to make of it. Therefore, a complex concept requires plenty of data and/or additional background knowledge.

In summary, a *grounded* concept is one that is both conceptualizable (there is data exemplifying the concept) and groundable (the concept can be recognized from the data).

The background knowledge can even be a selection of the words in this case: the interpretation is less ambiguous once we pinpoint a few key words. For example, once we indicate that "a person", "sunset" and "pizza" are key while "street" and "car" are not, the concept becomes defined. Similarly, should we lack the concept of "pizza", we would have to define it beforehand, as otherwise the concept of "sunspizaing" would not be grounded. Thus, background knowledge is composed of both the underlying concepts and of attention windows.

One should distinguish ontology grounding from unique identification. A particular concept can be identified uniquely for example using the uniform resource identifier or locator (URI/URL) [2]. However, this does not assure that the grounding of that concept is also unique. For example, while we may agree on the term "dog" and thus have a unique identification, we might disagree about the grounding – whether a domesticated wolf is a dog or not.

3 CLASSIFICATION

The previous section has discussed the problem of grounding in a rather abstract fashion. We will now present the usual problem of classification in machine learning and examine how it relates to the problem of grounding a topic ontology. In contrast to the usual problem of classification in machine learning, we will not question the learning algorithm, but the representation of the data and especially the concept structure.

The problem of classification has been addressed in machine learning and in statistics for a very long time. Recently, these technologies have been applied to text. A number of methods have been proposed, but for the past few years the support vector machines (SVM) have been considered to be the state-of-the-art. In addition to this, we used one-to-one handling for multi-category classification and probabilistic SVM. Through extensive benchmarks, this configuration outperformed other methods.

Even if the learning methodology is state-of-the-art, the results of learning might not be satisfactory. Of course one could passively blame it all on learning, but a more active approach would examine the causes of learning failure, and attempt to remedy them. For this idea to work, we need to attempt to present the failure in as much detail as possible to the knowledge engineer. We will now present methods for the identification and analysis of the grounding failure.

3.1 Description of Data

As a part of the SEKT project (European 6FP integrated project), the next generation knowledge management technologies will be evaluated on several case studies including a legal domain case study. The core problem of this case study is to enhance question answering and information retrieval tasks through additional semantic information. A novice judge will type a query and the system should return answers that match the query. In a preliminary study [8], a number of likely queries have been gathered through interviews with the judges. The queries have been manually organized into a topic ontology roughly as follows:

			#	error
1.	On Duty		79	0.23
2.	Family			
	a.	Family violence	62	0.29
	b.	Minors	19	0.34
	c.	Divorces	18	0.32
	d.	Other	4	0.36
3.	Foreigners		26	0.35
4.	Property		10	0.33
5.	Sentences		2	0.36
	a.	Execution	40	0.27
	b.	Noncompliance	4	0.36
	c.	Form	1	/
	d.	Notification	1	/
6.	Process		197	0.00
	a.	Trial	61	0.25
	b.	Competency	45	0.27
	c.	Criteria	4	0.34
7.	Office			
	a.	Organization	40	0.31
	b.	Officers	17	0.35
	c.	Financial 20	0.32	
	d.	Infrastructure	19	0.33
	e.	Security	2	0.37
	f.	Information Technology	13	0.35
	g.	Assessment	9	0.35
	h.	Police	11	0.35
	i.	Lawyers	2	0.35
	j.	Incompatibilities	14	0.34
	k.	Ministry of Justice (CGPJ)	2	0.34
	l.	Other	2	0.37
8.	Trade and Business		28	0.31
9.	Traffic Accidents		11	0.34
10.	Penal		5	0.32
	a.	Drugs	3	0.34
	b.	Theft	2	0.37

Next to each concept, we list the number of questions in the database that correspond to it. The error in grounding these concepts will be explained at the end of Section 3.2. It can be seen that this ontology identifies the key types of problems faced by a judge. On the other hand, each query is formulated as a question, for example:

How to proceed in a case where a woman files a complaint for ill treatment, but specifically requests that the restraining order is not to be issued?

There are currently 773 similar questions in the database. To ground this ontology, we need to be able to classify a particular question in the form of text into the appropriate semantic concept(s) in the above ontology. For example, the above question indicates an instance of the process/jurisdiction concept. This defines our grounding problem. We represent the question using the standard bag-of-words text representation with TFIDF weighting [7], preprocessing the Spanish text using a lemmatizer [6].

With a grounded ontology, we would be able to identify the topic area of the question. This can be useful for narrowing down the set of candidate matches. For example, if the question is clearly a process/jurisdiction one, we can provide answers only from that topic area. In that sense, we have extracted relevant semantic information, which helps perform semantic matching. The linking of ontologies with words or terms has been anticipated earlier [8], but the application of classifiers proposed here automatically finds the relevant terms and adjusts their weights. Instead of providing the linking directly, one can simply mark the questions up with concepts, and leave the rest to the classifier.

3.2 Identifying Grounding Errors

Since each question in the data is classified into exactly one category, the categories are mutually exclusive and we have simply a multiclass classification problem. But simply attempting to classify a question into the correct class would result in many errors. It is preferable to rank the classes by their suitability. If we employ probabilistic classification, we obtain a probability for each concept. That probability indicates how likely it is that a particular concept is the best descriptor for the question. Usually, multiple concepts obtain a nonzero probability. For the above example of a question, the dominant predictions of classes with the corresponding probabilities are as follows:

Process (0.311), Process/Trial (0.123), On Duty (0.094)

The main class of the question is predicted to be *Process*, with a possible refinement into a *Trial* question, and an additional class of *On Duty*.

But is this classification correct? How can we evaluate the correctness of such probabilistic classification? Although a single question might conceivably belong to multiple classes, the training data only lists the single one that best describes it. Partly this is because the purpose of labeling was only to organize the questions, not to provide their semantic markup. For that reason, maximizing the probability of the "correct" class might not be the best approach to identifying mistakes. For instance, in an ambiguous case assigning p_c=0.1 to the correct class might not be a bad choice if the second-highest class probability is 0.05: the correct class has twice the probability of any other. In another case, we might assign the correct class p_c=0.3 (which is more than 0.1 earlier), but the wrong class would be assigned p_w=0.7 (which is far more than 0.05 earlier). The naïve approach of probability maximization would deem the second case a greater error than the first one.

For that reason, the loss or error function will be defined as the difference between the highest class probability and the probability assigned to the correct class. Performing leave-one-out validation to prevent overfitting, we can thus identify the problematic classifications. The ontology is well-grounded when few or no classification errors occur. The results are shown in the topic ontology in the previous page. It can be seen that the rare concepts are not identified well: the Process concept seems to overwhelm other concepts.

3.3 Explaining Grounding Errors

Once the problematic classifications have been identified, actions must be taken to remedy them. By focusing only on the grounding errors, we already save a considerable amount of work. Only the non-trivial and problematic instances deserve our attention.

The actions can be improvements to the extraction of instances and features, or the provision of background knowledge. But it may also turn out that the ontology is inappropriate, preventing sensible classification. Or, the reference classification may not be correct. To choose the best action, it is helpful to provide insight into the causes of the errors.

Any grounded ontology contains a classification model able to recognize the concept in the data. Although the support vector machine itself can be expressed explicitly [4], it is often complex. Instead, we can explain the classification of a particular problematic instance, providing arguments in favor and against the classification. Following the methodology of [4], we can express a SVM based on a dot product kernel in the form of a linear model:

$$t = b + \beta_1 x_1 + \beta_2 x_2 + \ldots$$

Each of the algebraic terms $\beta_i x_i$ belongs to a specific word or an underlying concept, b is the bias and t is the distance from the separating hyperplane. To explain this classification, we can pick the most distinct terms (most positive, most negative), and present them in a list. For example, in the above case, the true classification (*Domestic Violence*) can be reasoned for and against as follows:

Keywords in favor of family/domestic violence
0.28 (1) alejamiento [restraining]
0.18 (1) pedir [file]
0.14 (1) denunciar [complain]
0.01 (1) trato [treatment]
Keywords against family/domestic violence
0.19 (1) caso [case]
0.17 (1) mujer [woman]
0.13 (1) pero [but]
0.07 (1) ninguno [no]

The original Spanish terms are accompanied by the corresponding term in English. Bracket contains the number of appearances of the word, and the number in front indicates the weight of the term corresponding to the word. In this case, the classifier determined that the

question is *not* an instance of the Domestic Violence concept. There are several causes to that:

- "Restraining order", "file a complaint" and "ill treatment" are not considered to be concepts of their own, to be identified in a sentence. In fact, these concepts are well-known in legal terminology (feature generation, feature construction).
- "But" and "no" are not relevant arguments in this case (feature selection).
- The question is a good example for the Domestic Violence concept (instance selection).

Therefore, such explanation helps focus the actions needed to assure a greater quality of concept grounding. We can see that feature generation is nothing else than the grounding of underlying concepts.

4 ONTOLOGY ENGINEERING WORKFLOW

The inclusion of grounding affects how the ontology is designed. Our proposal is shown in Fig. 1. Instead of using merely human expert feedback to adjust the ontology, we include grounding in the process. Specifically, grounding provides feedback both towards the designers of the ontology schema, and toward the designers of the information extraction modules.

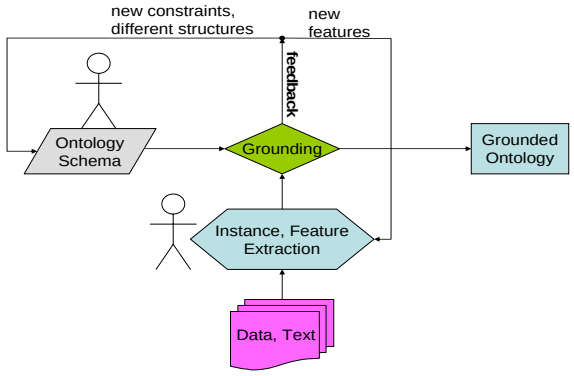

Figure 1: The process of *grounding provides feedback for both ontology design and information extraction.*

5 CONCLUSION

We have shown that the ontology can be linked with the data through the process of ontology grounding. This is an application of the common probabilistic classification techniques. When the learning algorithm cannot reliably recognize the appearance of concepts in text, we must question both the ontology and the data. On one hand, we may remedy the problem by making an ontology more concrete and less abstract. On the other hand, we can improve the features that are extracted from the data as to capture a higher level of abstraction, or we can adjust the way the instances are extracted from text.

In the present work we focused on topic ontologies, which are trivial in terms of instance extraction: each question or document is an individual instance. In a more complex situation, the extraction of instances is something to be considered. We could have used glossaries such as WordNet in order to expand the number of the features extracted from text: each individual sense would correspond to a feature extracted from text.

The grounding of concepts is a rather simple case of ontology grounding. In the future, it will be necessary to ground relations and slots. The techniques for these tasks are already under development in the machine learning community. Because infrequent concepts may be discriminated against frequent ones, the machine learning method should properly deal with imbalanced data sets.

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Temporal Interval Reasoning with CLP($\mathcal{Q}$)

Igor Mozetič
Jožef Stefan Institute
Jamova 39, 1000 Ljubljana, Slovenia
igor.mozetic@ijs.si

Abstract

Temporal reasoning is an important aspect of common-sense reasoning. The SUMO upper ontology incorporates Allen's influential axiomatization of temporal relations, but without reasoning capabilities. We propose a refinement of the SUMO temporal ontology, implemented in CLP($\mathcal{Q}$), a Constraint Logic Programming system over the domain of rational numbers.

1 Introduction

An ontology is a conceptualization of a domain of interest. In the Semantic Web context, it should be formalized and provide enough detail and structure to enable computers to process its content. An upper ontology is limited to concepts that are meta, generic and abstract, i.e., general enough to address a broad range of domain areas. There is an attempt by IEEE to define the Standard Upper Ontology (IEEE, 2003), currently embodied in the SUMO (Suggested Upper Merged Ontology). The SUMO (Niles and Pease, 2001) provides a foundation for middle-level and domain ontologies, and its purpose is to promote data interoperability, information retrieval, automated inference, and natural language processing. Some of the general topics covered in the SUMO include:

- Structural concepts such as instance and subclass
- General types of objects and processes
- Abstractions including set theory, attributes, and relations
- Numbers and measures
- Temporal concepts, such as duration
- Parts and wholes
- Basic semiotic relations
- Agency and intentionality.

SUMO is represented in a simplified form of the KIF language (Knowledge Interchange Format) which is based on the first-order logic and has formally defined semantics (Hayes and Menzel, 2001). However, to the best of our knowledge, there is no theorem prover or interpreter of the KIF language publicly available. As a consequence, the SUMO cannot be directly used for reasoning.

The motivation for this paper is the lack of reasoning capabilities in the existing SUMO ontology. We attempt to extend the SUMO, by defining a part of the ontology in compatible terms and implementing it in an executable language. Here we focus on temporal reasoning, as an important aspect of common-sense reasoning. To represent axioms about temporal concepts, SUMO adopted the influential Allen's temporal interval algebra (Allen, 1983), but without any reasoning capabilities.

We have actually implemented the temporal interval algebra in CLP($\mathcal{Q}$) . This simple implementation allows for the reasoning about temporal events, such as:

- "If X precedes Y, and Y overlaps with Z, what are the possible temporal relations between X and Z ?"
- "If X takes longer then Y, can X occur during Y ?"
- "Given a set of temporally related events, what are the possible consistent scenarios on the time line ?"

In Section 2, we give an overview of the Allen's interval algebra and some of its extensions. Section 3 presents Constraint Logic Programming (CLP), and CLP($\mathcal{Q}$) in particular. We show the CLP($\mathcal{Q}$) implementation of the temporal axioms in Section 4, and give some examples of reasoning.

2 Allen's interval algebra

Allen (1983) proposed an interval algebra framework to represent hierarchical and possibly indefinite and incomplete temporal information. This differs from the representation based on timestamps, since it allows for *relative* relations and at different levels of granularity. Events are represented by time intervals (in contrast to time points). There are thirteen basic relations between time intervals (Figure 1). The basic relations are disjoint and exhaustive.

Relation	Symbol	Inverse	Meaning
X before Y	b	bi	
X meets Y	m	mi	
X overlaps Y	o	oi	
X starts Y	s	si	
X during Y	d	di	
X finishes Y	f	fi	
X equals Y	eq		

Figure 1: The basic relations between time intervals.

In order to represent indefinite information, Allen allows for any subset (disjunction) of the basic relations to hold between two time intervals. A set of temporally related events forms a network, with edges corresponding to (possibly disjunctive) relations between events. van Beek (1991) refers to such networks as IA (Interval Algebra) networks. There are two fundamental queries one can ask of IA networks:

1. Finding feasible relations between all pairs of events, and
2. Determining the consistency of temporal relations.

For IA networks, answering such queries was shown to be an NP-complete problem (Vilain et al., 1989). Therefore, van Beek (1991) proposed a restricted class of IA networks, called SIA (Simple Interval Algebra) networks. This class restricts the disjunctive relations between the time intervals just to those that can be expressed as *conjunctions* of equalities and inequalities between the interval endpoints. van Beek (1991) argues that the restricted class still covers most of the practical cases, while at the same time he gives a tractable polynomial time algorithms for answering the fundamental queries of the SIA networks.

3 Constraint Logic Programming

Constraint Logic Programming (CLP, Jaffar and Lassez (1987); Cohen (1990)) is a generalization of logic programming. Unification, the basic operation in logic programs, is replaced by a more general mechanism of constraint satisfaction over a specific computation domain. An instance of the general CLP scheme is obtained by selecting a computation domain, a set of allowed constraints and designing a solver for the constraints. CLP combines the advantages of logic programming (declarative semantics, nondeterminism, partial answers) with the efficiency of specialized constraint satisfaction algorithms. CLP($\mathcal{Q}$) is an instance of the CLP scheme which extends logic programs with interpreted arithmetic functions and a solver for systems of linear equations and inequalities over the domain of $\mathcal{Q}$ (rational numbers). In our experiments we use an implementation of CLP($\mathcal{Q}$) (Holzbaur, 1995) which is incorporated in the SICStus and Yap Prolog.

A CLP($\mathcal{Q}$) program is a set of clauses of the form:

$H \leftarrow C_1, \ldots, C_n.$

and a CLP($\mathcal{Q}$) query is a clause without head:

$\leftarrow C_1, \ldots, C_n.$

where H is an atom and C_i are negated or non-negated atoms or arithmetic constraints. Arithmetic constraints are bracketed by { and }, and consist of equations or inequalities, built up from rational constants, variables, $+, -, *, /$ and $=, \geq, \leq, >, <$. All of these symbols have the usual meaning and parentheses may be used. An atom is a predi-

cate symbol applied to a number of terms. A term is a constant, a variable, an uninterpreted functor applied to a number of terms, or an arithmetic term. Variables start with capitals and are implicitly universally quantified in front of a clause, and constants start with lower-case letters.

CLP($\mathcal{Q}$) is restricted to systems of *linear* equations and inequalities. Non-linear constraints are accepted but not resolved — they are just delayed until (if) they eventually become linear. In the case of the Allen's temporal algebra, all constraints are linear. In general, however, a reply to a query is not just an answer substitution (as is the case with logic programs), but also potentially unresolved residual constraints between the variables involved.

4 CLP($\mathcal{Q}$) implementation and examples

In CLP($\mathcal{Q}$) we represent a temporal interval by a term *i(X1,X2)*, where *X1* and *X2* are rationals, representing the start and end points of the interval:

interval(i(X1,X2)) $\leftarrow$ $\{X1 < X2\}$.

Duration of an interval is trivially defined by the following clause:

duration(i(X1,X2), Dur) $\leftarrow$
$\{X1 < X2, Dur = X2 - X1\}$.

Basic temporal relations are defined in terms of equalities and inequalities between the endpoints. The following are the six basic relations and equality, their inverses are obvious:

temp(b, i(X1,X2), i(Y1,Y2)) $\leftarrow$ $\{X2 < Y1\}$.
temp(m, i(X1,X2), i(Y1,Y2)) $\leftarrow$ $\{X2 = Y1\}$.
temp(o, i(X1,X2), i(Y1,Y2)) $\leftarrow$
$\{X1 < Y1, X2 > Y1, X2 < Y2\}$.
temp(s, i(X1,X2), i(Y1,Y2)) $\leftarrow$
$\{X1 = Y1, X2 < Y2\}$.
temp(d, i(X1,X2), i(Y1,Y2)) $\leftarrow$
$\{X1 > Y1, X2 < Y2\}$.
temp(f, i(X1,X2), i(Y1,Y2)) $\leftarrow$
$\{X1 > Y1, X2 = Y2\}$.
temp(eq, i(X1,X2), i(Y1,Y2)) $\leftarrow$
$\{X1 = Y1, X2 = Y2\}$.

The SIA relations are all powersets of the basic relations which are consistent and can be expressed as conjunctions of (in)equalities between the endpoints. There are altogether 82 SIA relations which can be derived from the above basic definitions (and their inverses). For example, a disjunctive interval relation (X meets or overlaps or starts Y, in CLP($\mathcal{Q}$) represented by a list *[m,o,s]*) is defined as:

sia([m,o,s], i(X1,X2), i(Y1,Y2)) $\leftarrow$
$\{X1 =< Y1, X2 >= Y1, X2 < Y2\}$.

Simple query. What are the constraints on the interval Y which overlaps with *i(1,4)*:

$\leftarrow$ *temp(o, i(1,4), i(Y1,Y2)).*
Y1 > 1, Y1 < 4, Y2 > 4

Composition of two relations. Given "X starts Y and Y overlaps with Z", what is the relation between X and Z:

$\leftarrow$ *temp(s, i(X1,X2), i(Y1,Y2)),*
temp(o, i(Y1,Y2), i(Z1,Z2)),
temp(Rel, i(X1,X2), i(Z1,Z2)).
Rel = b ? ;
Rel = m ? ;
Rel = o ?

Backtracking yields three answer substitutions which can be simplified into a SIA *[b,m,o]* with the only two relevant constrains remaining: *X1 < Y1* and *X2 < Y2*.

Scenario. Let's take an example description of events from (van Beek, 1991): "Fred was reading the paper while eating his breakfast. He put the paper down and drank the last of his coffee. After breakfast he went for a walk." Here we have four events: *Paper, Break, Coffee, Walk*. The (indefinite) temporal relations between them are described by the following four SIA relations:

sia([d,di,eq,f,fi,o,oi,s,si], Paper, Break)
sia([d,o,s], Paper, Coffee)
sia([d], Coffee, Break)
sia([b], Break, Walk)

Feasible relations. Assume that each event, e.g., *Coffee* is represented by an interval *i(C1,C2)*, and similarly *Walk* by *i(W1,W2)*. Given the above SIA network, we can compute all feasible temporal relations between any pair of events. E.g., between *Coffee* and *Walk*, the only feasible relation is *before*:

$\leftarrow$ *sia_net([i(P1,P2), i(B1,B2),*
i(C1,C2), i(W1,W2)]),
temp(Feasible, i(C1,C2), i(W1,W2)).
Feasible = b,

... and some residual constraints

Consistent scenario. Another interesting question about a SIA network is finding a consistent scenario, i.e., a projection of the network to the time line. This can be simply realized by sorting the interval endpoints, while maintaining the consistency of constraints.

← *sia_net([i(P1,P2), i(B1,B2), i(C1,C2), i(W1,W2)]),*
sort([P1, P2, B1, B2, C1, C2, W1, W2, Scenario).

We get five consistent scenarios:

Scenario = [P1,C1,P2,C2,B2,W1,W2], B1=P1
Scenario = [P1,B1,C1,P2,C2,B2,W1,W2]
Scenario = [B1,P1,P2,C2,B2,W1,W2], C1=P1
Scenario = [B1,P1,C1,P2,C2,B2,W1,W2]
Scenario = [B1,C1,P1,P2,C2,B2,W1,W2]

Note that the endpoints can be sorted without assigning actual numerical values to them!

Duration. Assume an interval X with duration longer then an interval Y:

← *duration(i(X1,X2), Xd), duration(i(Y1,Y2), Yd),* $\{Xd > Yd\}$.
Xd= -X1+X2, Y1-Y2 < 0, Yd= -Y1+Y2, X1-X2-Y1+Y2 < 0

Can X occur during Y? No, the corresponding query fails. Query for all the feasible relations between X and Y yields the following answers: *[b, m, o, bi, mi, oi, si, di, fi]*. Note that this is no longer a SIA relation since it cannot be represented by conjunctive constraints.

5 Conclusion

This modest contribution can be regarded as an attempt at making an ontology operational. In our view, it does not suffice to use or develop an expressive language to formalize an ontology. The language must also be executable in order to enable automated reasoning and derivation of explicit consequences from implicit knowledge in the ontology. When choosing between different competing representation languages, their operationality should be an important consideration.

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USER PROFILING FOR INTEREST-FOCUSED BROWSING HISTORY

Miha Grčar, Dunja Mladenić, Marko Grobelnik
Department of Knowledge Technologies
Jozef Stefan Institute
Jamova 39, 1000 Ljubljana, Slovenia
e-mail: Miha.Grcar@ijs.si

ABSTRACT

User profiling is an important part of the Semantic Web as it integrates the user into the concept of Web data with machine-readable semantics. In this paper, user profiling is presented as a way of providing the user with his/her interest-focused browsing history. We present a system that is incorporated into the Internet Explorer and maintains a dynamic user profile in a form of automatically constructed topic ontology. A subset of previously visited Web pages is associated with each topic in the ontology. By selecting a topic, the user can view the set of associated pages and choose to navigate to the page of his/her interest. Each topic can be seen as an interest of the user (hence the term interest-focused browsing history). The ontology is constructed by transforming the textual contents of the pages into sparse word-vectors and applying bisecting k-means clustering (i.e. a form of hierarchical clustering) on the set of sparse vectors. The most recently visited pages are used to identify the user's current interest and map it to the ontology. The user can clearly see which topics, and their corresponding pages, are related (or are not related, for that matter) to his/her current interest. We see this as a useful way of organizing the user's browsing history. To illustrate the functioning of the system, we demonstrate its behavior in one particular real-life scenario.

1 INTRODUCTION

In this paper, user profiling is presented as a way of providing the user with his/her interest-focused browsing history. We present a system that is incorporated into the Internet Explorer and maintains a dynamic user profile in a form of automatically constructed topic ontology.

Let us begin by briefly summarizing some of the related work in the field of user profile construction. The most related work is that of (Kim and Chan, 2003). They propose a tree-like hierarchy of interests, the root being the user's general interest (i.e. long-term interest) and leaves representing domains the user is – was ever – interested in (i.e. short-term interests). User interest hierarchies are built using a form of hierarchical clustering on a set of Web pages visited by a user.

Another less related way of constructing a user profile is to analyze the user's browsing history and apply modified collaborative filtering techniques (Sugiyama et al., 2004). Here, the user profile is also a combination of both (i) user's persistent preferences (long-term preferences) and (ii) user's ephemeral preferences (short-term preferences – "today's" preferences) and is represented as a vector of term weights. Modified collaborative filtering is then applied to a user-term matrix (in contrast to being applied to a user-item matrix as is the case with the original collaborative filtering approach – hence the word "modified") to predict the missing term weights in each user profile. Clustering is used (in one of their approaches) to determine user communities. Cluster centroids are compared to the active user's term vector to find the user's neighborhood (a threshold is used to discard less relevant communities). The latter approach, according to (Sugiyama et al., 2004), achieves the best results.

In Foxtrot recommender system (Middleton et al., 2003), an ontology (taxonomy) based on CORA digital library is used – new documents are classified into the taxonomy by using a variant of the nearest neighbor algorithm. A user profile holds a set of topics and their corresponding interest values. Each topic adds 50% of its interest value to its super-class. They also used "static knowledge" ontologies to alleviate the cold-start problem. Visualization of profiles is used to encourage immediate users' feedbacks. For evaluation, collaborative filtering is performed on a user-topic matrix (they term this technique "collaborative and content-based recommendations").

The rest of the paper is arranged as follows. In Section 2, user profiling is viewed from the perspective of the Semantic Web. Architecture of our system is presented in Section 3. In Section 4, we describe implementation of the system. The paper concludes with the discussion and some ideas for future work in Section 5.

2 USER PROFILING FROM THE PERSPECTIVE OF THE SEMANTIC WEB

When thinking of the Semantic Web we can say that the Semantic Web is a Web focused on the exchange of information between computers that does not explicitly involve human users. Although computers could be quite busy communicating to each other, there still needs to be some space left for human users in the whole process – there is where user profiling comes into the play.

Technically speaking, the Semantic Web is mainly about the data that are self-explanatory, or in other words, about the data which are annotated in some standard fashion that enables efficient computer-to-computer communication. The main purpose of the Semantic Web is to enable better services for the end-users. Since in general the data can be understood in more than one way – especially when talking about the more abstract categories which cannot be annotated explicitly – one of the possible sources of annotations (i.e. meta-data) may also be the information about the user. This information can be represented in several ways. Typically, if we talk about more abstract and aggregated information, we talk about user profiles or user models. Their main characteristic is the ability to generalize the collected data about the user's behavior (such as click-stream data of the user's browsing behavior). Such user-models are then used to annotate the data in such a way that Web services are able to deliver personalized information, aiming at increasing the user's efficiency when he/she is communicating with the computer.

We can conclude this short description of user profiling from the perspective of the Semantic Web by saying that user profiling is an important source of meta-data on the user's understanding of the data semantics. In particular, this compensates for the differences in users' understanding of the data by using an alternative annotation, which is more of the soft nature (the softness comes from the fact that the data are annotated implicitly and dynamically by taking a user profile into the account). The main goal of user modeling is increasing the efficiency of user activities by delivering more personalized information.

3 DESIGN AND ARCHITECTURE OF THE SYSTEM

The system provides a dynamic user profile in a form of topic ontology. After a page is viewed, the textual content is extracted and stored as a text file as described in Section 3.1. Pages are represented as word-vectors (also termed bags of words) as explained in Section 3.2. To construct the topic ontology, we perform a variant of hierarchical clustering (see Section 3.3). By using the cosine similarity measure, we are able to map the user's current interest to the topic ontology (more details in Section 3.4). The latter identifies the ontology nodes that are in the context of the user's current interest. The whole process is illustrated in the system architecture (Figure 1) which also references Sections 3.1 through 3.4. These Sections contain a detailed description of individual phases of the process.

3.1 Handlind a Page-view

After a page is viewed, the textual content is extracted and stored as a text file. The text extraction is done in two relatively simple steps:

1. text segments between and including "<script>" and "</script>" or "<style>" and "</style>" are discarded,
2. substrings starting with "<" and ending with ">" are removed.

A collection of such text files (from now on simply termed pages) is maintained in two folders. The first folder holds m most recently viewed pages (the short-term interest folder). In our experiments, m is set to 5. The second folder contains the last n viewed pages, where n > m (the long-term interest folder). In our experiments, n is set to 300. When a page is first visited, it is placed into both folders. Eventually it gets pushed out by other pages that are viewed afterwards. A page stays in the long-term interest folder much longer than in the short-term interest folder (hence the terms long- and short-term), the reason for this being a much higher number of new pages that need to be viewed for the page to be pushed out of the long-term interest folder.

Pages are named after their 128-bit MD5 hash codes. In this way we are able to, at least to some extent, detect a page that was already visited and handle this scenario. Currently we simply update the timestamp of the file (i.e. the page) to mark it as recently interesting. This action is carried out in both folders.

3.2 Word-vector Representation of a Page

To build a user profile, we first take the pages from the short-term interest folder and compute their TFIDF vector representations of the textual content, ignoring the order of words (thus such vectors are also termed bags of words), as introduced in (Salton and Buckley, 1987). Each vector component is calculated as the product of Term Frequency (TF) – the number of times a word W occurs in the page – and Inverse Document Frequency (IDF), as explained by the following equation:

$$d^{(i)} = TF(W_i, d)IDF(W_i), \ \ where \ \ IDF(W_i) = \log \frac{D}{DF(W_i)}$$

where D is the number of pages and document frequency DF(W) is the number of documents in which word W occurred at least once.

Prior to transforming pages into vectors, stop-words are removed and stemming is applied. After vectors are obtained, the centroid of short-term interest pages is computed by averaging corresponding TFIDF vectors component-by-component. This process combines the short-term interest pages, regardless of their count, into one single construct – the short-term interest centroid.

3.3 Constructing the Topic Ontology

The long-term interest pages are treated slightly differently from the short-term interest pages. We first perform the bisecting k-means clustering (i.e. a variant of hierarchical clustering) over the long-term interest TFIDF vectors. This clustering method is computationally efficient and was already successfully applied on text documents (Steinbach et al., 2000). At start, all the pages form the root cluster which is first divided into two child clusters (hence the term bisecting clustering). The same procedure is repeated for each of the two newly obtained clusters and recursively further down the hierarchy. We perform the splitting until

the size of the clusters (i.e. the number of pages the cluster contains) is smaller than the predefined minimum size (usually set to 10% of the initial collection size). During the clustering process, the similarity between two vectors is computed as the cosine of the angle between the two vectors.

The result of the clustering is a binary tree (in this text termed topic ontology), with a set of pages at each node. Later on, for each node a centroid is computed in the same way as for the short-term interest pages. The root of the topic ontology holds the user's general interest while the leaves represent his/her specific interests. By our understanding the term general interest is not synonymous with long-term interest and in that same perspective the term specific interest is not a synonym for short-term interest. While the terms long-term and short-term (i.e. recent or current) interest emphasize the chronological order of page-views, this is not the case with the terms general (i.e. global) interest and specific interest. General interest stands for all the topics the user is – or ever was – interested in, while the term specific interest usually describes one more-or-less isolated topic that is – or ever was – of interest to the user.

3.4 Current Browsing Interest of the User

By using the cosine similarity measure, we are able to compare the centroid at each node to the short-term interest centroid. In other words, we are able to map the user's current interest to the topic ontology. The mapping reveals the extent to which a node (i.e. a set of pages) is related to the user's short-term interest. By highlighting nodes with the intensity proportional to the similarity score, we can clearly expose the topic ontology segments that are (or are not, for that matter) of current interest to the user.

Due to the highlighting the user can clearly see which parts of the topic ontology are relevant to his/her current interest. He/she can also access previously visited pages by selecting a node in the hierarchy which is visualized in the application window. This can be explained as the user's interest-focused Web browsing history, the interest being defined by the selected node.

4 IMPLEMENTATION OF THE SYSTEM

The user profile is visualized on the Internet Explorer toolbar that we developed for this purpose. The user can select a node (i.e. his/her more or less general interest) to see its specific keywords and the associated Web pages.

Generally, an Internet Explorer (IE) toolbar is an extension of the IE's GUI, as well as an application that extends the IE with additional functions. Since it is highly integrated into the IE, a toolbar can also:

- receive notifications and information about the user's actions in the IE; most notably the user's requests to "navigate to" (the user's requests can be filtered or preprocessed in some other way),
- access the contents of the currently loaded Web page,
- apply any kind of changes to the content of the currently loaded page (e.g. highlight links to recommended pages, highlight some parts of the text, etc.),
- easily access the Web as well as the local computer.

We have developed an IE toolbar to construct and visualize the user's interest-focused browsing history. The toolbar is placed into the left side of the IE's application window. It is divided into two panels, one showing the user's topic ontology and the other showing the most characteristic keywords and the set of pages corresponding to the selected node. The user can select any page from the list and navigate to that page. The user's current interests are highlighted in the ontology visualization panel. The color intensity of the highlighting corresponds to the relevance of the node to the user's current interest. The user can thus clearly see which pages that he/she already visited are in the context of his/her current interest.

5 DISCUSSION

Many research issues and technical details still need to be investigated. We noticed that when extracting the textual content of a Web page, a lot of interest-irrelevant text segments are also processed (e.g. standard navigation menus and adds). A simple heuristic that could be used to alleviate the problem is discarding text segments (i.e. chunks of text between two HTML tags) that are shorter than some predefined length. This solution has not been applied yet but we are planning to try it out in near future.

Since our software resides on the client side and we are able to track the Web browser's events, we could also efficiently measure the time the user spends on a page and use this information to additionally weight pages that were viewed by the user. In this same context, the pages that were visited more than once should be weighted by the sum of their page-view durations.

Currently we treat all Web pages equally. In the future, we should identify pages that are not suitable for the user profiling process. Such pages may be Web mail pages, search engine results and portal entry pages. To weaken the negative impact of such pages on the user profile construction, we could extend our stop-word collection with most frequent common Internet words. Another approach would be to allow the user to specify URLs (in the form of regular expressions, for instance) that should be excluded from the profiling process.

There is some work on document profiling that extends the vector representation by using word sequences (also termed n-grams) instead of single words (Mladenić and Grobelnik, 2003). This work suggests that using single words and also word pairs for features in the vector representation of short documents improves the document classification accuracy. We should incorporate these findings into our TFIDF vector representation of Web pages.

In our current implementation we are using the nearest neighbor approach to map the current interest to the topic ontology. Other more sophisticated machine learning techniques might provide better results in this process (e.g. classification with Naïve Bayes or SVM). In this implementation, each time a page is viewed, the entire profile is rebuilt from scratch. We need to consider ways to update the topic ontology rather than rebuild it.

The clustering method used was not evaluated. We need to define evaluation methods for the profile generation process and, on the other hand, for the page classification process. This is not a trivial task and needs to be investigated in great detail. Once we are able to evaluate the algorithms, we will also be able to apply other approaches and see how they measure up to the one described in this paper. The system was not tested in a real-life scenario. We should carry out an experiment involving test-users to see how useful the system really is.

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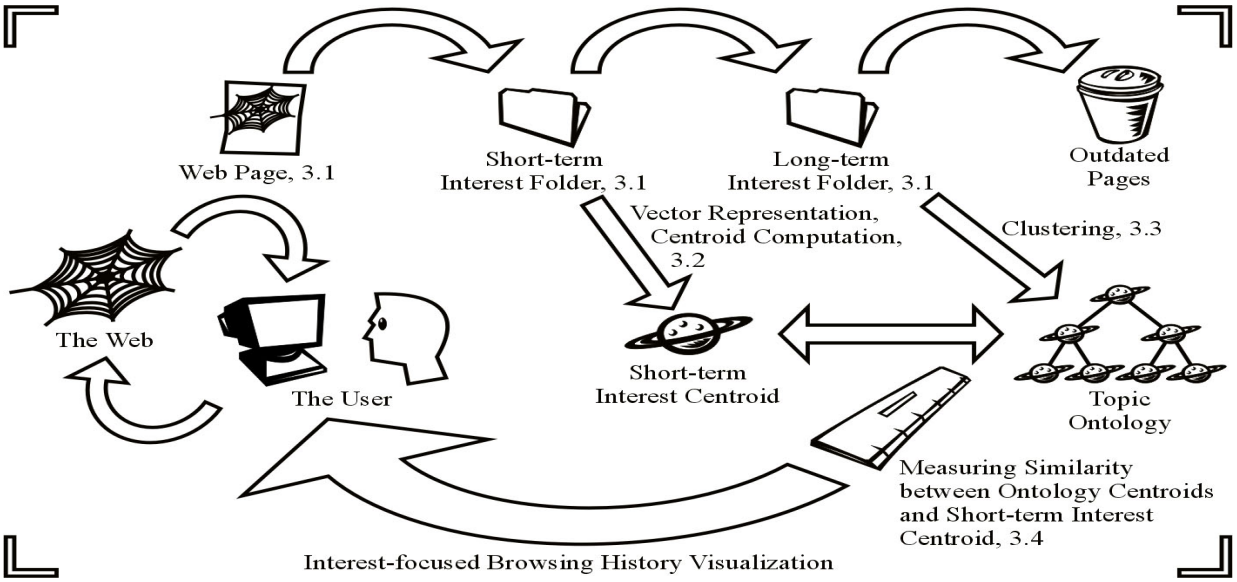

Figure 1. *The Interest-focused Browsing History Architecture. The process is described throughout Section 3. The corresponding subsections are noted in the figure (3.1, 3.2, 3.3, 3.4)*

USING MACHINE LEARNING TO STRUCTURE THE EXPERTISE OF COMPANIES: ANALYSIS OF THE YAHOO! BUSINESS DATA

Joel Plisson (1), Dunja Mladenić (1), Peter Ljubič (1),
Nada Lavrač (1, 2), Marko Grobelnik (1)

(1) Jožef Stefan Institute, Ljubljana, Slovenia
(2) Nova Gorica Polytechnic, Nova Gorica, Slovenia

ABSTRACT

Organizations have to collaborate in order to achieve business goals which require to use a variety of domain-specific knowledge. Selection of partners with an appropriate expertise is one of the crucial tasks in the creation of virtual organizations. Partner selection can be facilitated by structuring partners' competencies in an ontology. An alternative to manual ontology construction is to group and describe similar companies according to their domain of expertise. This paper proposes an approach to automatically construct a structured representation of companies' expertise applied on the Yahoo! business data.

1 INTRODUCTION

In order to form a Virtual Organization (VO) out of companies forming a Virtual Organization Breading Environment (VBE, [3]), it is important to know the competencies of VBE partners. When the number of partners in a VBE is reasonably small, this can be handled by a human having a good knowledge about the companies. When dealing with many organizations, it becomes difficult to remember the competencies of all the partners, and it becomes necessary to model their knowledge in a form that is easily understandable and that captures the essential information.

Ontologies are a productive way to represent knowledge about a domain. They can be used to represent part of a knowledge base of a VBE that contains the knowledge shared by VBE partners. Such a representation can be achieved by identifying organizations with similar competencies and organizing them according to their domain of expertise. An example of such structure can be found in the Yahoo! business section on the Web (see http://biz.yahoo.com). In the Yahoo! business ontology, companies are grouped together into categories representing different sectors and industries.

In this paper we propose a machine learning approach to build semi-automatically a similar structure directly from company descriptions. This may result in a comprehensive representation of the market, segmented into different market categories. The presented approach may enable the structuring of company information, and potentially facilitate the selection of partners in the process of virtual organization creation.

This paper simulates a scenario of virtual organization creation from VBE partners. In this scenario, all the companies in the Yahoo! business section are treated as VBE partners, and the goal is to try to automatically structure partners' competencies from company descriptions, without considering their human labeled Yahoo! categorization. The success of automated competency structuring, using clustering tools developed in the statistical and machine learning research communities, is evaluated by comparing the results of automated clustering with the original human-labeled categories.

The structure of this paper is as follows: Section 2 presents selected approaches to ontology construction, followed by Section 3, where our approach to semi-automated ontology construction is outlined. Section 4 presents the Yahoo! business domain and the results of the experiments. We conclude with a discussion and some ideas for future work.

2 APPROACHES TO ONTOLOGY CONSTRUCTION

An ontology can support a wide range of tasks such as natural language processing, information retrieval, database modelling, knowledge representation, etc. It provides a representation of knowledge, which can be used and re-used, in order to facilitate both the comprehension and the communication between different actors.

The content of an ontology depends both on the amount of information and on the degree of formality that is used to express it. Generally, we distinguish two main types of ontologies: lightweight and heavyweight [5]. A lightweight ontology is a structured representation of knowledge, which ranges from a simple enumeration of terms to a graph or taxonomy where the concepts are arranged in a hierarchy with a simple (specialization, is-a) relationship between them. A heavyweight ontology adds more meaning to this structure by providing axioms and broader descriptions of knowledge. The scope of this paper is limited to simple lightweight ontologies.

Different approaches have been used for building ontologies, most of them using manual methods. An approach to building ontologies was set up in the CYC project [7], where the main step involved manual extraction of common sense knowledge from different sources. [12] propose a methodology for manual ontology construction

consisting of four stages: purpose identification, ontology building, evaluation and documentation.

Most of the recent work on semi-automated ontology construction addresses the problem of extending the existing WordNet ontology using Web documents [1], using clustering for semi-automated ontology construction from parsed text corpora [2, 10], and learning taxonomic e.g., *is-a*, [4] and non-taxonomic e.g., *has-part*, relations [8].

3 AN APPROACH TO BUILD AN ONTOLOGY OF COMPANY' COMPETENCIES

In this paper we use machine learning techniques, namely hierarchical clustering of text documents, to structure the expertise of companies based on short company descriptions available on the Web in the Yahoo! business section. The approach to build an ontology of company' competencies, proposed in this paper, is based on document clustering [11] and cluster visualization, followed by the most important part of ontology construction (step 5) involving human intervention.

The proposed procedure consists of the following steps:

1. pre-process the data to get the `bag-of-words' representation of documents
2. initialize the first cluster to the whole document set
3. apply hierarchical *k*-means clustering as follows:
   - for each cluster do
   - if a stopping criterion is satisfied, stop splitting the cluster and describe the cluster with the most characteristic words
   - else repeat step 3 on the documents belonging to this cluster
4. visualize the output of clustering
5. manually form an ontology from the obtained hierarchy of clusters through detecting inconsistencies, possibly leading to manual re-engineering of clusters, naming the clusters by appropriate concept names, and their hierarchical dependencies by appropriate relationships between concepts (e.g., *part-of*, *subset-of*, …), and interpreting and evaluating of the results of clustering.

4 EXPERIMENTS IN STRUCTURING THE EXPERTISE OF COMPANIES

We have partially implemented the proposed machine learning approach, described in Section 3, through the use of two document clustering systems, both performing hierarchical k-means clustering [11] and providing the visualization of the generated clusters. In this way, we have implemented only steps 1 to 4 of the procedure outlined in Section 3. As there was no expert involved in the experiments, we were unable to implement step 5. As an alternative, we were only able to evaluate the results of clustering by comparing the results of clustering to the existing human-labeled Yahoo! ontology, an evaluation approach which is obviously unrealistic in real-life expertise modeling scenarios.

4.1 The experimental domain: Yahoo! business data

We have performed the analysis of Yahoo! business data, which we have downloaded from the Yahoo! business sector (see http://biz.yahoo.com). The experimental data set consists of descriptions of 7107 companies (brief summaries of companies' competencies). The length of the summaries varies from 180 to 1031 characters, averaging in approx. 842 characters per description. In Yahoo!, companies are structured into 12 *sectors*, which are further divided into 102 *industries*. For example, the *Healthcare* sector is divided into four industries: *Biotechnology & Drugs, Healthcare Facilities, Major Drugs, Medical Equipment & Supplies*. The number of industries in each sector and the distribution of companies over the sectors are shown in Table 1.

Sector	Industry	Industries	Companies
Basic Materials	Gold&Silver, Iron&Steel, …	11	429
Capital Goods	Aerospace & Defense, …	7	361
Conglomerates	Conglomerates	1	29
Consumer Cyclical	Footwear, Tires, …	12	318
Consumer Non-Cyclical	Beverages, Crops, …	8	232
Energy	Coal, Oil & Gas, …	4	310
Financial	Insurance, S&Ls/Savings, …	10	1212
Healthcare	Facilities, Major Drugs, …	4	860
Services	Advertising, Restaurants, …	25	1486
Technology	Hardware, Software, …	11	1578
Transportation	Airline, Railroads, …	6	150
Utilities	Electric, Water, …	3	142
Total		**102**	**7107**

Table 1: *Names of Yahoo! sectors, some industries, the numbers of industries (per sector) and companies (per sector).*

4.2 Experimental goals, the selected approaches and results

Trying to build an ontology of 7107 company summaries manually, we would have faced the problem of not knowing the characteristics of different business areas (e.g. banking, software, healthcare etc.), which would have disabled us of producing a relevant structuring of the domain. In this experiment, our goal was thus to automatically construct a hierarchical structuring of companies into distinct categories, with the potential (in step 5 of the approach presented in Section 3) to be interpreted as an ontology of Yahoo! companies.

We applied document clustering to automatically build a hierarchy of sets of documents, i.e., a hierarchy of company groups with a subset-of relationships between the groups of companies. In hierarchical k-means clustering, used in our approach, all companies are split into k groups; each group

is further split into k subgroups, based on the similarity between company descriptions. In our experiments we used two different clustering and visualization systems.

The first system [6] provides a two dimensional visual representation of document groups generated by k-means hierarchical clustering. The system performed several levels of 2-means clustering, and the stopping criterion (minimum number of companies in the clusters) was set to 1000. This resulted in a company hierarchy of 5 levels containing 11 nodes as shown in Figure 1. The main idea of tiling visualization is to split the rectangular area, representing all the companies, into sub-areas according to the size (numbers of instances) of sub-clusters. When a stopping criterion is satisfied, keywords describing the clusters are assigned to the leaves. The levels of the hierarchy are denoted by the ellipses connecting similar groups.

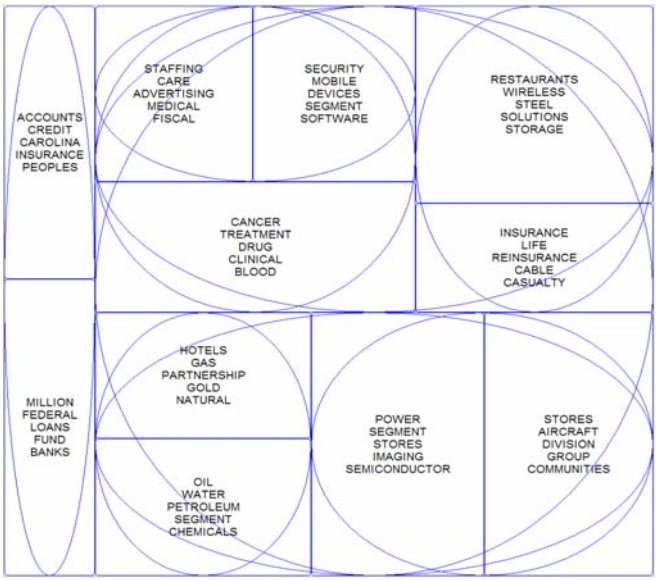

Figure 1: *Tiling visualization of companies' competencies, where the companies are organized in several hierarchical levels.*

The second system, gCLUTO [9], first performs stop-words removal and stemming in text pre-processing, followed by k-means clustering, using a predefined number of clusters of leaf-level nodes as the stopping criterion. In real-life scenarios, appropriate setting of the stopping criterion is a non-trivial task. In our experiment we have selected k equal to 12, the number of Yahoo! sectors, as one of our goals was to reconstruct the available Yahoo! business sector ontology. In gCLUTO's mountain visualization (shown in Figure 2), each peak represents an individual cluster: peak height is proportional to cluster's internal similarity, grayscale tone is proportional to cluster's internal deviation (darker tones indicate lower deviation), and peak volume is proportional to the number of elements in the cluster.

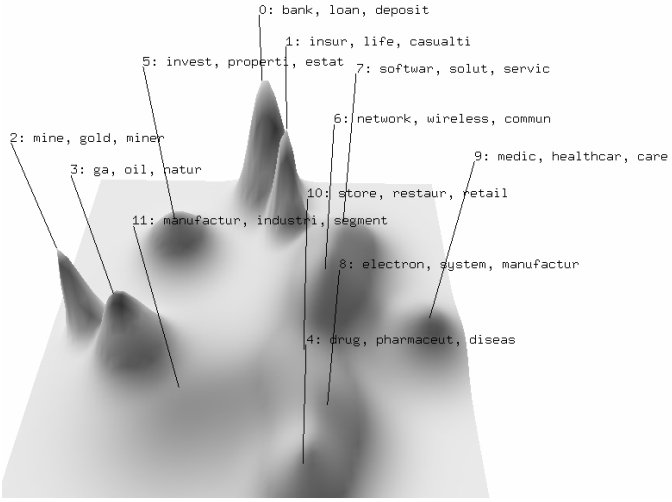

Figure 2: *Mountain visualization of 12 top-level clusters with inter-cluster similarity (ISim) represented by the peak heights*.

4.3 Evaluation of results

Without expert assistance we were unable to implement step 5 of the proposed semi-automated ontology construction methodology. Instead of intuitively naming the clusters by sector/industry names, we have - to the best of our capacity - manually aligned clusters to Yahoo! sectors, by comparing Yahoo! sector and industry names to the cluster keywords, and have evaluated the success of clustering on the scale 1-5, based on the number of keywords which – in our opinion – describe the sector.

While the first system resulted in a relatively weak correspondence between clusters and the Yahoo! sectors/industries, the cluster keywords proposed by the second system were pertinent enough to define distinct clusters that can be relatively easily understood and interpreted. Therefore we have concentrated on the results of the second approach by further analyzing the distribution (Table 3) of companies over the Yahoo! sectors in each cluster. To do so, the companies were labeled with their respective sector, and then the distribution of labels in each cluster was examined.

We can notice that clusters with higher inter-cluster similarity (ISim) contain more companies with the same label. In some cases, companies are spread among two or more different sectors. For instance the companies of cluster 6 (described by keywords *network*, *wireless*, *communications, internet, service*) are spread over sectors *Technology* and *Services*, which are closely related.

Id	ISim	Healthcare	Technology	Services	Basic Mat.	Financial	Cons. Cyc.	Capital Goods	Cons. Non-C.	Utilities	Transport	Energy	Conglom.
0	0.190	1	6	19	2	765	0	3	1	0	0	1	1
1	0.174	1	2	7	0	184	1	6	0	0	0	1	2
2	0.151	0	3	10	108	0	0	5	0	0	0	11	0
3	0.097	1	7	12	12	17	3	26	3	122	24	277	1
5	0.089	1	6	211	7	150	1	14	1	0	2	4	1
4	0.068	447	36	8	10	2	1	4	3	0	0	0	0
6	0.063	4	267	370	1	15	5	10	0	0	2	0	0
7	0.060	7	590	212	4	33	5	12	4	0	9	1	1
9	0.052	348	48	40	4	17	0	1	6	0	1	0	1
8	0.053	6	541	49	27	3	54	71	3	0	1	1	10
10	0.035	24	11	446	10	9	131	18	151	0	1	1	1
11	0.030	20	61	102	244	17	117	191	60	20	110	13	11

Table 3: *Results of System 2 - the distribution of 12 clusters among 12 sectors.*

5. CONCLUSIONS AND ACKNOWLEDGEMENTS

We have presented an approach to structuring the expertise of companies into a simple ontology, aimed at modeling competencies/expertise of companies from textual data. Two different systems were used to implement the proposed methodology, and two different visualization tools based on hierarchical k-means clustering of documents were applied in the experiments. To evaluate the results, we compared the results with the existing two-level Yahoo! ontology of companies. In terms of visualization, the advantage of the first system is that cluster hierarchy, represented by ellipses, is visualized in addition to leaf-level clusters. On the other hand, the mountain visualization of the second approach is especially appealing, as peak heights are proportional to cluster's internal similarity, and different color intensity is proportional to cluster's internal deviation, both being very important for estimating the success of clustering. The second system also resulted in much more cohesive clusters in terms of keywords used to describe the clusters of companies.

Despite the fact that the results are non-representative for a real-life situation in which pre-defined categories do not exist, the results of this experiment are interesting as they provide keywords representing company expertise as novel information over the human-defined Yahoo! sector categories. The results could be further improved by splitting the obtained clusters into more sub-clusters, thus achieving a complete hierarchy of companies' competencies. In addition the use of natural language processing methods could be used to provide additional information for word sense disambiguation, leading to improved clustering results and improved keyword extraction.

Acknowledgements.
This work was supported by the Slovenian Research Agency and the IST Programme of the European Community under ECOLEAD (IST-1506958-IP), SEKT Semantically Enabled Knowledge Technologies (IST-1-506826-IP) and PASCAL Network of Excellence (IST-2002-506778). This publication only reflects the authors' views**.**

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AUTOMATED STRUCTURING OF COMPANY COMPETENCIES IN VIRTUAL ORGANIZATIONS

Peter Ljubič (1), Nada Lavrač (1, 2), Joel Plisson (1), Dunja Mladenić (1), Stefan Bollhalter (3), Mitja Jermol (1)

(1) Jožef Stefan Institute, Ljubljana, Slovenia

(2) Nova Gorica Polytechnic, Nova Gorica, Slovenia

(3) Virtuelle Fabrik AG, Arbon, Switzerland

ABSTRACT

Creation of virtual organizations (VO) consists of several steps. One of the early steps is finding organizations with an appropriate expertise from a larger pool of organizations, referred to as a VO Breeding Environment (VBE). This requires a good knowledge of each company' competencies and thus emerges the need for a structured representation facilitating the choice of appropriate partners. Ontologies provide a structured representation of knowledge that is potentially useful for such a task. This paper proposes an approach to extract semi-automatically the companies' competencies from their profile data and then structure the information in the form of an ontology. This method is generally applicable for competency modeling in collaborative networked organizations. We present some existing methods and tools for ontology creation, followed by the proposed methodology to structure competencies, applied to the Bodensee industry sub-cluster of the Virtuelle Fabrik VO breeding environment.

1 INTRODUCTION

The main motivation for organizations to e-collaborate is to harness dispersed expertise, enable knowledge sharing and flexible resource management when solving a new business task. The strengths of virtual organizations (VOs) [3] lie in the range of competencies the partners are able to offer jointly through collaboration. To fully exploit this advantage, problems of efficiently storing, updating, sharing, promoting and transferring knowledge need to be solved, using appropriate knowledge management approaches. A basis for successful knowledge management is the common understanding of terms and a comprehensive representation of the knowledge. This can be achieved by the development of ontologies that can be shared among the VO partners. To introduce the context for this work, the paper first introduces the basic concepts and identify some of the existing methods and tools for ontology creation that are applicable in the context of *Virtual Organization Breeding Environments* (VBEs, [3]).

This paper proposes an approach to automated extraction of companies' competencies from their profile data, and semi-automatically structure these competencies in the form of an ontology in order to facilitate the representation of the competencies. The approach is illustrated with an experiment on the Bodensee industry sub-cluster of Virtuelle Fabrik (VF), an industrial cluster of mechanical engineering companies.

2 ONTOLOGIES: BASIC DEFINITIONS AND OVERVIEW

An ontology can support a wide range of tasks such as natural language processing, information retrieval, database modelling, knowledge representation, etc. It provides a representation of knowledge, which can be used and re-used, in order to facilitate both the comprehension and the communication between different actors. These actors can be software agents or people that need to access or share a piece of information. The most basic type of ontology is only a set of terms representing a controlled vocabulary (e.g. a glossary), which are the terms that people agree to use when dealing with a common domain. By providing definitions, an ontology helps people to use the same words for expressing themselves and thus understanding themselves more easily.

The content of an ontology depends both on the amount of information and on the degree of formality that is used to express it. Generally, we distinguish two main types of ontologies: lightweight and heavyweight [6]. A lightweight ontology is a structured representation of knowledge, which ranges from a simple enumeration of terms to a graph or taxonomy where the concepts are arranged in a hierarchy with a simple (specialization, is-a) relationship between them. A heavyweight ontology adds more meaning to this structure by providing axioms and broader descriptions of the knowledge.

Different approaches have been used for building ontologies, most of them using manual methods. An approach to building ontologies was set up in the CYC project [9], where the main step involved manual extraction of common sense knowledge from different sources. [13] propose a methodology for manual ontology construction consisting of four stages: purpose identification, ontology building, evaluation and documentation.

Most of the recent work on semi-automated ontology construction addresses the problem of extending the existing WordNet ontology using Web documents [1], using clustering for semi-automated ontology construction from parsed text corpora [2], and learning taxonomic e.g., *is-a*, [4] and non-taxonomic e.g., *has-part*, relations [10].

Our scope is limited to lightweight ontologies, where concepts are companies' competencies and instances are documents containing company' profiles.

3 ONTOLOGIES IN THE VBE CONTEXT OF VO CREATION

The purpose of VBEs is to support fast virtual organization (VO) creation: VOs are formed from a cluster of organizations in a VBE when a new business opportunity arises. As a VO is formed to meet a specific demand, it dissolves once the demand is fulfilled.

One of the difficulties in VO creation is partner selection with appropriate skills and competencies. The most important strength of the whole VO lies in the choice of partners with supplementary/complementary knowledge, skills and tools. The wider is the network of knowledge the more competitive is the VO. Therefore, the network can be highly dynamic with partners entering and leaving a VBE.

For the sake of marketing a VBE and for VO creation through appropriate partner selection, a VO broker has to have access to a knowledge repository, where the information about company resources, process costs, resource availability and company profiles in terms of skills, competencies, products and past projects are stored. To be able to manage the network and perform successful knowledge management, appropriate tools have to be selected. These include ontologies and knowledge maps. While ontologies enable appropriate domain conceptualization achieved in the consensus of involved ontology developers, knowledge maps [5] provide "a visual representation of a knowledge domain according to criteria that facilitate the location, comprehension or development of knowledge". Due to the complex and dynamic nature of VBEs, information gathering and VBE/VO analysis and modeling are best supported using advanced knowledge technologies, including data, text and web mining, decision support, as well as link and social network analysis. Web crawling is a useful means for data gathering, while visualization is of ultimate importance for the presentation of obtained results.

4 A METHODOLOGY FOR AUTOMATED EXTRACTION OF COMPANY COMPETENCIES

This section presents the proposed approach, aimed towards automated extraction of company competencies, using agglomerative hierarchical document clustering. Clustering methods aims to build clusters (groups) of objects so that similar objects fall into the same cluster (internal cohesivity) while dissimilar objects fall into separate clusters (external isolation). A class of clustering methods are *hierarchical clustering* methods [8], whose purpose of is to fuse objects (instances) into successively larger clusters, using a measure of (dis)similarity.

A typical result of this type of clustering is a hierarchical tree or *dendrogram*. A dendrogram is a binary tree where single objects form the leaves of the tree and each node of the tree represents a cluster of similar objects. The further the node is from the tree root, the more similar the items are under the node. For each node, the dissimilarity at which the respective objects were joined together into a new single cluster is called the *cluster level*. It is used to determine the most appropriate number of clusters that reflects the real structure in the data: at the point where the difference between successive cluster levels is maximal, the dendrogram is `cut', producing the partition where each cluster is the most internally cohesive and there is the highest external isolation between clusters. To implement hierarchical clustering, the (dis)similarity between objects and between clusters of objects has to be defined. The most frequent measure used in document clustering [12] is the so-called *cosine similarity* between bag-of-words vector representations of documents, where 1/0 represents the presence/absence of a word in the document.

The proposed approach to semi-automated ontology construction consists of the following steps:

1. pre-process the data to get a list of words representation of documents, further transformed into a bag-of-words vector representation of documents
2. apply agglomerative hierarchical clustering to construct a dendrogram in which each cluster is represented by the most characteristic words (using the *TFIDF* word quality measure known from information retrieval and text mining)
3. select the `best' set of clusters (either according to expert's background knowledge, or automatically by cutting the dendrogram at the point where the difference between successive cluster levels is maximal), and represent the leaves of the dendrogram by the most characteristic words
4. visualize the output of clustering, together with the corresponding word descriptions
5. manually form an ontology from the obtained cluster hierarchy by labeling the clusters by appropriate concept names, and their hierarchical dependencies by appropriate relationships between concepts (e.g*., part-of, subset-of,* …)

5 AN EXPERIMENT USING THE VIRTUELLE FABRIK INDUSTRY CLUSTER DATA

Company profiles of a 20-partner VFEB Bodensee industry sub-cluster of the Virtuelle Fabrik virtual organization breeding environment was made available for the experiment. Each company is described by its name, number of employees, products, services and their core competencies.

5.1 Data pre-processing

Text mining approaches usually require a pre-processing phase in which the document representation format is changed from the free text form to the bag-of-words representation (commonly used in text processing), possibly preceded by stop word elimination and stemming. In our experiment, this pre-processing step was simplified by simple elimination of stop words and some manual elimination of meaningless adjectives, resulting in a list of words. Each company was also assigned a unique numeric

identifier (see Table 1). Note that the company identifier and company name were not used as input information for text clustering used in the experiment.

1 AE&P	2 ALWO	3 Bachli	4 Bruggli	5 Beni
6 Buchler	7 Ccb	8 Flube	9 KBB	10 Heese
11 Innotool	12 Knobel	13 IPG	14 M+S	15 OMB
16 Pantec	17 Schar	18 SMA	19 Sulzer	20 Wiftech

Table 1: *Company identifiers assigned to company names.*

During pre-processing, the input data was transformed into word lists, representing simplified descriptions of the original text describing the companies. Selected company descriptions are shown below.

AE&P Entwicklung Konstruktion Bereich Maschinen Anlagenbau Lieferung Komplettanlagen Konstruktions einsatze direkt Kunden Projektmanagementmandate Gesamtlosungen Automation Entwicklung Handgeraten Breites CADKnowhow Autocad Bravo Catia Euklid

ALWO Zulieferfirma Halbleiterindustrie Werkzeugbau Sonderanlagen Baugruppenmontage Serien Stuck Kleinteilefertigung drehen frasen Montage Prufprotokoll

Bachli Transformatoren Drosseln Speisegerate Flexibilitat Schnelligkeit Sicherheit Normenerfullung Produktanforderungen EN UL CSA Normen

Bruggli Druckerei Informatik Internetdienste Fahrradanhanger Techn Textilprodukte Gurten Taschen Planen Industrie Kleingeratemontage Mechanische Bearbeitungen Offsetdruck Informatik Internetdienste Techn Textilfertigung Mechanik Montage Profil Rohrbiegen Frasen Bohren Baugruppenmontage

Beni …

5.2 Experimental results

The dendrogram of Figure 1 was induced from 20 VFEB company profiles (text documents) by using the agglomerative hierarchical clustering method available as part gCLUTO, a publicly available interactive clustering, visualization and analysis system [11]. It was built automatically, together with the lists of most representative words representing each document/cluster, whereas company identifiers (in curled brackets) were added manually, in order to simplify the interpretation of the obtained structure.

The dendrogram of Figure 2 was produced from the dendrogram of Figure 1, by cutting the dendrogram at the level where differences between successive cluster levels are maximal. This resulted in six company clusters, described by automatically extracted keywords describing the clusters. Curled brackets list original documents/companies belonging to a cluster (e.g., cluster 29 includes descriptions of companies 10, 13 and 14), while cluster numbers [0]-[5] corresponding to clusters as marked in cluster visualization in Figure 3.

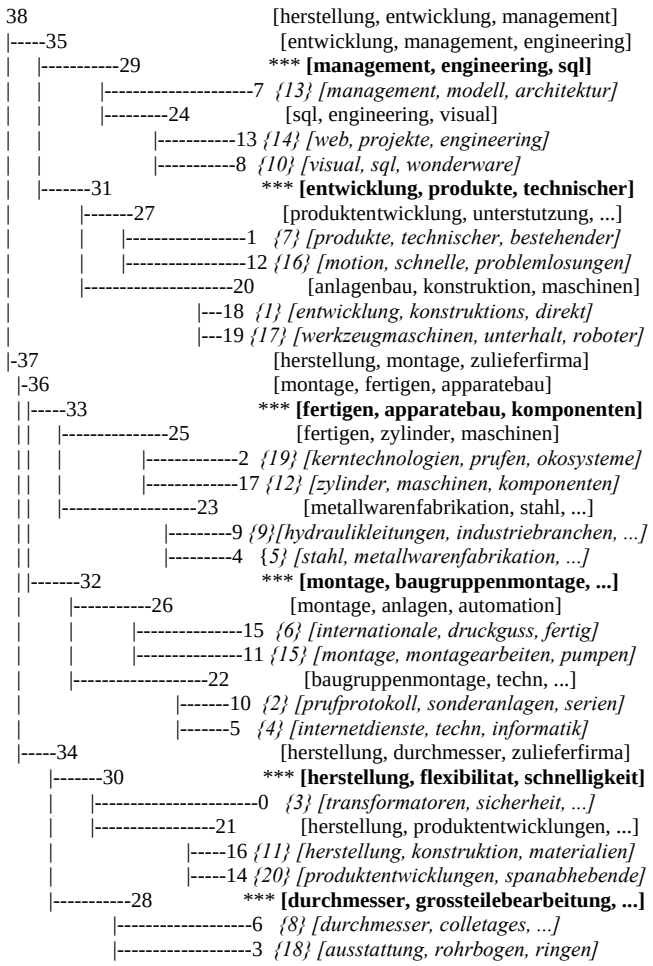

Figure 1: *Dendrogram of VFEB companies, starting with 20 clusters (one for each company), and merged into larger higher-level clusters. Extracted keyword descriptors of companies and company identifiers (in {}) are shown in italics. Bold cluster descriptions (*** clusters 29, 31, 33, 32, 30, 28) reappear in Figure 2.*

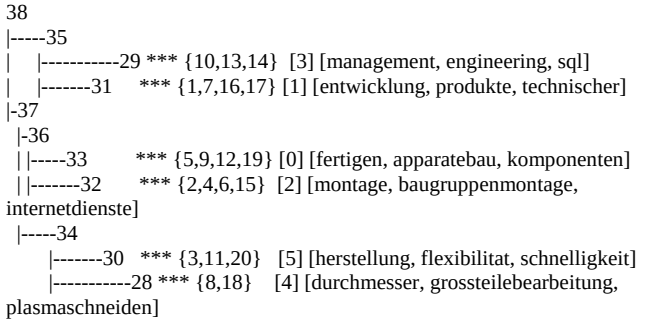

Figure 2: *Dendrogram of VFEB companies obtained by agglomerating bottom level clusters into six higher-leve clustersl.*

5.3 Visualization of six profile categories

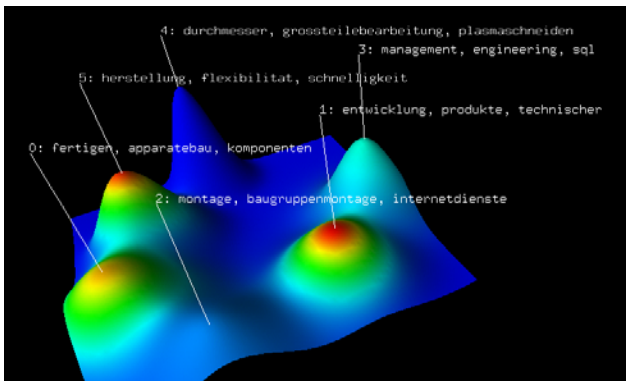

Figure 3: *Mountain visualization of six clusters, described with most descriptive words.*

The gCLUTO system [11] offers advanced cluster visualization tools, which we have used to visualize the results of VFEB clustering. The results are visualized in Figure 3. Peaks in Figure 3 represent individual clusters. The shape of each peak is a Gaussian curve, used as a rough estimate of the distribution of the data within each cluster. The height of each peak is proportional to the cluster's internal similarity. The volume of a peak is proportional to the number of elements contained within the cluster. The color of the top of a peak is proportional to the cluster's internal deviation (red indicates low deviation, whereas blue indicated high deviation). The resulting Gaussian curves are added together to form the terrain of the Mountain Visualization of gCLUTO.

5.4 Interpretation and result evaluation

Figure 3 gives a representative overview of the clusters of competencies, their strength and their homogenity. Interesting company clusters have been identified, and named by the Virtuelle Fabrik manager as follows. Cluster [1]: *Engineering, project management*; Cluster [2]: *Product, component assembly*; Cluster [3]: *Software engineering, project management*; Clusters [0], [4], [5]: *Parts manufacturing.* While clusters [1], [2] and [3] are independent clusters, clusters [0], [4] and [5] are all touching the same competencies. Cluster [4] could be identified as a sub-cluster, named *Heavy parts manufacturing.*

The results could be optimized by carefully reviewing the extracted keywords (e.g., *durchmesser* and *technischer*) which are not informative; *Flexibilität* and *Schnelligkeit* describe qualities rather than competencies). After removing non-informative words from the word list, a novel run of clustering could be performed, possibly leading to better results.

6 CONCLUSIONS AND ACKNOWLEDGEMENTS

For a complete validation of the potential of the proposed approach for the Virtuelle Fabrik industry cluster, the analyses should be extended to a wider/full set of member data. The combination of different data sources analyzed with clustering of VO creation tool, facilitating the identification of market opportunities.

Acknowledgements.
This work was supported by the Slovenian Research Agency and the IST Programme of the European Community under ECOLEAD (IST-1506958-IP), SEKT Semantically Enabled Knowledge Technologies (IST-1-506826-IP) and PASCAL Network of Excellence (IST-2002-506778). This publication only reflects the authors' views.

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SECTION: Language Technologies

LEARNING RULES FOR MORPHOLOGICAL ANALYSIS AND SYNTHESIS OF MACEDONIAN NOUNS

Aneta Ivanovska[1], Katerina Zdravkova[1], Sašo Džeroski[2], Tomaž Erjavec[2]
[1]Institute of Informatics, Faculty of Natural Sciences and Mathematics
Arhimedova 5, 1000 Skopje, Macedonia
[2]Department of Knowledge Technologies, Jozef Stefan Institute
Jamova 39, 1000 Ljubljana, Slovenia

ABSTRACT

This paper presents a machine learning approach to morphological analysis and synthesis of Macedonian nouns. For training and testing we used the nouns originating from Orwell's "1984". The paper presents experimental results of using the learned rules in the process of analysis, and in the process of noun formation. Training was performed with the whole set of Macedonian nouns from "1984" and tested by 10-fold cross-validation. All the potential nouns forms generated by the learning rules were compared with 275000 Macedonian noun forms. The accuracy of 92-97% is encouraging to apply the same approach to all categories of Macedonian words.

1 INTRODUCTION

Although morphological rules for noun formation in Macedonian have exhaustively been studied by linguists [1,2] for decades, they have been recently systematized [3].
The initial aim of the research presented here was to define morphosyntactic descriptions (MSDs) of Macedonian in line with Multext-East [5] and then implement them over all the words originating in Orwell's "1984". This process was not straightforward because the translation of the book didn't exist in electronic version [7].
The process of converting the printed version into a text file, the assignment of all the word-forms into appropriate grammatical categories, and their presentation into triplets (word-form, lemma, MSD) is also presented.
Particular attention in the paper is paid to noun analysis and formation, based on a machine learning approach. It has been performed with the machine learning system Clog [8].
This paper presents the process of machine learning of Macedonian headword and noun forms in more details (Fig. 1). Section 2 deals with the preprocessing of the printed version of the novel "1984" and its conversion into an electronic dictionary of word forms. Section 3 explains MSD tagging of Macedonian nouns. Section 4 describes the preparation of annotated nouns for training with Clog, training the rules for analysis and synthesis of the word-forms of the lemmas, and testing the accuracy of the generated rules. Section 5 presents experimental results of noun analysis and formation. Conclusion discusses the results and directions for future work.

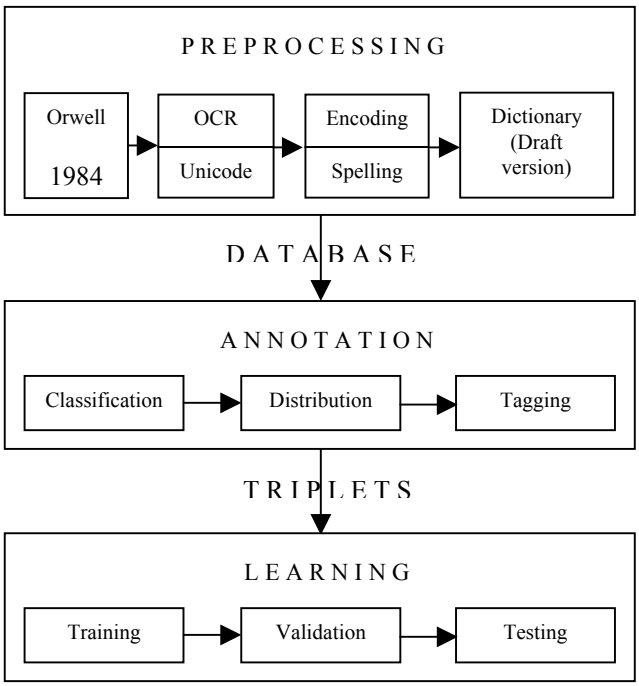

Figure 1: *Learning system diagram.*

2 PREPROCESSING OF "1984"

The Macedonian translation of Orwell's "1984" appeared rather late [7], but in spite of this fact, it didn't exist in an electronic form. There were two solutions to this initial problem: to type it from beginning to end, and simultaneously correct all the spelling errors, or to scan it. The second solution was found more appropriate, particularly because at that moment, no supplementary problems were noticeable.
The book was published in Macedonian Cyrillic script that can easily be transliterated into Latin. However, neither ISO Latin 2, which was used for other Slavic languages in Multext-East, nor its extension ISO Latin 5, could cope with Macedonian characters ќ and ѓ. Therefore, Unicode/UTF-8 encoding was chosen as the most suitable.
Unexpectedly, the selection of Unicode encoding became the first problem. Namely, many Latin characters, such as b (Cyrillic v), c (Cyrillic s), p (Cyrillic r), and s (Cyrillic dz) were recognized as characters from the English

alphabet. The character r was recognized as Cyrillic g. In the printed version of the novel, capital O was typed as number 0, the hyphen as minus, and the character ` (existing in words such as `рбет (spine)), as quotation mark ‘.

All incorrect characters were replaced. Then, correction of spelling errors started. After this stage, the electronic version of the book was ready for further processing.

In order to obtain the full “1984” dictionary, all sentences were first converted into a set of words, and multiple occurrences of the same 98846 word form were deleted from it. This approach was afterwards found wrong, because out of context, many word forms belonging to several different categories were deleted. Such examples are, for example, plural forms of the nouns врата = врати (doors), гради = гради (breasts), забрана = забрани (prohibition), which are at the same time verb bases врати (to return), гради (to build), and забрани (to forbid). The deleted words were returned back in the dictionary to be later classified into other categories.

The preprocessing stage ended with a dictionary with 16836 different word forms. In order to enable annotation, they were converted into a database divided into 11 tables according to the grammatical category of the word (Fig 2.).

Category PoS	Occurrences	Attributes	Values
Noun	5466	5	15
Verb	4565	8	23
Adjective	3952	6	19
Pronoun	78	10	34
Adverb	606	2	7
Preposition	28	2	3
Conjunction	64	2	4
Numeral	70	15	17
Interjection	4	11	2
Abbreviation	16	21	1
Particle	3	2	9

Table 1: *Occurrence of word forms and their MSDs.*

3 ANNOTATIONS OF THE WORDS

Annotation of the words was made with Multext notation [6]. According to this notation, each word form is associated with a morphosyntactic description (MSD) presented as a packed string. Its first character, always uppercase, represents the part-of-speech (grammatical category). It is followed by a list of character values corresponding to the part-of-speech attributes.

The Macedonian language has 11 word categories, 84 attributes, and 134 values (Table 1). The number of possible combinations of these has not been determined yet.

3.1 Word classification

Almost 60% of all the words were automatically classified according to their inflexions. Unclassified words were manually distributed. The process was not completely bug-free, so final adjustment was done during MSD tagging.

In parallel with the manual word classification, automatic rule-based classification of Macedonian words was also attempted. With the current accuracy of about 80%, this automatic system was found useless for Orwell’s novel.

3.2 Annotation of Macedonian nouns

Macedonian nouns have 5 attributes: type (common, proper), gender (masculine, feminine, neuter), number (singular, plural, count), case (nominative, vocative, oblique) and definiteness (no, yes, close, distant).

Three of these 15 values are language specific: the case oblique, which represents the remaining of former genitive, dative, and accusative and always has a unique form: Иван - Ивана, ешко - ешка. Definiteness is expressed by three forms: the suffixes от, та, то, те express definiteness of nouns independently of their location, suffixes ов, ва, во, ве express definiteness of nouns which are close, while suffixes он, на, но, не express definiteness of nouns which are distant.

The dictionary database enables the association of attributes and values, the addition, deletion, and replacement of the values, and manual correction of wrongly associated values (Fig 2, right corner).

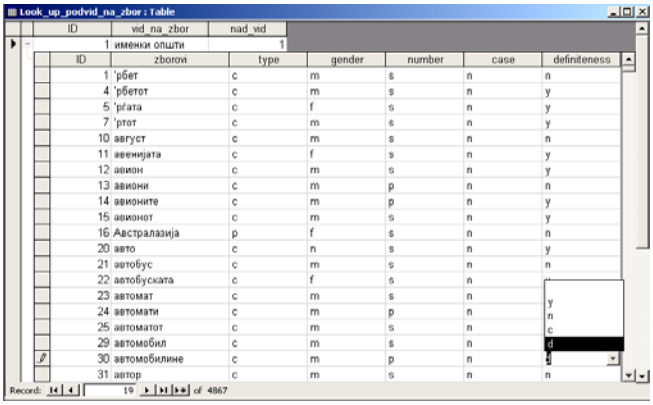

Figure 2: *Table of all the nouns and their MSDs.*

MSD tagging was automatically performed, and manually polished. Common nouns appearing in the middle of the sentence were separated from proper nouns according to the initial letter. The gender of definite nouns was determined from the definite suffixes, the gender of indefinite nouns according to the last character. The number of definite nouns was concluded by the definite suffixes, while the plural of neuter nouns and the count plural of masculine nouns was concluded according to the final characters (иња, and а). The case was set to be nominative, except for indefinite masculine and feminine nouns that ended with о (vocative) and masculine and neuter nouns that ended with а (oblique). Definiteness was completely determined by the suffixes.

In parallel with the annotation, lemmas were added in a separate column. At the beginning, it was intended to perform automatic analysis, but the number of rules [3],

and the former use of a machine-learning tool indicated that manual analysis of "1984" dictionary should be easier and more accurate.
Addition of lemmas was best opportunity to polish the remaining spelling errors, and correct the exclusions of the rules used for MSD tagging.

4 PREPARATIONS OF LEARNING RULES

After adding the columns with the lemmas in the table of all the nouns and their MSDs, the table had to be transformed in a format suitable for running Clog. Consequently, the table was transformed into a document in which every noun was in a separate row, together with its lemma and its MSD, separated with a TAB space. The rows of the document were of the form:

word-form <TAB> lemma <TAB> MSD

where the word-form was the word as it appears in the running Orwell's text. Before this document was further used in the process of analysis, it had to be transliterated. The document was transliterated from Unicode/UTF8 to Latin2. The format of the document remained the same (triplets: word-form, lemma, MSD). Then, the process of analysis started. The analysis was divided into two parts: training of the rules and testing the accuracy of the rules.
The rules were trained with Clog, on the whole set of Macedonian nouns. Clog was run separately for each MSD, once for analysis and once for synthesis. The triplets, where each triplet was an example of analysis of the form *MSD (orth, lemma)* from the training set, were used. *MSD (orth, lemma)* is a relation, or predicate that consists of all pairs (word-form, lemma) that have the same morphosyntactic description. *Orth* is the input, and *Lemma* is the output argument. A set of rules had to be learned for each of the MSD predicates. For every MSD predicate there could be a set of rules, and a set of exceptions from the rules. An example of the rules and the exceptions for morphological analysis are given in Figure 3.

Exceptions:

raspravii -> rasprava
strui -> struja
race -> raka
noze -> noga
boi -> boja

Rules:

*sti -> *st
*ii -> *ija
id*i -> id*ja
*i -> *a

Figure 3: *Morphological analysis exceptions and rules for common nouns of feminine gender plural.*

During the process of training, several mistakes were noticed in the set of words used for training. Those were mostly spelling errors, but they induced wrong rules, that cannot be used later. The spelling errors were easy to notice, and after they were fixed, the training was performed again. The number of erroneous rules decreased.
The second part of the process of analysis was the testing of the induced rules. At first, the testing was performed on the whole set of words that was used for the training. The accuracy of the rules was 100%, because the rules were induced from exactly the same set of words.
Therefore, to test the real accuracy of the rules, 10-fold cross validation was performed on the set of words. The ten sets were created by a random choice of words, and they consisted of approximately the same number of words (around 500).
There was an important numeric variable, which influenced the 10-fold cross-validation, namely the minimum number of examples each trained MSD should have. By default, that number was set to 100. Changing that number caused slight differences in the accuracy of the rules. If that value were very high, the accuracy would have been smaller. The same happened when that number was very small. Generally, with a minimum number of 100, the average accuracy was around 96-97%.
The next thing that has been done is the opposite process of analysis - synthesis and generation of the word-forms from the lemmas.
The first thing that was done, was rearranging the document with the triplets of the nouns. The columns with the lemma and the word-form were switched, so the triplets looked like this:

lemma <TAB> word-form <TAB> MSD

The process of synthesis is very similar to the process of analysis, so the activities for training and testing the rules are approximately the same. After the rearrangement of the document with the words, transliteration from Unicode/UTF8 to Latin2 has been made.
This was followed by the process of training the rules for the synthesis of word-forms from the lemmas. Again, some mistakes were found and corrected, and the training was repeated. An example of the rules produces can be seen in Figure 4.
Same as in the process of analysis, 10-fold cross validation was performed. The accuracy of the rules is slightly smaller, than the accuracy we have seen for the analysis.
The next step was the generation of all the word-forms for every lemma. The motivation for this was producing a lexicon for all the word-forms appearing in Orwell's „1984". First, it was decided what combination of MSDs one lemma can have. For example, if the gender of the lemma is feminine, then the word-forms of the lemma can have one of these MSDs: Npfsnn, Ncfsnn, Ncfsny, Ncfpny, Npfsvn, Ncfsvn, Ncfsnc, Ncfpnc, Npfson, Ncfson, Ncfsnd, Ncfpnd, Npfpnn, Ncfpnn.

Exceptions:

kolenica -> kolenicite
dete -> decata
zivotno -> zivotnite
bebe -> bebinjata

Rules:

po*e -> po*injata
*ce -> *cata

Figure 4: *Morphological synthesis exceptions and rules for common nouns of neutral gender single.*

Since the MSDs of the possible word-forms of one lemma were known, the induced rules from the process of synthesis could be used to generate all the word-forms of the lemmas. A document of all the triplets: lemma-MSD-word-form, was generated, where every combination of a lemma and a word-form was in a different row (Fig 5.).

vladetel	Ncmsnn	|vladetel|
vladetel	Ncmsvm	|!?!|
vladetel	Ncmson	|!?!|
vladetel	Ncmsny	|vladetelot|
vladetel	Ncmsnc	|vladetelov|
vladetel	Ncmsnd	|!?!|
vladetel	Ncmpny	|vladetelite|
vladetel	Ncmpnc	|???|
vladetel	Ncmpnd	|!?!|
vladetel	Ncmtnn	|vladetela|
vladetel	Ncmpnn	|vladeteli|

Figure 5: *Generated word-forms of the noun 'vladetel'*

The accuracy of the generation of word-forms is not yet known, since there is not a suitable document, in the right format, on which accuracy can be tested.

5 EXPERIMENTAL RESULTS

During the process of analysis and synthesis, measuring the accuracy of the rules has been made.
During the testing of the rules with 10-fold cross validation, the accuracy of every set of words has been calculated (Table 2).

Minimum number	0	10	50	100
Accuracy	96.97%	97.90%	97.29%	97.01%
Standard Deviation	0,71	0,46	0,50	0,47

Table 2: *Accuracy of the rules of analysis*

The total number of Prolog rules and exceptions for the analysis is 317. Here are the accuracies of the rules generated during the process of synthesis (Table 3):

Minimum number	0	10	50	100
Accuracy	94,18%	94,48%	94,61%	94,81%
Standard Deviation	2,72	2,43	1.29	0,18

Table 3: *Accuracy of the rules of synthesis*

The total number of Prolog rules and exceptions for the analysis is 364.

6 CONCLUSION

In the research presented in this paper, we have created Orwell's "1984" corpus, defined MSD specifications for Macedonian language, and manually annotated all the nouns form the created corpus. We have also presented the process of obtaining learning rules for the analysis and synthesis of Macedonian nouns.
We obtained an accuracy of more than 97% for noun analysis, and an accuracy of 94% for noun synthesis. It is encouraging to implement the same approach for other grammatical categories.
Further work will mainly focus on learning more nouns, preferably from the rule-based lexicon [3]. Furthermore, we intend to generate a complete lexicon for Orwell, and manually test at least for sample of forthcoming rule-based lexicon of Macedonian language.

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LEARNING POS TAGGING FROM A TAGGED MACEDONIAN TEXT CORPUS

Viktor Vojnovski[1], Sašo Džeroski[2], Tomaž Erjavec[2]
[1]Institute of Informatics, Faculty of Natural Sciences and Mathematics
Arhimedova 5, 1000 Skopje, Macedonia
[2]Department of Knowledge Technologies, Jožef Stefan Institute
Jamova 39, 1000 Ljubljana, Slovenia
e-mail: sparks@on.net.mk,{saso.dzeroski,tomaz.erjavec}@ijs.si

ABSTRACT

This paper presents several new linguistic resources for the Macedonian language, in particular a language corpus consisting of the digitized and annotated Orwell's "1984" in the Macedonian translation. The produced resources (morphosyntactic specification, lexicon, and corpus) are compatible with the multilingual MULTEXT-East data set. The paper presents the digitisation, up-conversion, alignment, and annotation of the corpus, and then discusses an initial experiment in training and evaluating a Part-of-Speech tagger for the Macedonian language on the produced corpus.

1 INTRODUCTION

Abundant is not the word one would use to describe the amount of linguistic resources available for the Macedonian language. The international linguistic community realized the advantages of a computer based approach long ago, and now computational linguistics is one of the most prominent directions in linguistics. It has to be said that the majority of work done focuses on English, while research in computational linguistics in the context of other languages is much more contained.

The first project to encompass linguistic resources for East-European languages was MULTEXT-East. The EU funded project ended in 1997, but resources for new languages are still being developed [1]; currently MULTEXT-East contains resources for Bulgarian, Czech, Estonian, Hungarian, Romanian, Russian, Slovene, Croatian and Serbian, as well as for English, the "hub" language of the project.

The work described in this paper builds on work by Zdravkova [2], which makes the first contribution to the development of Macedonian morpholexical resources according to the guidelines of MULTEXT-East. The development of the resources was made in three stages. First, morphosyntactic specifications were developed for the Macedonian language. These define the so-called morphosyntactic descriptions (MSDs), which express word-class syntactic information. The second stage was building word-form lexica, which cover the lexical stock of the corpus. Currently, the Macedonian MSD system is fully defined, and an initial attempt at creating a lexical collection was made. In this paper we will build upon this work and use the MSDs to annotate the novel "1984" by G. Orwell, therefore obtaining yet another piece of the MULTEXT-East puzzle.

While PoS tagging is not a new research topic, it is a new field as far as East-European languages are concerned. These languages typically have quite different properties, in particular a much richer word inflection. An even greater problem is the lack of training and testing data, i.e., pre-annotated corpora. In this paper, we will present the first PoS tagging learning and evaluation study ever made on a Macedonian corpus.

The paper is organized as follows. In Section 2, the process of digitalization of Orwell's "1984" is described, giving as a result a version of the book in a standardized format. What follows is the task of tokenizing the text into contextual units: paragraphs, sentences, and words, along with encoding in TEI format, which is the topic of Section 3. Section 4 presents the work done on aligning the sentences of the Macedonian version of 1984 with the English one. Next, Section 5 tackles the problem of learning and evaluation of a PoS tagger over the newly created corpus. Finally, Section 6 concludes the paper by discussing the results and proposes directions for further work.

2 DIGITALIZATION OF ORWELL'S "1984"

The Macedonian translation of Orwell's "1984" is relatively new [3], but nevertheless it suffers from grammatical errors in the translation, as well as many errors introduced during print. Furthermore, no digital version of the text was available to the authors, despite the fact that it was digitally typeset. So, we were facing the dilemma of typing the text anew, or using OCR methods of converting it to digital form. While typing the text from scratch could have helped solve many of the errors so prominent in the book, it was our opinion that it would undoubtedly introduce many new ones, and would surely take too much time.

Error correction

The book was scanned in a Microsoft Word format using ABBYY FineReader. Choosing the OCR method presented us with many challenges. Incorrectly scanned

characters were the first problem we sought to solve. The scanner recognized many Cyrillic characters as Latin ones, namely those whose glyph is shaped the same as a Latin one, and this had to be subsequently corrected.

As the Macedonian spellchecker that comes with Microsoft Office uses a very small wordlist, a list of the most common 300,000 Macedonian words found on Macedonian web pages was used [4]. More that 2000 words were corrected using the spellchecker. The next problem was the recognition of certain typographical characters, such as the dash sign, which was incorrectly interpreted as a minus sign. All of the abovementioned errors, along with a plethora of others, were corrected, resulting with a proofread version of the text.

Technical details

Conversion from Microsoft Word to XML was done using the program UpCast. The output from UpCast is fed through several XSLT conversion scripts, in order to get a TEI encoded version of the text, where the smallest unit of division is a paragraph. It has to be noted that during the process, a whole framework of programs in Perl, driven by Makefiles, was written. Therefore, the entire process is automatic, and all the documents mentioned in the paper can be generated from the initial scanned Word document.

3 TOKENIZING AND ENCODING

Tokenization

The corpus was tokenized using the Perl program `mltokenizer`, which was written during the development of the tool `totale` [5]. It works by splitting the text into tokens (according to language dependent resources, such as lists of abbreviations) and assigning a type to each token. The types distinguish not only words form punctuation, but also mark digits, abbreviations, clitics etc. The tokenizer also marks ends of paragraphs and sentences. Figure 1 is a sample of the tokenized text.

```
TAG     <div type="chapter" n="1" id="Omk.1.1">
TAG     <head>
TOK     I
TAG     </head>
TAG     <p id="Omk.1.1.1">
TOK     Беше
TOK     јасен
TOK     и
TOK     студен
TOK     априлски
TOK     ден
PUN     ,
TOK     а
TOK     часовниците
TOK     отчукуваа
TOK     тринаесет
PUN_TERM        .
```

Figure 1: *The tokenized intermediate version of the text.*

Corpus encoding and structure

Taking the tokenized version of the text as a starting point, the corpus was encoded in accordance with the XML-based recommendations of the Text Encoding Initiative, TEI P4 [6]. As in MULTEXT-East, we used the *TEI.prose* base tag set and the following additional tag sets: *TEI.corpus*, which gives us the root element of the corpus and a more detailed structure of the corpus header; *TEI.linking* for pointer mechanisms; TEI.analysis for basic linguistic analysis; and *TEI.fs* for feature structures, which encode our morphosyntactic descriptions and specifications.

```
<?xml version="1.0" encoding="utf-8"?>
<!DOCTYPE text SYSTEM "tei2.dtd">
<text id="mteo-mk." lang="mk">
 <body id="Omk" lang="mk">
  <div type="part" n="1" id="Omk.1">
   <head>I Дел </head>
    <div type="chapter" n="1" id="Omk.1.1">
     <head>I </head>
      <p id="Omk.1.1.1">
       <s id="Omk.1.1.1.1">
        <w ana="V">Беше</w>
        <w ana="A">јасен</w>
        <w lemma="и" ana="Ccs">и</w>
        <w ana="A">студен</w>
        <w ana="A">априлски</w>
        <c>,</c>
        <w lemma="ден" ana="Ncmsnn">ден</w>
        <w lemma="а" ana="Ccs">а</w>
        <w lemma="часовник"
                ana="Ncmpny">часовниците</w>
        <w ana="M">тринаесет</w>
        <c>.</c>
        <w ana="V">отчукуваа</w>
       </s>
```

Figure 2: *The TEI structure of the novel.*

The novel is composed of three parts and an Appendix, and each of these consists of a number of chapters, marked up using the <*div*> element with the appropriate type attribute. The divisions are then composed of paragraphs (tag <*p*>), and these of sentences (tag <*s*>). All elements, down to the sentence level are given identifiers. Finally, the sentences contain words (tag <*w*>) and punctuation marks (tag <*c*>), which can be qualified by their type and linguistic annotation. This structure is shown in Figure 2.

The size of the Macedonian "1984" corpus is 3.6 MB, and is on par with the MULTEXT-East releases in other languages. The number of different tags used in the final document is set forth in Table 1.

tag	count
<*div*>	28
<*p*>	1287
<*s*>	6821
<*c*>	17075
<*w*>	95954

Table 1: *Tag usage of the corpus.*

Linguistic annotation

For linguistic annotation, the default *TEI.analysis* attributes *lemma* and *ana* are added afterwards from lexical lists containing the word-form, the lemma, and the MSD. For example the Macedonian wordform ден might appear in the corpus as:

```
<w lemma="ден" ana="Ncmsnn">ден</w>
```

At the moment, the first available usage of the word is taken, which effectively removes all ambiguity. Therefore, ambiguous words still have to be corrected by hand in the corpus. Also, only several part-of-speech categories have *lemma* attributes in the encoded corpus, due to the unavailability of wordlists for the other categories. Most notably, verbs and adjectives are represented with an *ana* attribute containing only a part-of-speech category, and have no *lemma* attribute.

4 ALIGNMENT

The Macedonian translation of 1984 was automatically sentence aligned with the MULTEXT-East English original and the alignment hand validated.

The aligning was done using the Vanilla aligner [7]. It is a language independent aligner and uses an algorithm which assumes that the source and its translation consist of an equal number of smaller parallel units, delimited in some known way. All it has to do is to align smaller units inside these parallel units. In our case, the paragraphs were aligned to start with; therefore the alignment problem was driven down to aligning the sentences in each paragraph. So, we assume that the number of paragraphs is the same in both texts and the paragraphs are pair wise parallel. The algorithm also assumes that the order of sentences in the original text is the same as in the translation.

The algorithm works on the basis of the assumption that the length of the original and its translation are correlated. The translations of longer sentences are longer than translations of shorter sentences. When aligning the units, one should try to achieve that the length of the original is not too different from the length of the translation. Therefore it is sometimes necessary to prefer 0-1, 1-2, 2-1 or other complicated alignments to 1-1 alignment. It is also necessary to convert the text to a fixed length encoding, as the algorithm doesn't work with variable length character encodings, such as the UTF-8 we are using. Therefore, the corpus was transliterated to a Latin script, thus enabling the proper usage of the aligner.

The result from the aligner was hand checked several times in order to ensure the correctness of the alignment. However, there were cases where the aligner output wrong alignments, which were documented, and afterwards corrected manually.

The alignments are encoded in a separate document containing references to sentence IDs, as specified by the *cesAlign DTD*, an application of the Corpus Encoding Standard [8]. Figure 3 gives a Macedonian-English alignment span illustrating the syntax and types the alignment links: the first link encodes a 1-1 alignment, the second a 1-0, and the third an 2-1 alignment.

```
<link xtargets="Omk.3.1.76.1 ; Oen.3.1.76.1"/>
<link xtargets="Omk.3.1.77.1 ;"/>
<link xtargets="Omk.3.1.77.2 Omk.3.1.77.3;
                Oen.3.1.77.1"/>
```

Figure 3: *Example of bilingual alignment.*

5 LEARNING POS TAGGING USING TnT

TnT [9], the short form of *Trigrams'n'Tags*, is a very efficient statistical part-of-speech tagger that is trainable on different languages and virtually any tagset. The component for parameter generation trains on tagged corpora. The system incorporates several methods of smoothing and of handling unknown words. TnT is optimized for training on a large variety of corpora. Adapting the tagger to a new language, or a new tagset is very easy. Additionally, TnT is optimized for speed.

The tagger is an implementation of the Viterbi algorithm for second order Markov models. The main paradigm used for smoothing is linear interpolation, and the respective weights are determined by deleted interpolation. Unknown words are handled by a suffix trie and successive abstraction. TnT was chosen primarily for its performance/speed ratio. It currently stands as one of the fastest state-of-the-art PoS taggers available.

Learning the Tagger

The tagset used was the same one we worked with during the annotation. Currently, only a few PoS categories (nouns, conjunctions, particles, and adpositions) utilize the full MSD notation, whereas all the other categories are simply tagged with the PoS category letter, making no distinction on inter-part-of-speech attributes. This has probably led to an increase in the accuracy results, but as recent studies show [10], one not so drastic as to make a huge impact on our results.

For our dataset we took the newly created Macedonian “1984” corpus. As outlined in the previous chapters, the corpus was segmented and tokenized, and each word annotated with its MSD. This fully annotated corpus was converted to a format acceptable by the TnT tagger.

This tagged corpus is then used for learning the tagger, which generates the appropriate n-gram and lexicon files. It is these that are the afterwards used for tagging unknown texts. In absence of other pre-tagged Macedonian corpora, we performed cross-validation on the “1984” corpus, in order to obtain tagging accuracy results.

Evaluation

Average state-of-the-art PoS tagging accuracy is between 96% and 97%, depending on language and tagset. Our system achieved an at least en-par accuracy.

Table 3 presents the accuracy results using 10-fold cross-validation. The results were averaged over 10 test runs, and the training and test set were disjoint and randomly picked. The table shows the percentage of unknown tokens, separate accuracies and standard deviations for known and unknown tokens, as well as the overall accuracy. Let us note the achieved accuracy of 100% for known tokens. This is due to the absence of ambiguity between PoS categories in the corpus, as it has not yet been hand tagged with the correct morphosyntactic annotations. Introduction of the correct annotations in the corpus will result with a slight decrease in the accuracies achieved.

percentage	known		unknown		overall	
unknowns	acc.	σ	acc.	σ	acc.	σ
10,99%	100%	0	83,2%	0,71	98.1%	0,22

Table 3: *Part of speech tagging accuracy.*

Figure 4 shows the learning curve of the tagger, i.e., the accuracy depending on the training data. The bottom axis shows the training set size i.e. the number of tokens used for training. Each training set size was tested ten times, the training and test sets were disjoint and picked randomly, and the results were averaged. The training length is given on a logarithmic scale.

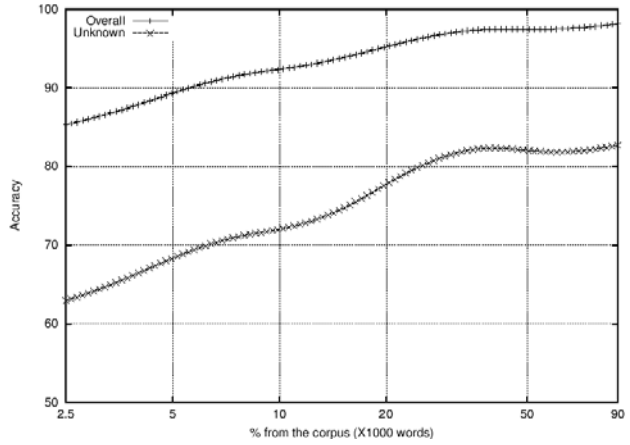

Figure 4*: Learning curve for tagging the corpus.*

6 CONCLUSION AND FURTHER WORK

In this paper we presented the process of digitalization of Orwell's "1984", and the subsequent conversion to a standard TEI format, resulting with the first annotated corpus in Macedonian.

In addition, we described the creation of an alignment between the sentences in the Macedonian and the English editions of "1984", therefore producing a substantial equivalence of the documents present in MULTEXT-East for the other languages.

We used our newly created resources for learning a PoS tagger for the Macedonian language. The outcome of the evaluation, albeit over incomplete data, showed promising results on par with state-of-the-art PoS tagging accuracies.

Considering further work on the subject, it is our opinion that finalization of the lexical lists, and subsequent automatic and hand tagging of the corpus is of prime importance. Re-learning the tagger with those resources would yield the real tagger performance.

It would also be of interest to see how the tagger would perform on a non-"1984" text, which illustrates the importance of creation of new annotated corpuses.

Overall, the resources created and the results obtained provide a milestone that should be built upon, and we hope that it will serve as a reference point for all kinds of Macedonian language engineering applications.

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SECTION: KDD Applications and Methods

MODELING LINK QUALITIES IN A SENSOR NETWORK

Jure Leskovec, Purnamrita Sarkar, Carlos Guestrin
Center for Automated Learning and Discovery,
School of Computer Science,
Carnegie Mellon University
{jure, psarkar, guestrin}@cs.cmu.edu

ABSTRACT

Sensor networks are ad-hoc wireless networks of small, low-cost sensors, which can measure characteristics of their environment. Autonomous low-cost sensors often have limited battery life, and are prone to failures and communication losses. It is thus important to devise efficient power usage, communication and message routing schemes. In this work, we concentrate on estimating the link qualities between pairs of sensors in a natural environment. The estimation is a basic component for algorithms that optimize the power of radio transmission signal, communication schedules, and a routing scheme. Our results show that simple regression models give estimates with only 6% error. We also show the dimensionality reduction techniques help us understand the topology of the communication network and identify potential bottlenecks in the network.

1 INTRODUCTION

A sensor network node is a small autonomous unit, often running on batteries, with hardware to sense environmental characteristics, such as temperature, vibrations and humidity. Such nodes usually communicate using a wireless network. A sensor network is composed of a large number of sensors deployed in a natural environment. The sensors gather environmental data and transfer the information to the central base station with external power supply [11].

Owing to the limited battery power of these sensors a very common strategy to maximize the expected lifetime is to use a better communication strategy. For this strategy to be globally optimized, we must model link qualities (LQs) between pairs of sensors. More precisely, the probability that sensor *j* will receive a message transmitted by node *i*.

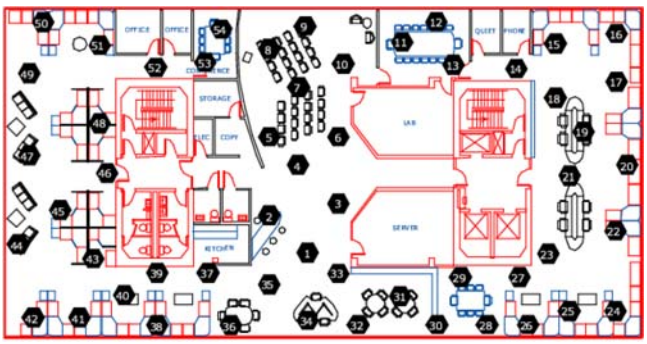

Figure 1: *Sensors in the Intel Berkeley Research lab*

Precise models of link qualitites are the basis of many optimization and networking algorithms. For example, these models can be used to refine the communication protocols, or to decrease the number of packet collisions by tuning radio power appropriately. A proper model for link quality can also be used to select the density and positions of the sensors to ensure efficient communication. These models can also helps us ensure robustness of the underlying network by finding the most unstable parts of the network, and the sensors which are critical for communication.

2. THE DATASET

The data comes from a deployment of 54 sensors positioned inside the Intel lab in Berkeley [3]. We have 33 days worth of data. For every 30 seconds we have a reading of binary link qualities between all pairs of sensors. There are more than 2.3 million readings in total (500MB of data). During the data collection period some nodes died and there are about 1% of readings with missing values. The readings from sensors are highly noisy and skewed due to power failures, crashes of base station, sensor failures and rapid changes in environmental conditions.

Figure 1 shows the map and the positions of 54 sensors inside the Intel Berkeley lab. The lab has a ring structure. The two ‘holes’ on the map correspond to the kitchen and the elevators. Near to the upper right corner of the map there was a cell phone base station. For this reason link qualities in the upper right part of the building are lower and decay faster with the distance than the link qualities for other parts of the building.

3. ANALYSIS OF LINK QUALITY

There are two obvious variables influencing the link quality: one is time and the other is location. Figure 2 shows the variance of link qualities over time of sensor 34 to all other sensors. We can observe that the variance is very low on the average. From figure 2, other experiments and measurements we concluded that link qualities do not change significantly over time.

So our work mainly concentrates on spatial link qualities. For spatial link qualities we try to relate physical position of the 2 sensors with the link quality. Having the (x,y) positions of the sensors we model the decay of link quality with the distance and build a link quality map.

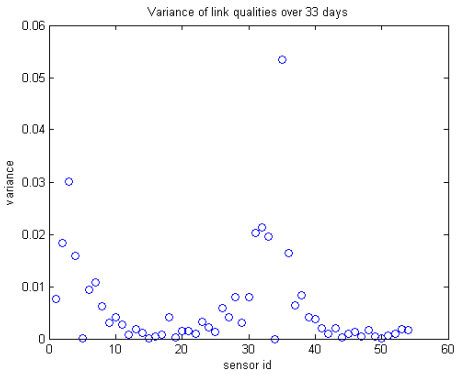

Figure 2: *Variance of link quality over time of sensor 34 to all other sensors. Notice the small variance.*

3.1 Link quality versus distance

Theoretically the strength of radio signal should drop with the square of distance, so we expected link quality to follow the same law. We analyzed a typical situation and tried to fit a function to the link qualities. We took sensor number 38 and plotted the link qualities to other sensors versus their Euclidean distance. A quadratic function had a very poor quality fit (R^2=0.55), a power function (LQ=distance^{-c}), with *c* around 2 performed even worse with R^2=0.19. On the average the quadratic regression was the best, with the average R^2 around 60%. The fits for power function were not at all very satisfying, having an average R^2 of 20%.
Investigating even further we tried to fit a second degree polynomial to the link quality vs. distance between each pair of sensors. Figure 3 shows the amount of noise in the data. The results were also not at all promising. We also tried to use different distance measures, especially ones motivated by the connectivity graph, but this also didn't help.

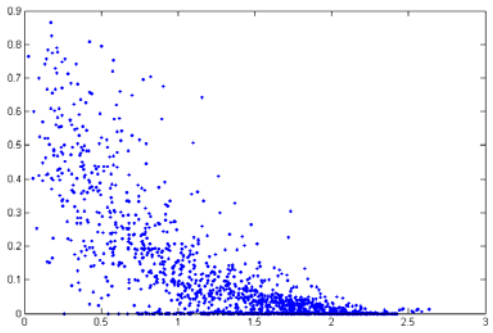

Figure 3: *For all possible pairs of nodes we plot link quality versus the distance between the sensors.*

3.2 Dimensionality reduction

So far we have been working with full 54 by 54 who-talks-to-whom link quality matrix. One way to reduce the amount of noise in the data is by using dimensionality reduction techniques. We use Principal Component Analysis (PCA) [2]. We perform PCA on 54 by 54 link quality matrix. We essentially do a metric multidimensional scaling [1] on the data to learn the underlying coordinates in a 3-dimensional Euclidean space, namely the latent space. The first 3 eigenvectors explain around 70% of the variance of the data. Increasing to 4 dimensions covers additional 5% more variance so we decided to continue experimenting with 3 dimensional latent space.
Figure 4 shows the latent coordinates of the sensors in a 3-dimensional space. We can clearly observe the two rings we had seen on the map of the lab (Figure 1). This means we are able to reconstruct the map of the lab using only the link quality data. This also implies that the sensor locations should be good attributes for modeling the link qualities. Notice also the big gaps in the rings. This shows the "hole" and a potential bottle neck in the communication network and suggests deploying more sensors in that part of the lab.
A close inspection of figure 6 reveals a set of nodes outlining a big hole in the graph. If any two of these nodes dies the communication between two halves of the network will seriously interrupted. These nodes are critical for the communication of the network. This suggests that one needs to deploy more sensors in this part of the lab to increase the robustness of the network. Thus we see that the multidimensional scaling approach reveals some very important and interesting patterns in the data, besides matching the true map of the sensor locations.

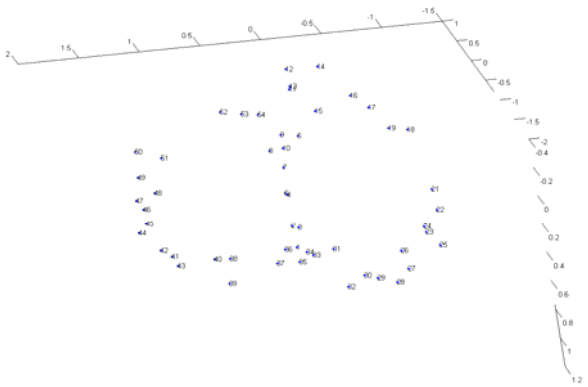

Figure 4: *The projection of link quality data on first 3 principal components. Notice the two rings very similar to actual map of the lab.*

3.3. Link qualities via dimensionality reduction

Now we use the notion of latent space to construct a 2 level model for link quality prediction. We will first learn a regression model to map from sensor (x, y) lab coordinates to the 3D latent space position. We then use the principal components to map from 3 dimensional latent space to the original 53 dimensional vector of link qualities. Figure 5 more clearly depicts our idea.
Note that we learn 3 separate regression models, each from mapping from (x,y) lab location to of the sensors to a particular latent space dimension. We use linear, quadratic and cubic regression. Also note that we have only 54

training instances. We performed leave one out cross validation and report the mean absolute error. Table 1 shows results on test and training set for the 3 models. Notice that quadratic model performs best and the cubic model overfits the data.

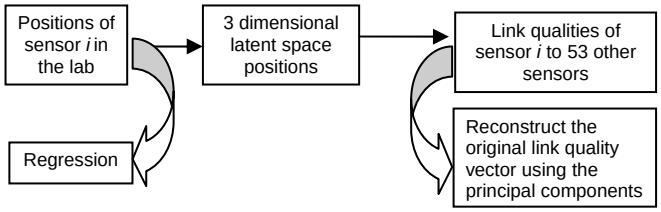

Figure 5: *The 2 level model. We learn 3 regression models to map from (X,Y) positions to latent space positions. We then use principal components to map from the latent space to the link qualities.*

Regression type	**Training Set** Mean Error	**Test Set** Mean Error
Linear		
LS dimension 1	0.073	0.078
LS dimension 2	0.229	0.244
LS dimension 3	0.124	0.131
Quadratic		
LS dimension 1	0.045	0.051
LS dimension 2	0.078	0.090
LS dimension 3	0.071	0.083
Cubic		
LS dimension 1	0.038	0.050
LS dimension 2	0.077	0.098
LS dimension 3	0.062	0.099

Table 1: *Performance of the regression mapping from XY to the latent space*

We also examined at the scatter plot of predicted latent space positions and the true latent space position of a particular sensor for the quadratic model. For all three dimensions we found that the residuals are well distributed, and concluded that the quadratic model is suitable.

So far we build the model to map from physical sensor positions to 3 dimensional latent space positions. Now we perform the last step where we use principal components to map from 3 dimensional latent space to original 54 dimensional vectors of link qualities. Using quadratic regression model and 3 dimensional latent space the final mean square error of link qualities is 0.14. If we increase the number of dimensions in the latent space to 4, the error increases to 0.145. Increasing the number of dimensions further to 10, gives the average mean error of 0.20.

As we pick more latent space dimensions the mapping from latent space to the link quality gets more accurate. On the other hand the mapping from (x,y) positions gets less accurate and the combination is worse performance. The problem with learning mapping to higher latent space dimensions is that they contain more noise, so the regression gets unstable with large errors. Using cross validation we get the best results when using 3 dimensional latent space.

3.4 Direct approach

We also tried a more direct approach of learning link quality between a pair of sensors given the lab coordinates of them, using a regression model. In this case we have 2862 (54 squared) training examples each having 4 real attributes (locations of the two sensors). As in previous section we perform 10 fold cross validation and report average mean error on training and on test set.

We compared 3 classes of algorithms: normal least squares polynomial regression, a variant of logit transform and regression Support vector machines [4] using polynomial and radial kernels. For the logit transformation our idea was to transform the link qualities (which are probabilities and thus reside on interval (0,1)) to the whole real space. Our hypothesis was that it may be easier to learn the link qualities spread out over the whole real space. In this case we transformed the link quality *LQ* with the equation *LQ' = log(LQ/(1-LQ)).* We then learned the regression model, performed the inverse logit transform and measured the mean error.

Regression type	**Training set** Mean Error	**Test set** Mean Error
Normal		
Linear	0.108	0.108
Quadratic	0.087	0.088
Cubic	0.086	0.088
Logit transform		
Linear	0.409	0.409
Quadratic	0.412	0.412
Cubic	0.411	0.411
SVM		
Linear	0.119	0.119
Quadratic	0.093	0.093
Cubic	0.090	0.090
6 deg polynomial	0.082	0.083

Table 2: *The performance of various regression techniques*

Table 2 shows the results for the 3 classes of regression algorithms we tested. Our first observation is that even simple linear regression outperforms our 2 level model by 4%. We observe a 2% improvement of quadratic and cubic model over the linear model. Next observation is that logit transform performs far the worse. It performs a bit better than random guessing which has the mean error of 0.5. The SVM with polynomial kernels have similar performance as normal least squares regression using the same degree polynomial as in SVM kernel. We observe that even very high degree polynomial kernel of degree 6 does not help to fit the data very well.

The radial kernel beats all other techniques with a mean error of around 6% on both training and test set. Radial

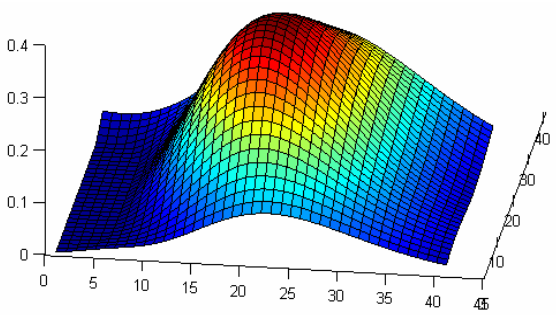

Figure 6(a): *Link quality map for a sensor in the center of the Intel lab.*

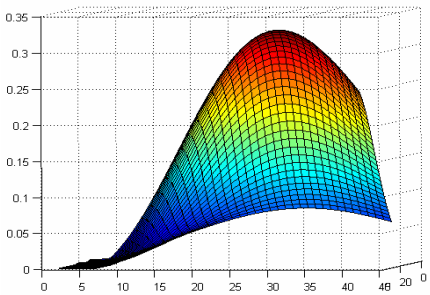

Figure 6(b): *Link quality map for a sensor in the corner of the lab.*

kernel is especially appropriate for this task, since it has a bell shape, which means that a link quality basically decays in a bell shape with the distance.

Having built the model we can now look at the link quality map for a particular sensor. We fix the location of the first sensor and then for every position of the second sensor we use the model to obtain the link quality. We call this the link quality map.

Figure 6 shows the two examples of link quality maps generated using the SVM radial kernel. Figure 6(a) shows the case when we positioned the sensor in the center of the lab. We observe a bell shape decay of link qualities. Notice how the link qualities are very low on the left middle part of the figure. Notice also that on the left side in the top corner link quality is better than left middle and left bottom corner. This is because left bottom part is further away and better hidden behind the wall. There is also a cell-phone base station on the left part of the map, which further decreases link qualities. One would falsely expect that link qualities in the holes of the two rings (kitchen and the elevator) should be close to zero. This is not the case since we have no data points inside those rings and the link quality just gets interpolated over that empty space. Figure 6(b) shows the case when the sensor is positioned into a corner of the lab. We observe a similar bell like decay of link quality away from the sensor.

4. RELATED WORK

The power efficiency plays a central role in sensor networks. People investigated scalable and power-efficient protocols [5], power management [6], efficient routing [7] and querying in sensor networks [8]. The most related to our work are [9] and [10]. Our findings are in accordance to conclusions in [9] that the link characteristics are far from the theoretical models. However, these works survey the detailed link stability but not its effect on positioning, while our work concentrates in modeling link qualities in a natural environment and how they change with positions of the sensors.

5. CONCLUSIONS

In this work, we showed exploratory results on the modeling of link qualities in a sensor network. Since link qualities are often invariant with respect to the time, we focused on the spatial aspect. In our experiments simple regression techniques were quite effective. However, in our comparisons, support vector regression with radial kernel was the best performing approach. Intuitively, link qualities decay with distance, a property captured effectively by this model. We also showed how dimensionality reduction techniques can be used to analyze link qualities, identifying critical nodes and sparsely connected parts of the sensor network.

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ANALYSIS OF DEMINING PROJECT PROPOSALS

Matjaž Bevk, Dunja Mladenić
Department of Knowledge Technologies
Jozef Stefan Institute
Jamova 39, 1000 Ljubljana, Slovenia
Tel: 386 1 4773127
e-mail: matjaz.bevk@ijs.si

ABSTRACT

This paper is an analysis of project proposals for mine clearance of mine-affected areas. Specifically we are studying the relationship between proposals and their evaluation scores influencing their funding possibilities. First we investigate the possibility of building a reliable predictive model for automatic evaluation score prediction from the attributes of the proposal, and second we analyze individual attributes and their trends with respect to the evaluation score of the proposals.

1 INTRODUCTION

The goal of this study is to investigate, how can machine learning methods help in a time consuming task of project proposal evaluation. Our problem domain are project proposals for mine clearance of mine-affected areas. The proposal evaluation procedure consists of three phases: administrative (checking the formal appropriateness), technical and financial. This study considers the technical evaluation only.

Technical evaluation involves analyzing several parameters which describe project team, animals (dogs), execution plan and equipment to be employed on a contract. The task is to evaluate these parameters in accordance with call for projects and rate the proposal with a numerical score from 0 to 100. The proposals with satisfactory technical score (above a predefined threshold) are further evaluated from financial perspective, which is not the subject of this paper.

The paper is organized in the following manner. In section 2 we present our solution plan and the procedure of data acquisition. Section 3 describes experiments and their results and in the last section we give the conclusions of this study.

2 SOLUTION PLAN AND DATA ACQUISITION

Our data base consists of 10 calls for projects and 39 proposals. The number of proposals per call varies from 3 to 6. Together with domain expert we defined a set of 23 attributes, which are important for technical evaluation. To obtain a data set as accurate as possible, we engaged a human operator to extract the attributes from the proposals which are originally unstructured text documents. We also added two attributes, which were extracted from the corresponding call for projects. These two attributes describe the contract value and the size of the area to be cleared. And finally, we also added the target concept, namely the attribute representing the evaluation score of the proposal assigned by an evaluation committee.

With data base constructed, we wanted to see if we can get some insights in the relation of evaluation score and the attributes describing content of the proposal. We are also interested in a predictive model and in attributes which are the most effective for prediction of the proposal technical evaluation score.

3 DATA ANALYSIS

Our data consists of 39 cases each described by 26 attributes. The target attribute (score) is a real value between 0 and 100, which means that we are dealing with a regression problem. Actually the score ranges from 69.2 to 80.6, which can be seen in Figure 1.

3.1 Target attribute transformation

Since we have small amount of cases (proposals), we decide to binarize the real-valued score attribute by dividing proposals that scored first and the ones that scored below the first. This gives us a binary target attribute, with majority class probability of 0.74.

3.2 Analysis with machine learning

Let us now apply machine learning algorithms to the data set to check how well can the binary score be predicted from the extracted attributes. For this purpose we used three algorithms SMO [3], j48 [4] and Naïve Bayes [5] from the WEKA machine learning software [6]. Since we have a relatively small data set, we use leave-one-out validation method to evaluate the obtained models.

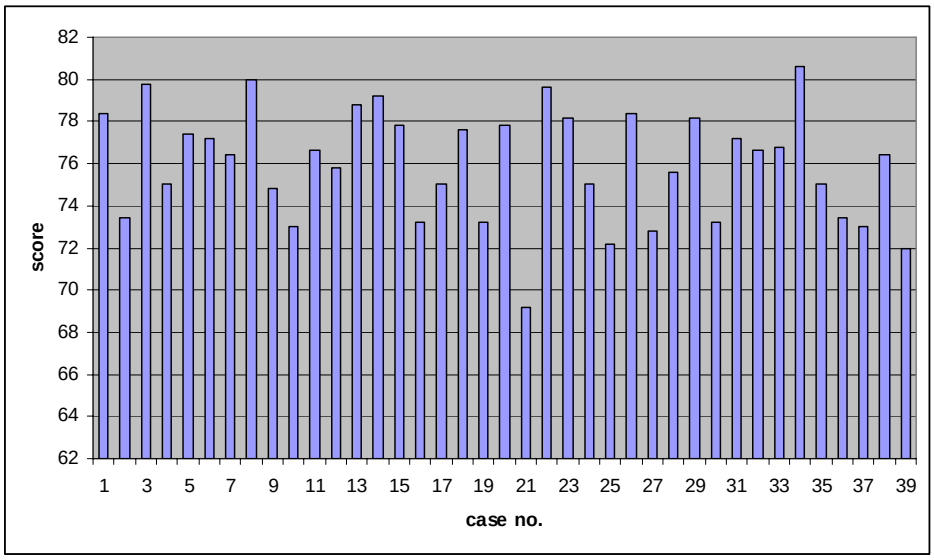

Figure 1: Graph showing values of the score attribute.

algorithm	accuracy	st. deviation
Baseline	74.4	44.2
J48	79.5	40.9
Naïve bayes	66.7	47.8
SMO	76.9	42.7

Table 1: Classification accuracies and standard deviations of j48, Naïve Bayes and SMO algorithm on our data set.

From the Table 1, we can see that neither of the three algorithms managed to improve the accuracy significantly over the baseline. Thus we conclude, that building a usable prediction model is not possible with the present data set. However, we can still take a peek at the models, for instance a decision tree built by j48 and investigate the most important attributes in that tree (Figure 2).

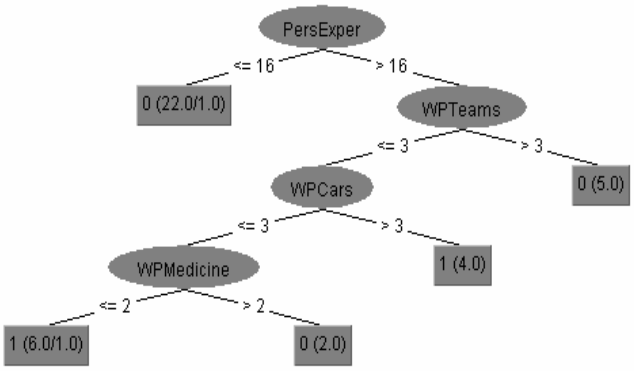

Figure 2: Decision tree built by j48.

In Figure 2, we see that the most important attribute is the experience of the personnel (PersExper). Figure 3 shows a graph containing the rank of the proposal against average experience of the personnel.

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Graph in Figure 3 shows a trend which means that better personnel experience yields better rank in the evaluation of the proposal, which is also reasonable.

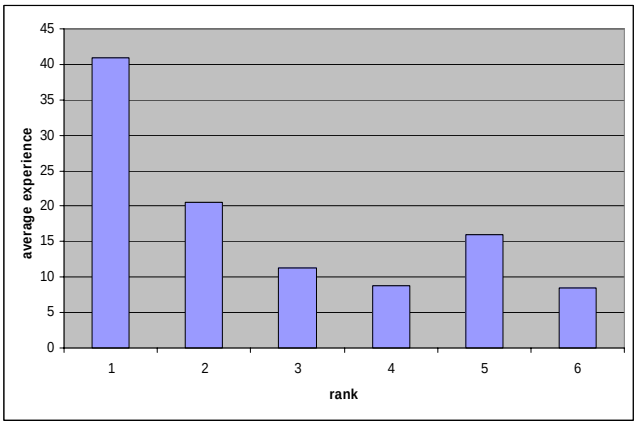

Figure 3: Graph showing the rank of the proposal against average experience of the personnel

3.3 Analysis of important attributes

In section 3.2 we tested several prediction models generated automatically from the available data, but using the available limited amount of data we did not get much further from the baseline prediction. However, by analysis of the generated models we found an interesting and reasonable trend in the data. Thus, we continue in that manner and analyze the most important attributes. In order to identify important attributes, we use one of the measures for attribute evaluation ReliefF [1,2]. Then, we plot the five most important attributes on graphs showing rank of the proposal against one of the selected attributes. Table 2 shows the top five attributes. Figure 4 through Figure 8 plot each of the top attributes against the average value of rank.

rank	Attribute
1	Dogs (number of dogs)
2	PersExper (experience of the personnel)
3	Helmets (number of helmets)
4	Vests (number of vests)
5	Cars (number of cars)

Table 2: Top five attributes as ordered by ReliefF.

Figure 4 is a graph showing a relationship between rank of the proposal against average number of dogs per rank. The trend here is clear: More dogs employed on a contract means more chances of getting a funding.

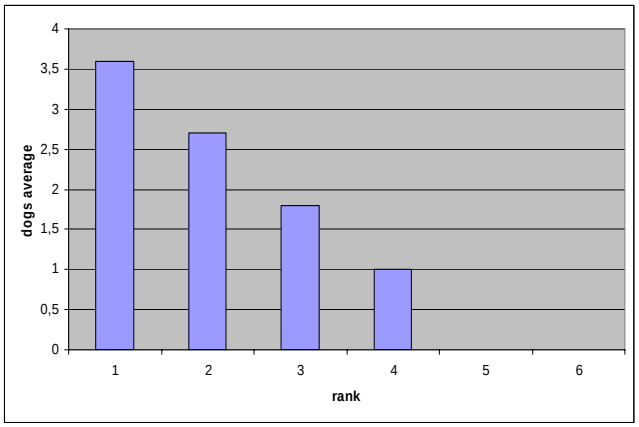

Figure 4: Graph showing the rank of the proposal against average number of dogs per rank.

The second attribute PersExper was already analyzed in section 3.2 and plotted in Figure 3. The trend shows that more experience of personnel means more chances of successfully getting funding for the proposal.

The third most important attribute is the number of helmets to be used on a contract. This attribute is plotted in graph in Figure 5. The trend indicates that, less helmets mean more chances of a success, which is a bit unusual. This fact could be explained away with a conclusion that excessive use of resources means less chances of a success in getting funding.

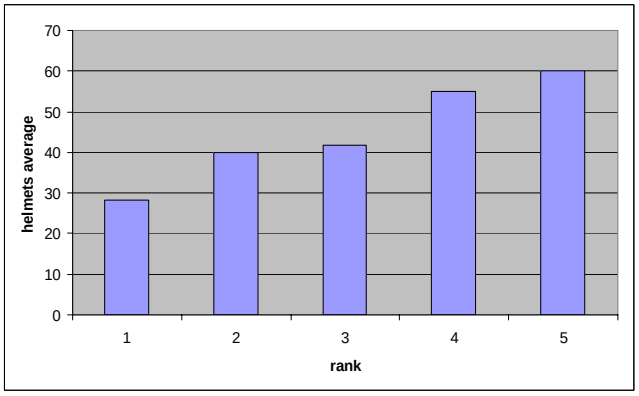

Figure 5: Graph showing the rank of the proposal against average number of helmets per rank.

The fourth attribute is the number of protective vests to be used on a contract. This attribute is plotted in a graph in Figure 6. The trend is similar to that for the helmets attribute. It shows that less protective vests means more chances of a success.

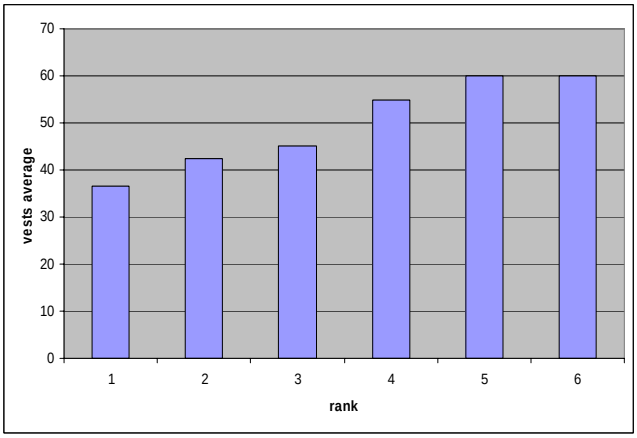

Figure 6: Graph showing the rank of the proposal against average number of protective vests per rank.

The fifth attribute is the number of cars to be used on a contract. The attribute is plotted in a graph in Figure 7. The trend here is not clear.

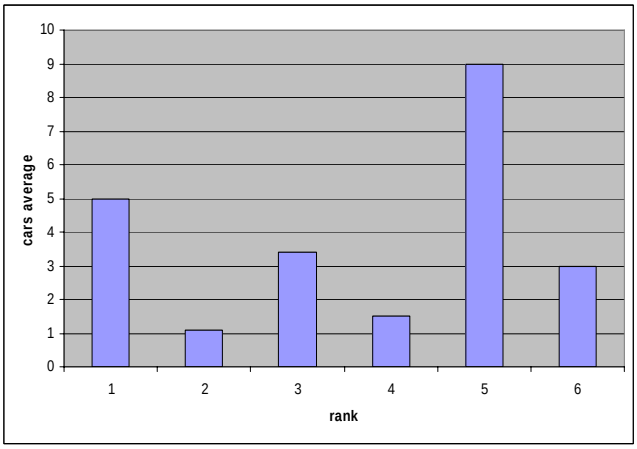

Figure 7: Graph showing the rank of the proposal against average number of cars per rank.

4 CONCLUSION

The subject of this paper is analysis of project proposals for mine clearance of mine-affected areas. We wanted to alleviate the time consuming task of project proposal evaluation.

The intention was to build a classifier which would predict proposal estimates from parameters which were previously extracted from documents. It turned out that, we were

unable to construct a reliable classifier from our data set. One of the explanations for this fact could be a relatively small number of learning examples.

Further on, we analyzed five most important attributes according to ReliefF measure. We found out some interesting trends. The most important attribute was the number of dogs employed on a contract. The trend showed that employing more dogs helps achieving a high evaluation score. The second important attribute was experience of the personnel. It turned out that employing a more experienced personnel is also a very important factor of success. The third and fourth important attributes were the number of helmets and protective vests respectively. It turned out that using more equipment (helmets and vests) is not favorable for the success of the proposal. The fifth important attribute was the number of cars to be used on a contract. This attribute showed no apparent trend.

To give a concluding remark: We weren't able to obtain a good predictive model from our data set, but the analysis of the individual attributes showed some interesting trends, which seem to have an important influence on the evaluation score of the proposals.

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Constrained Clustering of Gene Expression Profiles

Ivica Slavkov[1], Sašo Džeroski[2], Jan Struyf[3], Suzana Loškovska[1]

1. Faculty of Electrical Engineering, University of "Ss. Cyril and Methodius", Skopje, Macedonia
2. Department of Knowledge Technologies, Jožef Stefan Institute, Ljubljana, Slovenia
3. Department of Computer Science, Katholieke Universiteit Leuven, Leuven, Belgium

ABSTRACT

In this paper a querying environment for analysis of patient clinical data is presented. The data consists of two parts: patients' pathological data and data about corresponding gene expression levels. The querying environment includes a generic algorithm for constructing decision trees, as well as algorithms for discretizing gene expression levels and for searching frequent patterns (itemsets). The algorithms are accessed by means of a query language. The language can be used to simulate various data mining algorithms, such as the one developed by Morishita et al. for Itemset Constrained Clustering.

1 INTRODUCTION

In recent years a lot of data recording gene expression levels (microarray data) has been generated at a very high throughput. One of the challenges faced by molecular biologists is to discover knowledge from this data. This includes diagnosis of disease, classifying disease and gaining information that can suggest possible treatments. Various data mining techniques have been developed for finding useful gene expression profiles (discovering bi-sets, formal concept mining [5]) and for discovering relations between the patients pathological information and microarray data. Of particular interest to this paper is the technique of itemset constrained clustering of gene expression levels based on patients' pathological features.

2 ITEMSET CONSTRAINED CLUSTERING

A classical approach towards relating the two parts of data (pathological and gene expression) would be a two step clustering-classification process (Figure 1). First, the clustering is performed according to the similarity of gene expression profiles and then a classifier is constructed for each cluster. The classifier is actually one of the pathological features (attributes), i.e., it predicts a tuple to be in the cluster if it includes the particular feature, and usually does not have 100% accuracy. Itemset constrained clustering [3] takes this one step further by allowing *n*-itemsets of the pathological data to act as classifiers, but only if they have 100% accuracy. It allows only clusters which can be expressed by item sets. The IC-clustering algorithm itself, is an association rule mining and clustering algorithm at the same time. The index which is maximized in this algorithm is *interclass variance*, which is defined as follows:

Let *n* be $|D|$ (the number of tuples) and $x(I)$ be $|D_I|$ (the number of tuples including itemset *I*) for a given database $D = \{t_1, t_2, ..., t_n\}$. Let $s_i = \sum_{t \in D} t[a_i]$, and $y_i(I) = \sum_{t \in D_I} t[a_i]$, then the *interclass variance* is defined as:

$$\mathrm{var}(D,I) = x(I)\sum_{i=1}^{m}\left(\frac{y_i(I)}{x(I)} - \frac{s_i}{n}\right)^2 + (n - x(I))\sum_{i=1}^{m}\left(\frac{s_i - y_i(I)}{n - x(I)} - \frac{s_i}{n}\right)^2$$

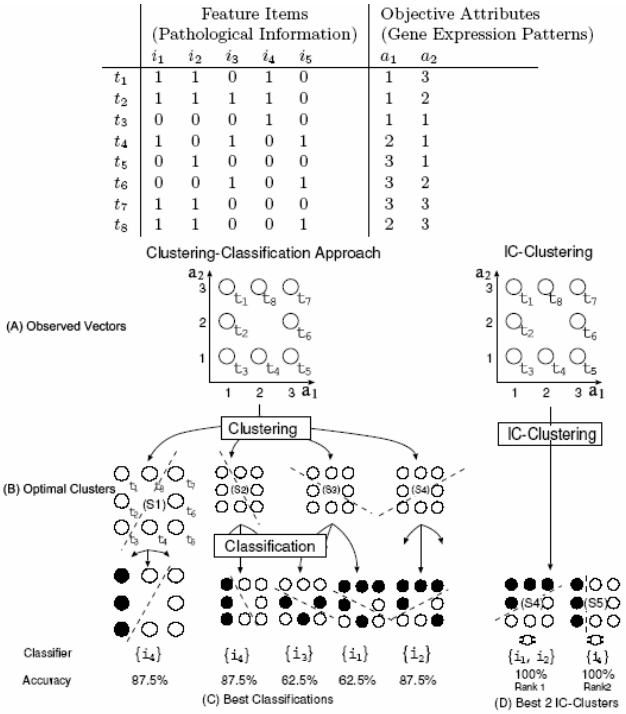

Figure 1: A comparison between the clustering-classification and itemset-constrained clustering approach.

In short, the IC-clustering algorithm can be described as follows.

IC-clustering algorithm:

- **Input:** minimum cluster size (C), maximum number of tuples in which an item *I* is contained (S)
- **1**. Search for a feature itemset that splits the tuples into two clusters
- **2**. Compute the interclass variance between the clusters
- **Output:** List of the top *N* itemsets sorted by interclass variance

3 QUERY LANGUAGE

The purpose of developing the query language was to allow a simple and easy-to-use approach towards mining gene expression data. On one hand it allows mining for local patterns (i.e., finding frequent itemsets) and also for the creation of global models of the data like predictive clustering trees [1]. It also has various discretization techniques for microarray data implemented (Mid Range, X%Max, Max-X%Max), as described in [6]. For each query the rule is that it always has as input a data table specified, and as a result it also returns a table, but analysed or processed in some way. Also, the idea was to relate the query language to inductive databases [2] by allowing compositionality of the queries: the output of one query can be used as an input to another.

3.1 Query Language Syntax

The rules for generating the query language predicates are given in BNF[1] form. They can be divided in a number of groups according to their function.
The first group would be the one that allows basic content selection. It consists of the following three clauses:

<create-clause>

Used for creating new tables from rows and columns previously selected or processed in some way. It has the following notation:

<create-clause>::= **create** <table-name> **using** <extend-clause>|<select feature-clause>

example: **create** "newPatients" **using select from** "patients" **where** "tumor==yes"

<extend-clause>

Useful for extending existing tables by adding new attributes (columns) which are somehow acquired.

<extend-clause>::= extend <table-name> **with** <table-name>

example: **extend** "pathological" **with** "genes"

<select feature-clause>

Selecting a specific part of the data is often required. With this clause, a selection can be made by specifying a set of names of attributes, by certain attribute values or by simply selecting which rows and columns are needed.

<select-clause>::= select from <table-name> **where** (<attnames="names"> | <att-names=att-values> | <rows&columns>)

example: **select from** "genes" **where** "attnames=={gene1, gene5, gene9 }"

The clauses through which basic data mining tasks can be achieved are:

<discretize-clause>

Gene expression level data often needs to be discretized before various data mining techniques for pattern discovery can be used. Many discretization techniques have been proposed [6] and several are implemented in our query language.

<discretize-clause>::= discretize (* | < att- names > | <rows&columns>**) in** <table-name> **[using** <method name>**]**

example: **discretize * in** "geneNumeric"

<frequent items-clause>

Discovering frequent itemsets (patterns) from Boolean data is very useful for extracting information, especially for discovering genes that are co-regulated. The following clause uses ACminer [7] to extract these frequent itemsets with specified support.

<frequent items-clause>::= **frequent itemsets in** (<table-name>) **with support** <real>

example: **frequent itemsets in** "pathological" **with support** 0.65

<external-clause>

For greater flexibility in using the query language, the external clause can be used. The idea is to allow an interface with external programs which can be used to further process the data or represent it in some other way.

<external-clause>::= call external <program name & location> **[using** <parameters>**]**

[1] Backus Naur Form.

example: **call external** "c:\program\program.exe" **using** " -i "file" "

<convert-clause>

This clause provides some basic conversion utilities. Usually data represented in binary form is not suitable as input to the different miners, so it must be transformed to the required format.

<convert-clause>::= convert (bin | miner | freqitems) <table-name> **to (miner|bin|features)**

example: **convert bin** "patientsBin" **to miner**

<predict-clause>

This is the last clause, and it is used for interfacing with the Clus system (Section 3.2). Clus is used for constructing predictive clustering trees [1], with support for certain constraints, which are specified in the <parameters> part of the predict clause.

<predict-clause>::=predict from <table-name> **using** <parameters>

example: **predict from "**patients" **using** clusterN=50

3.2 Brief Description of Clus

Clus is a generic system for constructing decision trees. It can be used to create classification trees for predicting symbolic attributes and regression trees for predicting numerical values. In some cases it is useful to predict several attributes at the same time, so multi-objective decision trees can also be constructed. Clus can generate so-called Predictive Clustering Trees (PCTs) [1], using a beam search algorithm. PCTs are decision trees that are used for hierarchical clustering purposes. Clus also allows for generating trees with user-constraints, which can be supplied to Clus by means of our query language.

4 SIMULATING IC-CLUSTERING

The IC-clustering algorithm can be easily simulated without its dedicated implementation with the help of the query language described above. It is an association rule mining and clustering algorithm, so it can be simulated by the following steps:

- Find frequent itemsets using the patients pathological data
- Create a modified patient record using the previously generated frequent itemsets
- Create PCT stubs using the beam search algorithm of Clus

The first step is finding frequent itemsets in the patient records Boolean data, with the user specified support. The ability to specify the support of the frequent itemsets simulates the parameter *C* (minimum cluster size) in the IC-clustering algorithm. The second step of creating the so-called modified patient records is actually using the frequent itemsets as patient features, i.e., we add a Boolean attribute for each of the item sets, which takes the value true if and only if the record contains the item set. To this modified patient record we "append" the gene expression level data. By using Clus we generate PCT stubs, i.e., decision trees with only one test node. The test is selected from the modified pathological data and imposes a binary split (clustering) on the samples. The interclass variance is calculated for each stub and if the corresponding clustering is suitable it is put in the current search beam of width N.

5 RESULTS

The first scenario for analysing gene expression data with the query language that we considered was the previously described simulation of IC-clustering. The queries which are used to perform this simulation are:

- **create** *"freqpatients"* **using frequent items in** (**convert bin** *"patients*" **to miner**) **with support** 0.*1*
- **create** *"features"* **using** (**convert freqitems** *"freqpatients"* (**convert bin** *"patients"* **to miner**) **to freqfeatures**)
- **extend** *"features"* **using** *"expression"*
- **predict** *"features*" **with** *clusterN=100 targetAtt=535-2527*

The first query creates a table that is generated using the frequent itemset clause. The support is set to 0.1 to match the one that is used in [3]. Then with a few conversions the frequent itemsets are used to modify the patients' pathological data and create the "features" table. In the third query the gene expression levels are merged with the modified patients' pathological data. In the end the PCTs are created using Clus.

The dataset that was used is the same as in [3]. It contains patient records of 213 patients. The gene expression level data considers 1993 genes. The data has been previously preprocessed and missing values were substituted (predicted) in some way. The patients' pathological data contains the features: age >/< 65, sex M/F, tumor/except tumor, chirossis/ no chirossis, abnormal / normal liver, abnormal/normal liver function.

The results that were acquired are presented in the following table:

Rank	Constraint	Cluster size	Interclass variance
1	{tumor}	107	3126.9
2	{except tumor, normal liver function}	88	2534.7
3	{except tumor, HBV-}	88	2397.3
4	{tumor, man}	86	2181.5
5	{except tumor, HBV-, normal liver function}	74	2098.9
6	{except tumor, man}	83	2037.87
7	{except tumor, no cirrhosis}	68	1979.74
…	…	…	…
17	{tumor, not over 65 years old}	55	1587.7

The results in this table are identical to those in [3][2].

The second scenario concerns prediction of patients diagnosis from gene expression levels. The microarray data was first discretized using the Max-X%Max method, for a threshold of X=50% which encodes the over expressed genes with 1 and the others with 0. Then frequent itemsets were found with a support greater than 30%. Similarly as in the previous scenario they were used as features and a modified gene expression dataset was created. They were combined with the patient pathological data. Prediction was made with Clus concerning which set of genes are over expressed in patients that have a tumor.

The queries that were used are:

- **create** "*freqGenes*" **using (frequent itemsets in** (**discretize * in** "*genes"* **using** "*Max-XMax X=50%"*) **with support 0.3)**
- **create** *"featuresGenes"* **using** (**convert freqitems** *"freqGenes"* (**convert bin** *"patients"* **to miner**) **to freqfeatures**)
- **extend** "*featuresGenes"* **using** *"patient"*
- **predict** "*featuresGenes*" **with** *clusterN=100 targetAtt=1*

The results are presented in the table:

Rank	OverExpressed Gene	Cluster Size	Error of prediction
1	{GS11588, GS2496}	78	0.286
2	{GS2496}	79	0.291
3	{GS1659}	77	0.309
4	{GS1859}	71	0.319
5	{GS72419}	76	0.342
6	{GS12398}	73	0.347
…	…	…	…

[2] Unfortunately, the table in [3] contains two errors concerning the size of the clusters (Jun Sese, personal communication).

6 CONCLUSION AND FURTHER WORK

The purpose of the query language that was developed was to create an environment that supports basic data mining tasks, and also a compositionality of queries thus relating the language to the concept of inductive databases. With the previously described scenarios we aimed to demonstrate that the query language facilitates gene expression analysis and also allows for the simulation of some data mining algorithms.

Our further work would be first to validate the usefulness of the query language by testing it with other patient record/gene expression datasets and by using it in new scenarios. Also introducing new query constructs in the language is considered, like feature selection, mining for bi-sets and others.

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DEVELOPMENT OF A LAKE MODEL USING DATA AND EXPERT KNOWLEDGE - CASE STUDY: GREIFENSEE

Nataša Atanasova[1], Johanna Mieleitner[2], Sašo Džeroski[3], Ljupčo Todorovski[3], Boris Kompare[1]

[1]UL-FGG
Jamova 2, 1000 Ljubljana, Slovenia
Tel: +386 1 425 40 52; fax: +386 1 251 98 97; e-mail: natanaso@fgg.uni-lj.si

[2] Swiss Federal Institute of Aquatic Science and Technology (Eawag),
Überlandstrasse 133, 8600 Dübendorf, Switzerland

[3]Jozef Stefan Institute
Jamova 39, 1000 Ljubljana, Slovenia

ABSTRACT

This paper deals with setting a simple lake model of lake Greifensee by using an automated modelling (AM) method. The method combines an empirical and a theoretical approach to modelling. Theoretical knowledge, encoded in a knowledge library, is used to guide the procedure of model induction from measured data. The Greifensee data set comprises long term measurements that are crucial for describing the lake behaviour and the lake's trophic state. Using the AM method and the measured data we discovered a lake model of Greifensee that consists of three ordinary differential equations. The model describes the temporal dynamics of phosphate, chlorophyll-a, and zooplankton, taking a one day time step. Validation of the model, performed on a four years time period, indicates fairly good fit to the measurements and long term model stability.

1 INTRODUCTION

In this paper we evaluate a modelling method that combines an empirical (data-driven) and a theoretical (knowledge-driven) approach to modelling (Todorovski, 2003). The background (theoretical) knowledge is introduced in the procedure of automated model induction from data (equation discovery) in the form of a knowledge library. As a result, the method discovers a set of models (equations) that follow the basic principles in the domain of interest.

In order to be used in the AM procedure the theoretical knowledge is coded in a knowledge library. For this research we use a knowledge library for lake modelling. It was estimated that the library comprises a great part of the existing modelling knowledge from this domain, i.e. ecosystems modelling with ordinary differential equations (Atanasova, 2005). Details about this kind of modelling can be found in e.g. (Jørgensen and Bendoricchio, 2001), (DeAngelis, 1992), (Chapra, 1997), and many others. Further, the models discovered from this library are structurally correct according to the expert modelling knowledge. The lake library was applied on real-world domains, i.e. discovering a phytoplankton model for lake Bled (Slovenia), lake Kasumigaura (Japan), lake Glumsø (Denmark) and Lagoon of Venice (Italy) (Atanasova, 2005). All of the discovered models consist of a single differential equation, except for the lake Bled where we discovered a model of three differential equations. Yet, the model was discovered step wise, i.e. one equation at a time, by strictly limiting and controlling the search space of the candidate models (Atanasova et al., 2005).

The main goal of this paper is to further evaluate the AM method and the existing knowledge library. Furthermore we make an attempt of simultaneously discovering a model of three differential equations. The data used in this study are measured on lake Greifensee (Switzerland).

Previous work was done on modelling this lake with a complex mechanistic model. This model is one-dimensional, resolving the depth of the lake and uses 13 state variables. The model was developed by Omlin et al. 2001and applied to Greifensee by Mieleitner and Reichert 2005. Current work on modelling Greifensee with this model approach is focused on developing a box model (i.e. the lake is described with four boxes) and on improving the plankton sub-model. In this research we reduce the lake description to 0-dimensional, i.e. one-box model, and three state variables. Thus, we are setting a model of three ordinary differential equations.

2 AUTOMATED MODELLING FRAMEWORK

The machine learning method, used in this paper, supports introduction of the background modelling knowledge in the procedure of model induction from data. The knowledge provides a recipe for building models in the domain of interest – it provides (1) taxonomy of basic process classes in the domain, (2) commonly used modelling alternatives for the processes in these classes, as well as (3) rules for combining the models of individual processes into the model of the whole observed system. The knowledge

library used here provides knowledge for modelling of food webs in lakes, following the mass conservation principle. The models are based on ordinary differential equations. For further details see (Atanasova, 2005).

In order to apply the modelling framework to a particular task of modelling a specific ecosystem, we have to provide a modelling task specification, i.e., specification of the observed system variables and processes. Given a specification of the modelling task at hand, Lagramge's pre-processor can transform the high-level knowledge from the library into an operational form of a grammar that specifies the space of candidate models of the observed system. Once we have the grammar, we can use the equation discovery method Lagramge to heuristically search through the space of candidate models and match each of them to submitted data by fitting the values of the constant parameters. These models can be evaluated by two heuristic functions. One is mean square error (MSE) – it measures the discrepancy between measured data and data obtained by simulating the model. The other is the minimum description length (MDL) function that takes into account model complexity and introduces preference towards simpler models.

3 LAKE GREIFENSEE DATA

3.1 LAKE DESCRIPTION

Greifensee is located in Switzerland with a watershed area of 163 km^2, and maximal and average depth of 32 m and 18 m respectively. The surface area of the lake measures 8.5 km^2, while the volume is 148 millions m^3. The lake has an average discharge of 4.08 m^3/s and an average retention time of 1.1 years. In the 1960s the lake was highly eutrophic with average phosphate concentrations of over 500 mg/m^3. The lake begun to recover around the 1970s after some measures have been taken to improve the water quality. Now, the average phosphate concentration in Greifensee has been reduced to 100 mgP/m^3. It is still relatively high and corresponds to eutrophic state (Bürgi 1994).

3.2 THE DATA: SOURCES AND DESCRIPTION

Input data to the lake. The input data obtained from the AWEL (Amt für Abfall, Wasser, Energie und Luft, Switzerland), include daily measurements of two river inflows, i.e. Aabach-Mönchaltdorf and Aabach-Niederuster. The measurements include the flow rates, temperature, pH, Oxygen, ammonia, nitrite, nitrate, total nitrogen, phosphate, and total phosphorous. Of the meteorological data we use the global solar radiation obtained from the Swiss Meteorological Institute (MeteoSchweiz). Values measured hourly were converted to daily averages.

*Chemical and Physical variables in the lake***:** Monthly measurements in the period of 1988 to 1999 were obtained from the Swiss Federal Institute of Aquatic Science and Technology (Eawag). We use averaged data of temperature, phosphate and chlorophyll (measured at the deepest location).

Biological variables in the lake: Monthly to weekly measurements of the years 1987-1999 were obtained from the Eawag. The data set comprised depth-integrated samples of phytoplankton and zooplankton (measured at the deepest location). Phytoplankton and zooplankton concentration data consist of counts of many different species. The total volume of all zooplankton species was used. The volumes were calculated by multiplying the counts of each species by the typical volume of one cell of this species. The volume was converted to wet weight (WW) using the density of water. For the conversion from wet to dry weight (DW), which is modelled, a factor of 10 was used for zooplankton (based on measurements of the Water Supply Authority of Zürich).

3.3 DATA PREPARATION FOR MODELLING

Previous experiences with Lagramge indicate that daily data are needed for discovering ordinary differential equations. Therefore we interpolated the monthly data by cubic spline interpolation to get a convenient data set of "*daily*" measurements of the variables measured in the lake for induction of differential equations with Lagramge. The variables used for model induction are depicted in Table 1.

Table 1: Description of the variables

Variable name	Description	Units
v	Volume of the lake	m^3
d	depth	m
q_uster	Inflow to the lake	m^3/day
q_moe	Inflow to the lake	m^3/day
po4_uster, po4_moe	phosphorus concentration in the inflows	mg/l
load_uster_po4, load_moe_po4	calculated load to the lake: po4*q for both inflows	m^3/day
temp	Water temperature	°C
light	Averaged daily light	W/m^2
po4	Inorganic phosphorus concentration in the lake	mg/l
Chl_a	Chlorophyll concentration	mg/l
zoo	Zooplankton biomass concentration	mg DW/l

4 EXPERIMENTAL SETUP

The experiments were aimed at discovering a simple lake model for prediction of the relevant state variables that describe the trophic state of the lake, i.e. phosphorus and chlorophyll_*a* concentrations. The basic concept of such a model can be represented as shown in Figure 1. The concept consists of three state variables: inorganic dissolved phosphorus (*po4*), phytoplankton, represented as chlorophyll_a (*Chl_a*), and zooplankton (*Zoo*). The state variables are influenced by the biological processes (arrows in Figure 1) that take place in the system. The phytoplankton concentration (*Chl_a*) is increasing due to consumption of the nutrient (*po4*) in the process

PP_growth and decreasing due to the processes of respiration, sedimentation and grazing by zooplankton, i.e. *Respiration_PP*, *Sedimentation*, and *Feeds_on* (Figure 1). The last contributes to the zooplankton concentration (*Zoo*). Zooplankton is lost due to the processes of *Respiration_A* and *Mortality_A*. In contrast, the nutrient concentration increases due to both respiration processes (*Respiration_PP* and *Respiration_A*), and decreases due to phytoplankton growth (*PP_growth*). The described modelling concept in Figure 1 represents the expert knowledge of this system that is introduced in the procedure of model induction from measured data.

The modelling knowledge library specifies how to combine the processes into a corresponding model of the whole system (Džeroski and Todorovski, 2003; Todorovski, 2003; Atanasova et al., 2005). According to the combining rules from the knowledge library, the processes defined in the system specification (Figure 1), will be composed in a model based on three differential equations (1), (2), and (3).

$$\frac{dpo4}{dt} = \text{(Loads) - (Outflows) } + \text{const} \cdot \text{Respiration\_A} + \text{const} \cdot \text{Respiration\_PP} + \text{Sediment\_release} - \text{const} \cdot \text{PP\_growth} \quad (1)$$

$$\frac{dChla}{dt} = \text{PP\_growth - Respiration\_PP - Sedimentation - Feeds\_on} \quad (2)$$

$$\frac{dzoo}{dt} = const \cdot \text{Feeds\_on - Respiration\_A - Mortality\_A} \quad (3)$$

Each of the processes is represented with several mathematical formulations in the knowledge library. This specifies the space of candidate models for this system, which are further fitted to the given measurements. The fitting (training) was performed on one year measured data from 1989.

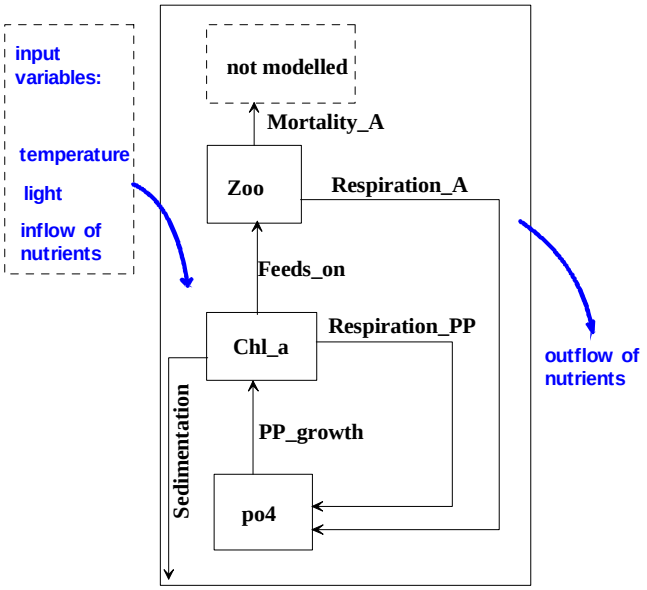

Figure 1: *The conceptual model of the Greifensee lake.*

5 RESULTS

Given the expert knowledge as described in section 4 (and using the lake modelling library) Lagramge discovered 28 224 candidate models, which were fitted and evaluated against the given measurement data from year 1989. The models were evaluated by two error measures. To rank the first ten models (best fitted to the measurements) we used the error measure included in Lagramge, i.e., MSE and MDL (see section 2). These best models were then evaluated according to the visual perception of the expert. Note that models with lowest MSE are not necessarily the best according to the domain experts. The best evaluated model using both error measures is presented in equations (4), (5), and (6).

The model equations follow the background knowledge as presented in equations (1), (2), and (3) in section 4. Each term in the equations (4), (5), and (6) represents the formulation of the processes in the equations (1), (2), and (3), correspondingly. For example, the process PP_growth is formulated as evident from the last term of the equation (4) and the first term of the equation (5).

$$\frac{dpo4}{dt} = \frac{load\_uster\_po4}{v} + \frac{load\_moe\_po4}{v} - po4 \cdot \frac{q\_uster}{v} - po4 \cdot \frac{q\_moe}{v} + 0.01 \cdot zoo \cdot 0.002 \cdot \frac{temp-4}{20-2.6} + 0.5 \cdot chla^2 \cdot 0.15 \cdot 1.13^{(temp-20)} + \frac{0.01+0.0021 \cdot temp}{d} - 0.088 \cdot chla \cdot 2.88 \cdot \frac{po4}{po4+10^{-7}} \cdot \frac{temp-2}{20-4} \cdot \frac{light}{light+30} \quad (4)$$

$$\frac{dchla}{dt} = chla \cdot 2.88 \cdot \frac{po4}{po4+10^{-7}} \cdot \frac{temp-2}{20-4} \cdot \frac{light}{light+30} - chla^2 \cdot 0.15 \cdot 1.13^{(temp-20)} - chla \cdot \frac{0.9}{d} - zoo \cdot 9.6 \cdot 1.11^{(temp-20)} \cdot \frac{chla}{chla+0.0014} \cdot chla \quad (5)$$

$$\frac{dzoo}{dt} = 0.99 \cdot zoo \cdot 9.6 \cdot 1.11^{(temp-20)} \cdot \frac{chla}{chla+0.0014} \cdot chla - zoo \cdot 0.0021 \cdot \frac{temp-4}{20-2.6} - zoo \cdot 0.047 \cdot \frac{temp-4}{20-3.6} \quad (6)$$

We simulated the model over a period of four years, i.e. 1988 to 1991. Recall that the model was calibrated on the one year (1989) measurements, while the rest of the simulation period is used for model validation. Figure 2 shows the simulated data together with the measurements. Phosphorus simulation performs with slight shift in time, which is acceptable from the expert point of view. The simulation of chlorophyll-a shows a distinctive local dynamics, unlike the other two state variables. The local dynamics of the state variable can be neither rejected nor confirmed from the measurements. Note, that the time scale of the measured data is one month, while the simulated data have daily time scale. Moreover, an expert would expect more dynamics then evident from the monthly measurements. It is especially encouraging that the model remains stable in spite of the distinctive local dynamics.

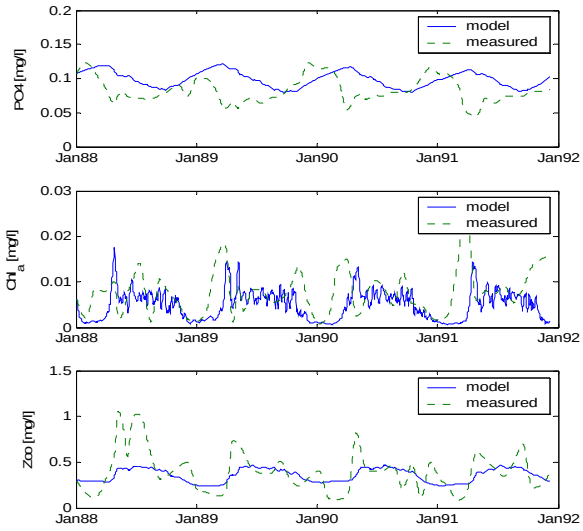

Figure 2: *Simulation of the model (equations 4, 5 and 6) over a period of four years. Simulated data (solid line) are plotted together with the measured data (dotted line)*

6 CONCLUSION

A modelling method that combines empirical and theoretical approach to modelling has been applied to real world data, i.e. the lake Greifensee. We discovered a simple model of three ordinary differential equations that simulates the behaviour of three state variables, i.e. phosphorus, chlorophyll-a, and zooplankton. The model was trained (identified) on one year's data and validated on a period of four years. The validation shows good behaviour of the model in terms of fitting to the data measurements and long term stability from the expert's point of view, regarding the complexity of the system.

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EXPERIMENTAL COMPARISON OF THREE SUBGROUP DISCOVERY ALGORITHMS: ANALYSING BRAIN ISCHAEMIA DATA

Petra Kralj(1), Nada Lavrač(1,2), Blaž Zupan (3,4), Dragan Gamberger (5)
(1) Jozef Stefan Institute, Jamova 39, Ljubljana, Slovenia
(2) Nova Gorica Polytechnic, Vipavska 13, Nova Gorica, Slovenia
(3) Faculty of Computer and Information Science, Tržaška 25, Ljubljana, Slovenia
(4) Department of Molecular and Human Genetics, Baylor College of Medicine, Houston, TX
(5) Rudjer Bošković Institute, Zagreb, Croatia
e-mail: Petra.Kralj@campus.fri.uni-lj.si

ABSTRACT

This paper presents experimental results of subgroup discovery algorithms SD, CN2-SD and Apriori-SD implemented in the Orange data mining software. The experimental comparison shows that algorithms perform quite differently on data discretized in different ways. From the experiments, performed in the brain ischemia domain, it is impossible to conclude which discretization is the most adequate for subgroup discovery.

1 INTRODUCTION

This paper addresses the problem of subgroup discovery in a medical domain. Subgroup discovery is an appropriate method for analyzing medical data, since it provides short and understandable descriptions of subgroups regarding the property of interest.

Formally, the task of subgroup discovery is defined as follows: given a population of individuals and a specific property of the individuals that we are interested in, find population subgroups that are statistically 'most interesting', e.g., are as large as possible and have the most unusual statistical (distributional) characteristics with respect to the property of interest.

Standard classification rule learning algorithms can be adapted to perform subgroup discovery. In this paper we discuss three subgroup discovery algorithms, SD [1], CN2-SD [2] and Apriori-SD [3], two of which are adaptations of classification rule learners: CN2-SD is an adaptation of CN2 [8] and Apriori-SD is an adaptation of APRIORI [6]. We compare the results of these three algorithms, implemented in the Orange data mining environment [5], on brain ischaemia data [4].

These algorithms take as their input the training examples described by discrete attribute values. Since some of the attributes in the brain ischemia domain are continuous, data discretization is needed in the pre-processing phase. Discretization is performed in two different ways.

This paper is organized as follows: Sections 2, 3 and 4 present the basic ideas of algorithms SD, CN2-SD and Apriori-SD, respectively. Section 5 explains how subgroups can be used for classification purposes. In Section 6 the data set and its pre-processing are presented. Experimental results are provided in Section 7. Finally, Section 8 provides conclusions and references.

2 THE SD ALGORITHM

The SD algorithm [1] is a variation of the beam search algorithm. At the beginning all the subgroup descriptions in the beam are initialized to empty. The algorithm builds subgroup descriptions in a general-to-specific fashion by adding conjunctions to subgroup descriptions. Discovered subgroups must satisfy criteria of minimal support and they must be relevant. The new subgroup is irrelevant if there exists a subgroup R such that true positives of the new subgroup are a subset of true positives of R and false positives of the new subgroup are a superset of false positives of R.

The algorithm keeps the best subgroup descriptions in a beam of fixed width (beam width is a parameter of the algorithm). In each iteration of the algorithm it adds a conjunction to every subgroup descriptions in the beam and replaces the worst subgroup in the beam if the new subgroup in better.

The goal of the subgroup discovery algorithm SD is to find subgroups that maximize the generalization quotient heuristic (Equation 1), where TP are the true positives, FP are the false positives, and g is a generalization parameter.

$$q_g = \frac{TP}{FP + g} \qquad (1)$$

High quality subgroups cover many target class examples and a low number of non-target examples. The number of tolerated non-target class examples, relative to the number of covered target class examples, is determined by parameter g. For low g, induced rules will have high specificity since the coverage of every single non-target class example is made relatively very 'expensive'. On the

other hand, by selecting a high g value, more general rules will be generated, covering also non-target class instances.

3 THE CN2-SD ALGORITHM

The CN2-SD algorithm [2] consists of two main procedures: the bottom-level search procedure that performs beam search in order to find a single rule, and a top-level control procedure that repeatedly executes the bottom-level search and performs the weighting of covered examples to induce a rule set.

The bottom-level procedure performs search in a general-to-specific fashion, specializing only the subgroup descriptions in the beam by iteratively adding features. This procedure stops when no specialized subgroup description can be added to the beam, because none of the specializations has a higher weighted relative accuracy (Equation 2).

$$WRAcc(X \to Y) = \frac{n'(X)}{N'}\left(\frac{n'(XY)}{n'(X)} - \frac{n(Y)}{N}\right) \qquad (2)$$

In this equation, N is the number of all examples, N' is the sum of the weights of all examples, n'(X) is the sum of weights of all covered examples, N(Y) is the number of examples within the target class, and n'(XY) is the sum of the weights of all correctly covered examples. The weights are calculated as follows:

$$w(e_j, i) = \frac{1}{i+1} \qquad (3)$$

In this equation, e_j is an example that is covered i times.

4 THE APRIORI-SD ALGORITHM

The APRIORI-C algorithm [7] uses techniques from the association learning algorithm APRIORI [8] to build classification rules. Some adaptations of the APRIORI algorithms are needed to perform the classification task, like building only the rules with the target variable on the right hand side and others, described in [7].

The main modification of the APRIORI-C algorithm, making it appropriate for subgroup discovery, involve the implementation of an example weighting scheme in rule post-processing, a modified rule quality function incorporating example weights and a probabilistic classification scheme.

Algorithm Apriori-SD [3] is very similar to the CN2-SD algorithm, since they have very similar top-level control procedures that repeatedly execute the bottom-level search and perform the weighting of covered examples to induce a rule set. In Apriori-SD, a set of potential subgroup descriptions is generated at the beginning of the control procedure by executing the Apriori-C algorithm. The condition parts of the generated rules can be interpreted as subgroup descriptions.

The bottom-level procedure in Apriori-SD finds the subgroup with the highest weighted relative accuracy (WRAcc, Equation 2) among the subgroup descriptions (rules) generated by algorithm Apriori-C. It removes the found subgroup description from the set and returns this rule.

5 SUBGROUP DESCRIPTIONS AS CLASSIFIERS

Even though subgroup discovery belongs to descriptive induction, using and testing it as a classifier enables us to better evaluate the general descriptive usefulness and generalization properties of the found subgroups.

Subgroup discovery can be used as predictive induction by building subgroups for every class within the target variable. When classifying a new example, this approach calculates the average of distributions of all the discovered subgroups that cover this example and classifies it into the class that has the highest probability estimation. In this way the votes of all the subgroups have the same weight when deciding in which class to classify, regardless how many examples they cover.

6 BRAIN ISCHAEMIA DATA

The brain ischemia dataset consists of records of patients who have been treated in the Intensive Care Unit of the Department of Neurology, University Hospital Center "Zagreb", in Zagreb, Croatia during the year 2003. 300 patients are included in the database: 209 with confirmed diagnosis of brain attack, and 91 patients who entered the same department with adequate neurological symptoms and disorders, but were diagnosed with other diagnosis. In this paper, the goal of subgroup discovery is to discover regularities that characterize brain attack patients.

Patients are described with 26 attributes; 14 of them are discrete, 12 continuous. They are described in [4].

Since the subgroup discovery algorithms we compare in this paper take as their input discrete attribute descriptions of data, we need to discretize the continuous attributes. We do it in two ways: one is by performing the entropy based discretization [10] as implemented in Orange, the other is by performing binarization in feature construction and feature subset selection [9] and using the results as binary attributes.

- The Orange implementation of the entropy based discretization transforms 14 continuous attributes into seven discrete attributes: six binary and one with three values. Five attributes are discarded as irrelevant.
- By performing feature generation and feature selection on the continuous attributes we obtain 509 features of the form attribute<value or attribute>value. We use them as binary attributes, therefore when they appear in a subgroup description, they look like "attribute>value =y" or "attribute>value =n", where y and n stand for logical values *true* and *false*, respectively.

7 EXPERIMENTAL RESULTS

We performed tests of all three algorithms on data discretized in both ways. Unfortunately we were unable to test the algorithms CN2-SD and Apriori-SD on the data,

discretized by feature generation and selection because the implementations of these algorithms are not capable of dealing with that many attributes.

We first ran the algorithms on the entire data set and calculated which subgroups are on the convex hull in the ROC space (marked by *) and calculated the corresponding area under the ROC convex curve (AUC). In another experiment we performed ten-fold cross validation and calculated the average classification accuracy (CA) of the algorithms. The results are shown in the following tables.

Tables 1 to 4 show the results of three subgroup discovery algorithms on the brain ischemia domain. The discovered subgroups show the importance of attributes Age and Fibr, since all the algorithms discovered subgroups containing these attributes in their subgroup descriptions.

The tables are formatted as follows: The first column contains subgroups names. The second column contains subgroup descriptions, where spaces between conjuncts denote logical and. Columns TPr and FPr show the rate of positive and negative examples covered by each individual subgroup. The asterisks in the last column denotes that the specific rule is on the ROC convex hull. The numbers in the last column show the classification accuracy obtained by performing ten-fold cross validation.

Apriori-SD (Table 1) has a high classification accuracy while its area under the ROC convex hull is not large. Algorithm CN2-SD (Table 2) produced only three very short and understandable rules.

Ref.	**Subgroup description**	**TPr** [%]	**FPr** [%]	**CA** **AUC**
a1	D_Fibr≥4.30	54	5	*
a2	D_Age≥66.0 D_RRsys≥158.0	48	8	
a3	D_Age≥66.0 D_Gluc≥5.90 AHyp=yes	39	4	
a4	D_au≥378.0 D_Gluc≥5.90	27	2	*
a5	D_Age≥66.0 D_Gluc≥5.90 D_RRdya≥89.0 Stat=no	37	3	*
a6	D_Gluc≥5.90 D_RRsys≥158.0 ASS=no Ahypo=no	29	4	
a7	FA=yes AHyp=yes	28	5	
a8	alcoh=yes stres=no	28	5	
a9	D_au≥378.0 AHyp=yes	28	4	
a10	D_Age≥66.0 Fhis=yes Stat=no	31	4	
a11	D_Gluc≥5.90 D_RRsys≥158.0 D_RRdya≥89.0 ASS=no Acoag=no Stat=no	28	3	
a12	D_Age≥66.0 Smok=no stres=no	28	5	
classification accuracy				**0.83**
area under ROC convex hull				**0.74**

Table 1: *Subgroup descriptions induced by algorithm **Apriori-SD** on discretized data.*

If we compare the classification accuracy of algorithm SD on differently discretized data, we can see that the simple entropy based discretization (Table 4) works better for small values of the generalization parameter g, while the feature based discretization (Table 3) is better for large values of the g parameter.

Ref.	**Subgroup description**	**TPr [%]**	**FPr** [%]	**CA** **AUC**
c1	D_Fibr≥4.30	54	5	*
c2	D_Age≥66.0 D_Fibr≥4.30	41	1	*
c3	D_Fibr≥4.30 Fhis=yes	34	1	*
classification accuracy				**0.77**
area under ROC convex hull				**0.75**

Table 2: *Subgroup descriptions induced by algorithm **CN2-SD** on discretized data. The algorithm induced 20 descriptions, but only three of those are different.*

Ref.	**Subgroup description**	**TPr** [%]	**FPr** [%]	**CA** **AUC**
generalization parameter value 5				0.75
g5a	Fibr>2.75=n Age>62.50=y	44	1	
g5b	Fibr>2.75=n Plat<145.50=n Age>70.50=y	34	0	
g5c	Fibr>2.75=n PT<0.99=n	33	0	
generalization parameter value 10				0.76
g10a	Acoag=yes=n Trig<1.48=n Trig>1.48=y Fibr>4.55=n	49	2	
g10b	Fibr>2.75=n Age>60.50=y	43	0	*
g10c	Acoag=yes=n Trig<1.48=n Trig>1.42=y Fibr>4.55=n	49	2	*
generalization parameter value 20				0.74
g20a	Trig<1.48=n Age>59.50=y Plat<133.0=n	66	10	*
g20b	Trig<1.48=n Age>55.50=y	60	7	
g20c	Trig>1.48 Age>59.50 Gluc>6.85 Plat>133.0	61	7	*
generalization parameter value 50				0.8
g50a	Trig<1.48=n Plat<145.50=n	78	21	
g50b	Trig<1.52=n Age>61.50=y	75	16	*
g50c	Trig<1.48=n Plat<133.0=n	77	19	*
generalization parameter value 100				0.85
g100a	Trig<1.52=n	84	31	*
g100b	Trig<1.52=n RRsys>169.0=n	82	29	
g100c	Trig<1.52=n Plat<145.50=n	82	27	*
average classification accuracy				**0.78**
area under the ROC convex hull				**0.85**

Table 3: *Subgroup descriptions induced by algorithm **SD** on feature data. The subgroup descriptions and the*

classification accuracy are induced for different values of generalization parameter g in the range [5, 100].

Ref.	Subgroup description	TPr [%]	FPr [%]	CA / AUC
generalization parameter value 5				0.8
d5a	D_Fibr≥4.30	54	5	*
d5b	D_Age≥66.0 D_Gluc≥5.90 D_RRdya≥89.0 D_RRsys≥158.0	34	2	*
d5c	D_Fibr≥4.30 Stat=no	47	4	
generalization parameter value 10				0.81
d10a	D_Fibr≥4.30	54	5	*
d10b	D_Age≥66.0 D_RRsys≥158.0 Stat=no	43	5	
d10c	D_Fibr≥4.30 Stat=no	47	4	
generalization parameter value 20				0.8
d20a	D_Age≥66.0	66	23	*
d20b	D_Fibr≥4.30	54	5	
d20c	D_Age≥66.0 D_RRdya≥89.0	54	14	
generalization parameter value 50				0.7
d50a	D_RRdya≥89.0	80	55	
d50b	D_Gluc≥5.90	74	48	
d50c	AHyp=yes	74	46	
generalization parameter value 100				0.81
d100a	D_Age≥66.00	66	23	
d100b	D_RRdya≥89.00	80	55	
d100c	-	-	-	*
average classification accuracy				**0.78**
area under the ROC convex hull				**0.76**

Table 4: *Subgroup descriptions induced by algorithm **SD** on discretized data. The subgroup descriptions and the classification accuracy are induced for different values of the generalization parameter in the range [5, 100].*

8 CONCLUSIONS

In this paper we confronted three subgroup discovery algorithms on the brain ischemia domain. We discovered that algorithms perform quite differently on data discretized in different ways. From the experiments we made it is impossible to conclude which discretization is the most adequate for subgroup discovery – this evaluation should be performed by the medical expert in future work. Additionally, comparison of algorithms on many other domains should be performed to get relevant statistical results from which one could conclude which algorithm and discretization perform the best.

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Predictive Data Mining Using Itemset Frequencies

Panov Panče[1], Sašo Džeroski[1], Hendrik Blockeel[2], Suzana Loškovska[3]
[1]Department of Knowledge Technologies, Jozef Stefan Institute, Ljubljana, Slovenia
[2] Department of Computer Science, Katholieke Universiteit Leuven, Heverlee, Belgium
[3] Department of Computer Science, Faculty of Electrical Engineering, Skopje, Macedonia
e-mail: {Pance.Panov,Saso.Dzeroski}@ijs.si,
Hendrik.Blockeel@cs.kuleuven.ac.be,
suze@etf.ukim.edu.mk

ABSTRACT

Predictive models make predictions about values of data using known results from different data, while frequent itemsets describe properties of a subset of the data and are descriptive in nature. In this paper we present a method of building predictive models by using frequency information from frequent itemsets. Modifications were done on three standard algorithms for learning probability models, decision trees and rules. Implementation was done in the WEKA system. We present preliminary results on two datasets and discuss further work to be done in this area.

1 INTRODUCTION

Predictive models make predictions about values of data using known results found from different data.
Frequent sets play an essential role in many data mining tasks that try to find interesting patterns from databases.
The difference between frequent itemsets and models is that frequent itemsets are local in that they typically describe properties of a subset of the data, whereas models are global in that they characterize the entire dataset. In addition, frequent itemsets are typically used for descriptive purposes and models for predictive ones.
Once interesting frequent itemsets have been identified, they can be used as descriptors for building models.
Itemset frequencies can be used for many more things than just for mining association rules. Once the work of finding and storing them is done, we can build any kind of model (in context of inductive queries) quickly.
In this paper, we present a new way of building predictive models by using frequency information from frequent itemsets, instead of dataset itself. Frequency information from the itemsets is used at different places of the machine learning algorithms to calculate the probability distributions which are used to build predictive models.

2 OVERVIEW OF PREDICTIVE MODELS

2.1 Probabilistic models

Probabilistic models describe probabilistic dependencies among variables. One such model is the naive Bayes classifier. Bayesian classification is based on the Bayes theorem. This theorem is used to estimate the probability of an example belonging to each of the possible classes in a classification problem.
An example $X = (x_1, ..., x_n)$ from the dataset is represented as a conjunction of conditions $(A_i = x_i)$ for each of the n attributes A_i. A Bayesian classifier will assign to a new example the class value c_k that maximizes $P(C_k|X)$, i.e., $P(C_k|X) \geq P(C_j|X), j = 1, ..., m$. According to the Bayes theorem $P(C_j|X) = P(X|C_j)P(C_j)/P(X)$.
The key assumption of the naive Bayesian classifier is the assumption of class conditional independence. This allows the term $P(X|C_j)$ to be replaced by the product $\prod_i P(A_i = x_i|C_j)$. Individual conditional probabilities $P(A_i = x_i|C_j)$ are easy to estimate from the training data.
Learning a naive Bayes classifier consists of estimating the prior probabilities $P(C_j) = P(C = c_j)$ and $P(A_i = v_{ik} \mid C_k)$ for each of the possible values c_j for the class C and each of the attribute values v_{ik} of each attribute A_i. $P(C_j)$ is estimated by counting the number of examples $n_j = N(c_j)$ of class c_j and dividing this by n, the total number of training examples, i.e. $P(C_j) = n_j / n$. $P(A_i = v_{ik} \mid C_k)$ can be estimated as $N(A_i = v_{ik} \wedge C = c_j)$ divided by $N(C = c_j)$.

2.2 Decision trees

Decision trees are hierarchical structures, where each internal node contains a test on an attribute, each branch corresponds to an outcome of the test, and each leaf node gives a prediction for the value of the class variable.
Finding the smallest decision tree that would fit a given dataset is computationally expensive so heuristic search is thus employed to build decision trees. Tree constructing proceeds recursively starting with the entire set of training

examples. At each step, an attribute is selected as the root of the subtree and the current training set is split into subsets according to the values of the selected attribute.
Tree construction stops when the examples in a node are sufficiently pure if some other stopping criterion is satisfied. Different measures can be used to select an attribute in the attribute selection step. Quinlan [4] uses information gain, which is the expected reduction in the entropy of the class value caused by knowing the value of a given attribute.
An important mechanism used to prevent trees from over-fitting data is tree pruning. Pruning can be employed during tree construction (pre-pruning) or after the tree has been constructed (post-pruning). The minimum number of examples in branches can be prescribed for pre-pruning and a confidence level in accuracy estimates for leaves for post- pruning.

2.3 Predictive rules

Predictive rules are a popular alternative to decision trees. We will use the word rule here to denote patterns of the form "IF antecedent THEN consequent". The antecedent, or precondition, of a rule is a series of tests on attributes just like the tests on nodes in decision trees, and the consequent, or a conclusion, gives the class or classes that apply to instances covered by that rule. Generally, the preconditions are logically ANDed and all tests must succeed in order the rule to fire.
For a classification problem with several class values, a set of rules is constructed for each class. When rules for class c_i are constructed, examples of this class are referred to as positive, and examples from all the other classes as negative. The algorithm for constructing rules works as follows. We first construct a rule that correctly classifies some examples. We then remove the positive examples covered by the rule from the training set and repeat the process until no more examples remain. To construct a single rule that classifies examples into class c_i, we start with a rule with an empty antecedent an the selected class c_i as a consequent. The antecedent of this rule is satisfied by all examples in the training set, and not only those of the selected class. We than progressively refine the antecedent by adding conditions to it, until only examples of class c_i satisfy the antecedent. To allow for handling imperfect data, we may construct a set of rules which is imprecise, i.e. does not classify all examples in the training set correctly.

3 FREQUENT ITEMSETS

Given a set *R*, a *0/1* relation *r* over *R* is a collection (multiset) of subsets of *R*. The elements of *R* are called items, and the elements of *r* are called rows/transaction. The number of rows in *r* is denoted by $|r|$.

Let $X \subseteq R$ be a set of items. The set *X* matches a row $t \in r$, if $X \subseteq t$. The set of rows in *r* matched by *X* is denoted by $M(X,r)$, i.e., $M(X,r) = \{t \in r | X \subseteq t\}$, also called the cover of *X*. The frequency of *X* in *r*, denoted by $fr(X,r)$ is $\frac{|M(X,r)|}{|r|}$. Given a frequency threshold $min\_fr \in [0,1]$, the set *X* is frequent if $fr(X,r) \geq min\_fr$.

4 BUILDING PREDICTIVE MODELS USING ITEMSET FREQUENCIES

All of the above described algorithms for building predictive models use probability estimates based on counts. Here we present a new way of estimating probabilities by using frequency information from frequent itemsets. To build the models we first have to generate the frequent itemsets with a given *min_fr* threshold. For the calculation of probability estimates we need collection of frequent itemsets containing only combinations of attribute values and itemsets containing combinations of attribute values along with a class value. The size of the collections of frequent itemsets being used depends on the algorithm for building the predictive models.
A problem arises when we need a frequency of an itemset *X* that is infrequent i.e. $fr(X,r) \leq min\_fr$. In this case we only know that the frequency of this itemset is lower than minimal frequency and we have to guess the frequency of the itemset to get the probability distributions.

4.1 Modifications of Naive Bayes

In section 2.1 we described the original algorithm for learning a naive Bayes classifier that uses counts to estimate the probabilities. The modification of this algorithm includes the change of counts with frequencies of itemsets of size 1 and 2. We need itemsets of size 2 that contain only pairs of attribute value and class value i.e. $A_i = v_{ik} \wedge C = c_j$, for all attributes $A_i, i = 1,...,n$ and all classes $c_j, j = 1,...,m$, and itemsets of size 1 containing class values. The conditional probabilities can be calculated using equation 4.1.

$$P(A_i = v_{ik} \mid C_k) = \frac{fr(A_i = v_{ik} \wedge C = c_j)}{fr(C = c_j)} \quad \text{(Eq. 4.1)}$$

If we need frequencies of itemsets that are infrequent we estimate the frequency as *min_fr/2*. As we can see the estimate depends on the value of minimal frequency. If the threshold is too large, the number of infrequent itemsets is increasing and the probability distribution becomes more uniform. For a specific value of the threshold the model becomes invariant of the changes in the minimal frequency and probabilities are uniformly distributed.

4.2 Modification of the algorithm for inducting decision trees

In section 2.2 we described the algorithm for induction of decision trees using information theory heuristics. The modification of this algorithm includes the usage of frequent itemsets to estimate the probability distributions for all nodes of the tree. The probability distributions are needed to calculate information gain and gain ratio parameters for choosing the appropriate attribute to split the tree. In this case we need itemsets of size 1 to size h+1, where h is the height of the tree.

Let $A_i = v_{ik}, ..., A_l = v_{lm}$ be a path of attribute tests from the root to one node of the tree, and let q be the number of attributes being tested. To calculate the probability distribution of classes for a specific node of the tree we have to know the frequency of the itemsets of size q containing combination of attributes $fr(A_i = v_{ik} \wedge ... \wedge A_l = v_{lm})$ and the frequency of itemsets of size q+1 containing combination of attributes including a class value $fr(A_i = v_{ik} \wedge ... \wedge A_l = v_{lm} \wedge C = c_k)$ for all class values c_k. According to the former, the probabilities for a specific node can be calculated using equation 4.2.

$$P(C = c_k \mid A_i = v_{ij} \wedge ... \wedge A_l = v_{lm}) = \frac{fr(A_i = v_{ij} \wedge ... \wedge A_l = v_{lm} \wedge C = c_k)}{fr(A_i = v_{ij} \wedge ... \wedge A_l = v_{lm})} \quad \text{(Eq.4.2)}$$

If we need frequencies of itemsets that are infrequent we estimate frequency as $min\_fr/(2 \cdot s)$, where s is the size of the itemset. As we can see, the estimate of frequency of infrequent itemsets decreases as the size of the itemsets becomes higher.

4.3 Modification of the algorithm for learning predictive rules

In section 2.3 we described the original algorithm for learning predictive rules that uses counts to estimate the accuracy of the rules being built. The modification of the algorithm includes the use of frequent itemsets to estimate the accuracy of all rules. In this case we need itemsets of size 1 to size h+1, where h is the number of attribute tests used in the antecedent of the rule..

Let $A_i = v_{ik} \wedge ... \wedge A_l = v_{lm}$ be an antecedent of the rule and let q be the number of attributes being tested in the antecedent. If the consequent of one rule is determined, i.e., $C = c_k$, to calculate the accuracy of the rule we need to know the frequency of the itemsets of size q containing combination of attributes $fr(A_i = v_{ik} \wedge ... \wedge A_l = v_{lm})$ and the frequency of itemsets of size q+1 containing combination of attributes including a class value $fr(A_i = v_{ik} \wedge ... \wedge A_l = v_{lm} \wedge C = c_k)$. According to the former, the accuracy for a specific rule can be calculated using equation 4.3.

$$Accuracy = \frac{fr(A_i = v_{ij} \wedge ... \wedge A_l = v_{lm} \wedge C = c_k)}{fr(A_i = v_{ij} \wedge ... \wedge A_l = v_{lm})} \quad \text{(Eq.4.3)}$$

If we need frequencies of itemsets that are infrequent we estimate frequency as $min\_fr/(2 \cdot s)$, where s is the size of the itemset.

5 IMPLEMENTATION

All of the above described algorithms and their modifications were implemented in the WEKA system. WEKA provides implementations of a wide range of learning algorithms that can easily be applied to any dataset. It also includes a variety of tools for pre-processing and post-processing the data. In most data mining applications, the machine learning component is just a small part of a far larger software system. If the intention is to write a new data mining algorithm we can access the programs in WEKA from inside of our own code and we can solve the machine learning subproblem with a minimum of additional programming. This was the reason why we used this system for testing the modifications of the standard algorithms for machine learning.

For frequent itemset generation we used the Apriori algorithm, that was already implemented in the WEKA system. The problem with this implementation is that it is limited to small datasets because of its inefficiency handling large number of attributes and large memory usage. Further work will include the use of faster and more efficient algorithms and the use of condensed representations of itemsets so that we could handle large datasets.

Modifications on predictive models were done on three algorithms: Naive Bayes, J48 - JAVA implementation of C 4.5 (release 8) and JRIP - JAVA implementation of RIPPER.

6 PRELIMINARY RESULTS

For evaluation purposes we used only nominal datasets to avoid the process of attribute discretization. In this preliminary phase we generated and compared only unpruned trees and rules. However, pruning can be used in J48, but it was not tested in this implementation. There is a problem with RIPPER pruning of rules because of the re-sampling of examples from the training set. If we implement this pruning, our algorithms would become inefficient because in every pruning phase we would have to generate new frequent itemsets.

Evaluation of the algorithms was done by using 10-fold cross validation on two datasets (more are in progress) from the UCI Repository.

We tested the algorithms for different values of minimal frequency of the frequent itemsets. The results of the evaluations are presented in tables 1 and 2.

Min freq.	Accuracy Naïve Bayes	Accuracy J48	Size of tree	Number of leaves	Accuracy JRIP	Number of rules
Unpruned	0,9011	0,963218	19	37	0,954023	10
Pruned	/	0,91326	6	10	0.954022	4
0,1	0,8920	0,956322	25	49	0,921839	4
0,15	0,8920	0,954023	22	43	0,873563	3
0,2	0,8828	0,905747	19	37	0,852874	2
0,25	0,8851	0,931034	9	17	0,88046	3
0,3	0,8805	0,845977	4	7	0,896552	3
0,4	0,8805	0,82069	2	3	0,845977	2
0,5	0,8805	0,613793	1	1	0,567816	1

Table 1. Results on Vote dataset

Min freq.	Accuracy Naïve Bayes	Accuracy J48	Size of tree	Number of leaves	Accuracy JRIP	Number of rules
Unpruned	0,7168	0,695804	152	179	0,734266	5
Pruned	/	0,755245	4	6	0,70979	3
0,02	0,7203	0,70979	38	48	0,744755	5
0,05	0,7308	0,723776	46	89	0,748252	2
0,08	0,7343	0,716783	35	47	0,702797	1
0,1	0,7448	0,706294	20	29	0,702797	1
0,15	0,7517	0,706294	7	11	0,702797	1
0,2	0,7308	0,723776	5	8	0,702797	1
0,25	0,7308	0,723776	5	8	0,702797	1
0,3	0,734266	0,723776	3	5	0,702797	1
0,35	0,716783	0,716783	3	5	0,702797	1
0,4	0,713287	0,702797	1	1	0,702797	1

Table 2. Results on Breast Cancer dataset

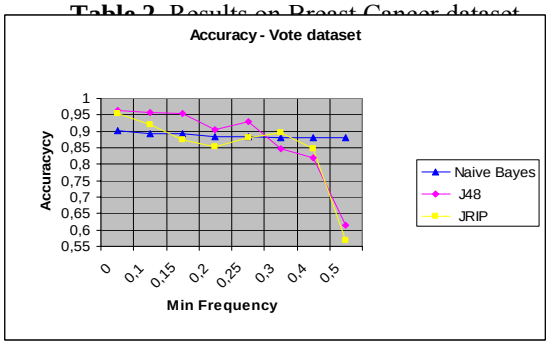

Figure 1. Accuracy comparison for Vote dataset

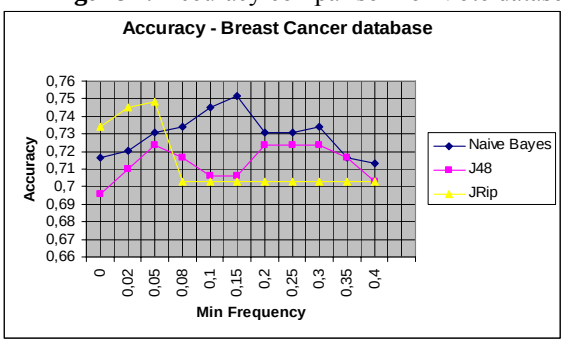

Figure 2. Accuracy comparison for Breast Cancer dataset

7 CONCLUSION AND FURTHER WORK

As we can see from the tables 1 and 2 the accuracy of the models depends on the choice of minimal frequency. The accuracy of the models doesn't decrease linearly as was expected at the beginning. From the results we can conclude that for small values of minimal frequency we get similar results as if we used some pruning method to handle the noisy data. This is so because by increasing the minimal frequency we get combinations of attributes that dominate in the dataset and the models are based mostly on them. As the frequency threshold increases at 0,5 (0,4) we have models that predict only the majority class because there is not enough information in the generated frequent itemsets.

This paper presents preliminary work done in this topic and is a starting point for further work. We want to use faster and more efficient algorithms, that can handle large datasets, to generate frequent itemsets. For very large datasets it would be convenient to use condensed representations of itemsets. Tests have to be made on large number of datasets in various domains so that we can see how the minimum frequency parameter affects the results and to see what are the limitations of the algorithms that can be used, and constraints that can be imposed. By doing the tests we will have more global conclusions about the usefulness of this approach in building predictive models.

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SUBGROUP VISUALIZATION

Petra Kralj(1), Nada Lavrač(1,2), Blaž Zupan (3,4)
(1) Jozef Stefan Institute, Jamova 39, Ljubljana, Slovenia
(2) Nova Gorica Polytechnic, Vipavska 13, Nova Gorica, Slovenia
(3) Faculty of Computer and Information Science, Tržaška 25, Ljubljana, Slovenia
(4) Department of Molecular and Human Genetics, Baylor College of Medicine, Houston, TX
e-mail: Petra.Kralj@campus.fri.uni-lj.si

ABSTRACT

This paper presents the state of the art of subgroup visualization methods. Visualization methods are evaluated by different criteria. A novel subgroup visualization method is proposed and its implementation as a part of an interactive interface for subgroup discovery is presented.

1 INTRODUCTION

Data visualization methods have been part of statistics and data analysis research for many years. This research concentrated primarily on plotting one or more independent variables against a dependent variable in support of explorative data analysis [3]. The visualization of analysis results, however, gained only recently attention with the proliferation of data mining [2]. The visualization of analysis results primarily serves four purposes:

- to better illustrate the model to the end user
- enable comparison of models
- increase model acceptance, and
- enable support for »what-if questions«

Subgroup discovery [4,5,6] aims at discovering individual patterns of interest. Formally the task of subgroup discovery is defined as follows: given a population of individuals and a specific property of the individuals that we are interested in, find population subgroups that are statistically 'most interesting', e.g. are as large as possible and have the most unusual statistical (distributional) characteristics with respect to the property of interest.

Since subgroup discovery is a task of descriptive induction, the visualization of results is crucial for presenting the results to the end user. The subgroup visualization task is to visualize the subgroups detected by subgroup discovery algorithms.

Many subgroups visualization methods have been proposed so far. In this paper we evaluate them by their intuitiveness, attractiveness, correctness of displayed data, usefulness and ability to display the contents of data.

A novel subgroup visualization method that combines two other subgroup visualization methods is proposed and its implementation as a part of an interactive interface for subgroup discovery in the Orange data mining software [7] is presented.

This paper is organized as follows: Subgroup visualization methods are described in Sections 2-7. In Section 8 an implementation of subgroup discovery and visualization is presented.

2 SUBGROUP VISUALIZATION BY PIE CHARTS

Slices of pie charts are the most common way of visualizing parts of a whole. They are daily used and everybody, even a total laic, understands them.

Subgroup visualization by pie chart consists of a two level pie for each subgroup. The base pie represents the distribution of individuals in terms of the property of interest of the entire example set. The upper pie represents the size and the distribution of individuals in terms of the property of interest in a specific subgroup. An example of five subgroups visualized by pie chart is presented in Figure 1.

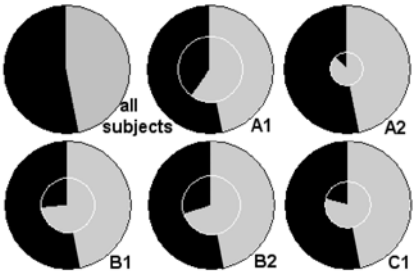

Figure 1: *Subgroup visualization by pie charts.*

The main weakness of this visualization is the misleading representation of the size of subgroups. The size of a subgroup is represented by the radius of the circle. The faultiness is that the surface of the circle increases with the square of its radius. A subgroup that covers 20% of examples would be represented by a circle that covers only 4% of the whole surface, and a subgroup that covers 50% of examples would be represented by a circle that covers 25% of the surface.

In terms of usefulness this visualization is not very handy because it is difficult to compare sizes of circles; neither the comparison of distributions is straightforward. This visualization does not show the contents of subgroups.

3 SUBGROUP VISUALIZATION BY BOX PLOTS

In the visualization by box plots each subgroup is represented by one box plot (all examples are also considered as one subgroup and are displayed in the top box). Each box shows the entire population; the hatched area on the left represents the positive examples and the white area on the right-hand side of the box represents the negative examples. The grey area within each box indicates the respective subgroup. The overlap of the grey area with the hatched area shows the overlap of the group with the positive examples. Hence, the more to the left the grey area extends the better. The less the grey area extends to the right of the hatched area, the more specific a subgroup is (less overlap with the subjects of the negative class). Finally, the location of the box along the X-axis indicates the relative share of the target class within each subgroup: the more to the right a box is placed, the higher is the share of the target value within this subgroup. The line (in Figure 2 at value 46.6%) indicates the default accuracy, i.e., the number of positive examples in the entire population. An example of five subgroups visualized by box plots is presented in Figure 2.

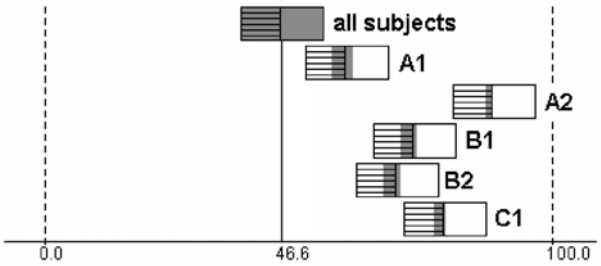

Figure 2: *Subgroup visualization by box plots.*

The intuitiveness of this visualization is scarce since interpretation is absolutely necessary for understanding it. It is illogical since the boxes that are placed more to the right and have more grey colour on the left-hand side represent the best subgroups. This visualization is not very attractive since most of the image is white. The grey area, (the part of the image that really represents the subgroups) is just a tiny portion of the entire image. All the displayed data is correct and the visualization is useful since the subgroups are arranged by their confidence. It is also easier to contrast the sizes of subgroups compared to the pie chart. This visualization does not display the contents of data. The general appraisal of this visualization is bad, even though it is useful.

4 VISUALIZING SUBGROUPS THROUGH DISTRIBUTIONS OF A CONTINUOUS ATTRIBUTE

The distribution of examples by a continuous attribute was first introduced as a visualization method in [1], and was often used in the medical domain. It is the only subgroup visualization method that offers an insight of the visualized subgroups.

The approach assumes the existence of at least one numeric (or ordered discrete) attribute of expert's interest for subgroup analysis. The selected attribute is plotted on the X-axis of the diagram. The Y-axis represents a target variable, or more precisely, the number of instances belonging (Y+) or not belonging (Y-) to the target class for a specific value of the attribute on the X-axis. It must be noted that both directions of the Y-axis are used to indicate the number of instances. The entire data set and two subgroups A1 and B2 are visualized by their distribution over a continuous attribute in Figure 3.

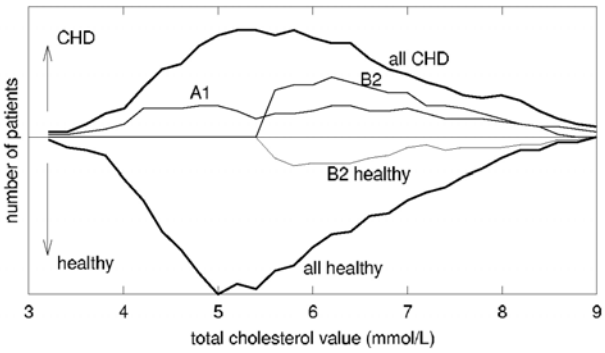

Figure 3: *Subgroup visualization by distribution over a continuous attribute. For clarity of the picture, only the positive (Y+) side of subgroup A1 is depicted.*

This visualization method is not completely automatic, since the automatic approach does not provide consistent results. The automatic approach calculates the number of examples for each value of the attribute on the X-axis by moving a sliding window and counting the number of examples in that window. The outcome is a smooth line. The difficulty appears when the attribute from the X-axis appears as a part of the condition that forms a subgroup. In such case a manual correction is needed for this method to be realistic.

This visualization method is very intuitive since it practically does not need any explanation. It is attractive and very useful to the end user since it offers an insight in the contents of displayed examples. However the correctness of displayed data is questionable.

5 REPRESENTATION IN THE ROC SPACE

The ROC (Receiver Operating Characteristics) space is a 2-dimensional space that shows classifier (rule/rule set) performance in terms of its false positive rate (FPr) plotted on the X-axis, and true positive rate (TPr) plotted on the Y-axis.

The ROC space is appropriate for measuring the success of subgroup discovery, since subgroups whose TPr/FPr tradeoffs are close to the main diagonal (line connecting the points (0, 0) and (1, 1) in the ROC space) can be discarded as insignificant [6]. The reason is that the rules with TPr/FPr on the main diagonal have the same distribution of covered positives and negatives (TPr = FPr) as the distribution in the entire data set. An example of five subgroups represented in ROC space is shown in Figure 4.

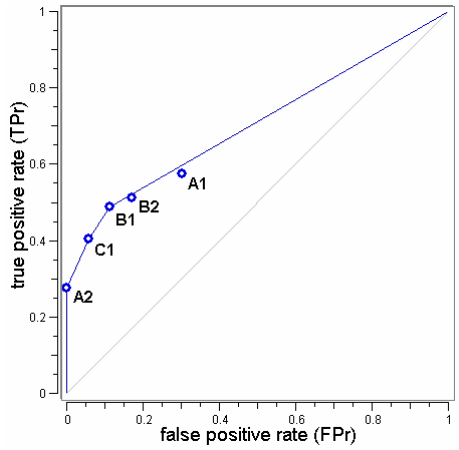

Figure 4: *Representation of subgroups in ROC space.*

Even though the ROC space is a good-looking visualization, it is more often used for evaluation of discovered rules. The ROC convex hull is the line connecting the potentially optimal subgroups. The area under the ROC convex hull (AUC, area under curve) is a measure of the quality of the result.

This visualization method is not intuitive to the end user, but is absolutely clear to any machine learning expert. The displayed data is absolutely correct, even though there is no content displayed. An advantage of this method compared to the others is that it allows the comparison of outcomes of different algorithms at the same time.

6 BAR CHARTS VISUALIZATION

The new visualization method we propose combines the good properties of the pie chart and the box plot visualization. It is simple, understandable and shows all the data correctly. An example of five subgroups visualized by bar charts is shown in Figure 5.

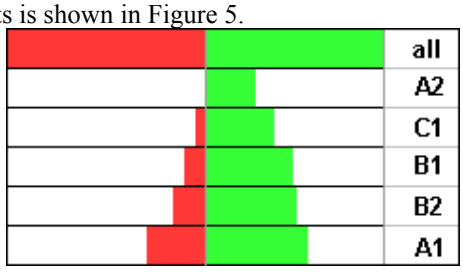

Figure 5: *Subgroup visualization by bar charts.*

In the visualization by bar charts the first line's purpose is to visualize the distribution of the entire example set. The area on the right represents the positive examples and the area on the left represents the negative examples. Each following line represents one subgroup. The positive and the negative examples of each subgroup are drawn below the positive and the negative examples of the entire example set. Subgroups are sorted by the relative share of positive examples.

This visualization method allows simple comparison between subgroups and is therefore useful. It is very intuitive and attractive enough. All the displayed data is correct and not misleading. It does not display the contents of data.

7 SUMMARY OF SUBGROUP VISUALIZATION METHODS

We now discuss the five different subgroup visualization methods by considering their intuitiveness, attractiveness, correctness of displayed data, usefulness and their ability to display the contents of the data. The summary of the evaluation is presented in Table 1.

	intuitiveness	attractiveness	correctness	usefulness	contents
pie chart	+	+	**o**	-	-
box plot	-	**o**	+	+	-
continuous	+	+	-	+	+
ROC	+ , -	**o**	+	+	-
bar chart	+	+	+	+	-

Table 1: *Summary evaluation of subgroup visualization methods.*

8 THE INTERACTIVE INTERFACE

In this section we present an implementation of the bar visualization and the ROC representation of subgroups in the Orange data mining software [7]. Orange goes beyond static visualization, by allowing interaction of the user and combination of different visualization techniques. A screen shot displayed in Figure 6 shows a use case of this tool.

In Figure 6 an example of a visual program in the Orange visual programming tool Orange Canvas is shown. The first widget from the left (File) loads the dataset (in this example we load the Brain Ischemia dataset). The following two widgets (Build Subgroups Apriori-SD and Build Subgroups SD) are two instances of the same widget Build Subgroups that performs subgroup discovery by one of the selected algorithms: SD [4], Apriori-SD [6] or CN2-SD [5]. The rest of the program performs visualization.

The outputs of subgroup discovery are connected to the ROC Visualization widget. In this widget the subgroups discovered by the algorithm Apriori-SD are displayed as blue circles and the subgroups discovered by the algorithm SD are shown as red circles (the window top right). The output of Build Subgroups SD is also connected to the Bar visualization widget (window bottom left). In the bar visualization we can select one or more subgroups (in Figure 6 subgroup D_Fibr>4.30 is selected.) The output of the Bar visualization widget is connected to the ROC Visualization widget causing the circle of the subgroups selected in the Bar visualization to be filled.

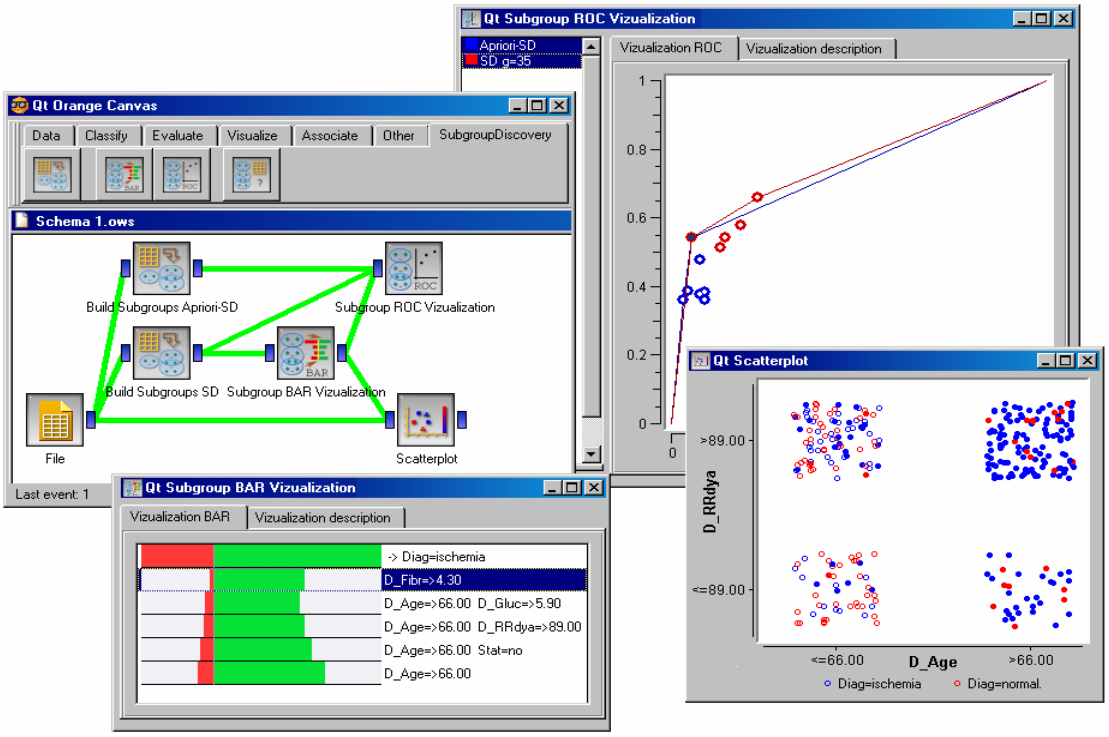

Figure 6: *A screen shot of the usage of the subgroup discovery tool implemented in Orange.*

The last part of the visual program allows us to see the contents of the selected subgroups. The Scatterplot widget takes as its input the example set from the widget File (the empty circles) and a set of examples covered by the selected subgroup(s) in Bar Visualization (full circles). The examples are arranged by the attribute D_Age on the X-axis and by the attribute D_RRdya on the Y-axis.

This visual program is just one example of what can be done by using the Subgroup discovery tool implemented in Orange. Subgroup evaluation and different method for visualizing the contents of subgroups are also available.

9 CONCLUSIONS

This paper presents the state of the art of subgroup visualization methods. The visualization methods are compared and evaluated by different criteria and a new visualization method is proposed. The implementation and usage of the Subgroup Discovery tool in Orange data mining software is presented.

In our view, the implemented capabilities offer new possibilities for understanding and usage of the subgroup discovery process.

Acknowledgements

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PREDGOVOR / PREFACE

Spoštovani!

Integracija informacijskih sistemov tudi letos ostaja pomembna tema razvoja in prenove informacijskih sistemov. Uveljavitev storitveno in procesno usmerjenih arhitektur odpira nove možnosti integracije in povezljivosti med sistemi ter izboljšuje fleksibilnost sistemov in njihovo zmožnost prilagajanja. Skladno z novimi zahtevami se tako pri razvoju, kakor pri prenovitvi informacijskih sistemov uvaja nove pristope, metode in metodologije dela, ki naslavljajo naraščajoče potrebe po integraciji aplikativnih rešitev, vzpostavitvi portalnih sistemov, podpori elektronskega poslovanja ter druge.

Z znanstveno-raziskovalnega, pa tudi s praktičnega vidika, postajajo vedno bolj pomembne metodologije razvoja in integracije, vzorci, varnost, ponovna uporaba, ogrodja za dokumentiranje in modeliranje poslovnih procesov. Kljub navidezni enostavnosti novih tehnologij za razvijalce se te v samem bistvu zelo kompleksne in ponujajo velik potencial za nadaljnji razvoj.

Sekcija prenovitve in načrtovanja informacijskih sistemov naslavlja omenjena področja. Vključuje devet prispevkov, ki pokrivajo področja integracije dostopa, avtentikacije, ponovne uporabe, dokumentacijskih ogrodij, načrtovalskih in integracijskih vzorcev, spletnih storitev in poslovnih procesov. Prispevki prikazujejo nove, izvirne rešitve in zaključke s področja prenove in načrtovanja informacijskih sistemov.

Dear guests!

Information systems integration has been an important topic this year too. The enforcement of service oriented and process oriented architectures opens new possibilities for integration and interoperability of systems and increases their efficiency and level of adaptability. In accordance to the demands, new approaches, techniques, methods and methodologies are being used by the development as well as by the reengineering of information systems. These new methodologies address increasing demands on enterprise application integration, development of portal solutions, support for electronic business, etc.

From the scientific perspective, but also from the applicative perspective, increased importance is addressed to methodologies for information systems development and integration, patterns, security, software reuse, documentation frameworks, and business process modeling. Although they look relatively simple to the developers, such technologies are very complex in their cores.

The Information System Development and Reengineering section focuses on the mentioned research areas. It includes nine scientific articles. The articles cover following topics: access control integration, message authentication, reuse, documentation frameworks, design and integration patterns, web services, and business processes. The articles present new, interesting research results related to the topic of this conference.

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INTEGRATION OF ACCESS CONTROL IN INFORMATION SYSTEMS: FROM ROLE ENGINEERING TO IMPLEMENTATION

Romuald Thion, Stéphane Coulondre
LIRIS / INSA
University of Lyon
20 Av. Albert Einstein
69621 Villeurbanne Cedex, France
Tel: +33 472 43 70 55; fax: +33 472 43 87 13
e-mail: romuald.thion@insa-lyon.fr

ABSTRACT

Pervasive computing and proliferation of smart gadgets make organizations open their information systems, especially by extensive use of mobile technology: information system must be available any-time, any-where. This cannot be performed reasonably without thorough access control policies. Such an access control must be able to deal with user's profile, time and eventually with other complex contexts like geographical position.
This paper shows that it is possible to take into account confidentiality constraints straight into the logical data model in a homogeneous way, for various aspects treated independently (user profile, time, geographical position, etc.). We propose a language called LORAAM which includes a way to express authorizations at the class level. We first present the syntactical aspects, then the semantics of such a language, based on the object-oriented paradigm.

1 INTRODUCTION

Companies and public interest for new technologies keeps growing, either for mobile use (laptops, Wi-fi, pocket-PC, GPS, UMTS, Java technology in GSM, etc..) or for "traditional" use. Information systems now become open and online, and their security must be guaranteed. These new technologies lead to the concept of context: a new constraint to consider in access control to the information system services. From now on, access control mechanisms tend towards integration of user profile, time, state of the computing environment and even geographical position.

In this paper, we show how to take into account general context data (user roles, spatio-temporal environment, etc.) in a homogeneous way, straight in the object data model (and more generally in Information Systems, Objects, Web Services, etc). Indeed security management, and especially access control, is often postponed until the end of the design cycle and is implemented at the end of the process. The software is therefore often developed without taking confidentiality constraints into account. We think that confidentiality must also be present throughout the whole development cycle. Our proposal provides a logical data model in which contextual role-based access control is integrated: we thus provide a support to upstream design methods [1,2] which rely on it.

Section 2 presents the original Role-Based Access Control that our proposal uses for the organisation of privileges within an information system, and surveys previous work in attempting to integrate the role concept in logical object data models for security purpose. Section 3 details syntactical and functional aspects of the LORAAM language we propose, together with an illustrative example in the medical area. Section 4 finally concludes the paper and discusses some perspectives.

2 THE RBAC MODEL

2.1. An Access Control Model

The RBAC Model [3] was defined in the 90's and has been extended in many ways since (temporal, geographical extensions, etc). It was introduced in order to tackle the weaknesses of DAC (Discretionary Access Control) and MAC (Mandatory Access Control) models: the former is difficult to implement whith a large number of users, and the latter is too rigid for modern applications.

The basic RBAC philosophy is based on the observation that most of the access permissions are determined by a person authority or function, inside an organisation. This defines the central concept of role. The introduction of role concept in access control policies as an intermediate layer between subjects and permissions, really facilitates and simplifies the system administration task. The RBAC definition of a role is "a job function within the organization with some semantics regarding the authority and responsibility conferred on the member of the role".

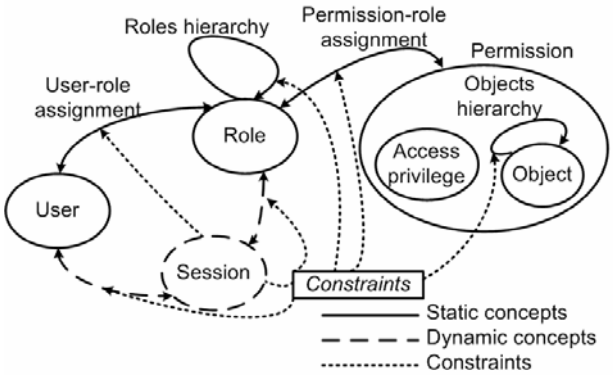

Figure 1. *The RBAC model [3]*

The RBAC model family is based on the identification of a certain number of roles [4], each of them representing a set of actions and responsibilities within the system. Thus in the RBAC model (figure 1):

- No permission is granted directly to the subject (ex: user, process, object...), permissions are only granted to roles
- The subjects endorse the roles which are given by the administrator (it is only possible to specify positive authorisations, no prohibitions).
- Roles are defined and organised in a hierarchy: a child role has the permissions granted to his/her parents.

An example of confidentiality policy in a hospital would be:

- A nurse can only read the patient prescriptions. But she can write the last care date and time, provided it takes place during her working time.
- A doctor can only prescribe if he/she is geographically located in the hospital. He has access to the whole medical record, but he/she cannot write the last care date and time.
- A head nurse has read access to prescriptions and cares history without conditions of time.

Permissions associated to roles allow expressing access authorisation in a generic way. Therefore we do not specify that "Dr. Johnson" has access to "Mr. Rabot" record. Instead we only specify that doctors have write access to patient records. Note that in this paper we only take into account the static aspect (i.e. not related to individuals) of RBAC access control. Thus is is not possible to specify that only "Dr. Johnson" has access to "Mr. Rabot" record. The RBAC roles, their hierarchical organisation and the associated permissions constitute the organisation confidentiality policy.

2.2. Related work

The object paradigm is a very expressive framework, largely used. However, implementing object roles is a difficult task. Indeed, the multiplicity of roles and their lifecycle (creation, deletion) is incompatible with the hard constraints of class-based models: object identity, strong typing, etc. Very few work focused on integrating of RBAC within logical data models. Therefore, confidentiality constraints are unfortunately taken into account at the end of the development process, by mean of various techniques added on top of the applications.

This problem could be partly solved with multiple inheritance (figure 2a) in an object programming language. But each combination of role must lead to create a new class, which leads to an explosion of the number of necessary classes. Moreover, their existence is only motivated by technical reasons and not by a modelling need. Another solution is to create a structure of "handles" [5] (figure 2b) which corresponds to the desired multiple-role instances. The handle references several OIDs, each of them corresponding to a role played by this instance. This leads to a referencing problem and involves the use of message delegation. Moreover, "Jacques" would be only a "handle", loosing its encapsulation, and therefore not an object anymore.

A review of role-based object models in the programming object and database areas can be found in [6,7]. However, these models are intended mainly to take into account the evolutive part of the objects during their life, but either they do not propose in general any access control primitive or they do not totally respect the standard paradigms of object programming [8].

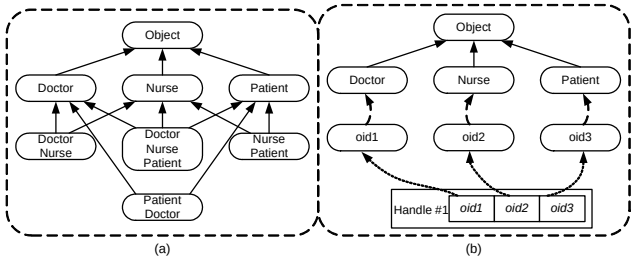

Figure 2. *Empirical solutions for role implementation*

3 THE LORAAM LANGUAGE

In order to tackle the problems of RBAC integration within object data models, we propose a generic language LORAAM allowing the expression of RBAC authorisations and integrating an access control mechanism. The declarative part of the language is composed of:

- The body, which relies on C++ syntax (on a purely illustrative basis, as any class-based language could have been used: Java, Python, etc.) while adding access authorisations formulae to methods.
- The header, which defines the roles which are to be used in the definition of access authorisations.

3.1. The Header

The header is used to specify:

- Various categories of roles to be taken into account. In this example we included the categories of [9] which are adapted to organisations: functional, seniority and context. These categories, freely chosen by the developer, form groups of roles. These groups represent transverse role aspects, which are combined to form complex roles. It would be possible to add some other groups such as "ward", (ex: cardiology, radiology, etc. which remains static), or "classification" (ex: white, grey, black information according to the sensitivity of data) which can be used for example to simulate a MAC access control.
- Hierarchical relations between roles [10]. For example *head << assistant* means that the head has (at least) all the privileges of the assistant. Thus, the conjunction of these roles with a functional role "doctor" makes it possible to specify complex roles, for example "head doctor", who would have more privileges than a “simple" doctor, but fewer privileges than the manager (who is also a doctor).
- The various contexts in which the access authorisations are defined. These contexts can be geographical (by using the predicate "position") or temporal (with the predicate "hour"). We suppose that the position of the user is obtained by reliable mechanisms which are not in the scope of this paper. We suppose we can get an absolute reference as a couple of (X, Y) co-ordinates, indicating the user position from where he/she invokes the service. In practice, space modelling by mean of linear constraints is sufficient for many cases [11]. Within the header, we can for example restrict access only if the user is located within the hospital or the building.

All simple roles defined in the header are combinable via conjunctions and disjunctions, in order to create complex roles, modelling access control constraints based on the transverse aspects of the profile, time and space at the same time.

```
Functional Roles {
Roles : nurse, doctor, day_nurse, night_nurse;
Hierarchy : day_nurse << nurse, night_nurse <<
nurse ;
}

Seniority Roles {
Roles : manager, head, assistant;
Hierarchy : manager << head << assistant;
}

Contextual Roles {
Hospital_enclosure = (position(X,Y) and X>10 and
X<50 and Y<10 and Y>30);
First_shift = (hour(H) and H>=4 and H<12)
Second_shift = (hour (H) and H>=12 and H<20);
Third_shift = ((hour (H) and H>=20) or (hour(H)
and H<4));
}
```

3.2. The Body

In LORAAM, the body part allows the expression of access authorisations at the method level. This is made possible using the *auth* keyword, followed by an appropriate logical formula. The authorisation logical formulae condition access to each method, according to the roles defined in the header. These access authorizations can model access control rules defined in the confidentiality policy.

```
Class CElectronicPatientRecord {
Public:
contact getPatientContact()
auth (doctor or nurse);
string getLastPrescription()
auth (doctor or nurse);
string getPrescriptionHistory()
auth (doctor or (nurse and head));
string getCareHistory()
auth (doctor or (nurse and head));
void setPrescription(string prescription)
auth (doctor and Hospital_enclosure);
void setLastCare(hour h, string care)
auth ((day_nurse and first_shift)
or (day_nurse and second_shift)
or (night_nurse and third_shift));
/* This authorization prevent day nurse from
filling the LastCare field of the e-Patient
record during night and night nurse during the
day */
}
```

3.3. Functional Aspects

As the access control we propose is defined at the class level, the following statements hold :

- For confidentiality-critical applications, access control authorisations should be taken into account from the very start of an information system design cycle [1]. We do think that it does not have to be postponed until the end of the cycle.
- Roles must be defined as soon as the requirement engineering stage.
- Roles and authorizations can only be static, as the class structure is modified, therefore recompiling is necessary. We consider that this is not necessarily a major problem, as the set of information defined in the header and authorizations are very static (ex: hierarchical levels, internal organisation, administrative responsibilities, etc.). However, no recompiling is necessary for dynamic user role assignment or revocation. Moreover, privilege delegation is possible between users.

The principle of access control decision is as follows: when a method call is detected, the LORAAM engine checks if the dynamic user profile logical formula implies the method authorisation. The dynamic user profile is constructed as follows: each role *r* is defined within a category *c*, and is associated to a logical first-order atom *c(r)*. The profile is obtained by conjunction of all played roles and their parents roles. Contextual information is obtained by mean of software/hardware tools such as

LDAP, GPS, time clock, etc. and also translated in a logical formula. If the implication is valid, the method is invoked, else an catchable exception is raised.

3.4. Example

Let us suppose that a user, John, wants to access the *setLastCare()* method from his mobile device. John, who has previously identified himself on the information system, has a profile *functional(nurse) and functional(night_nurse) and position(150,45) and hour(23)*. The functional part can be extracted from a LDAP directory for example, and the spatio-temporal part can be added by a time and position server.

The authorisation formula associated with the *setLastTreatment()* method is specified within the LORAAM body, as *((day_nurse and first_shift) or (day_nurse and second_shift) or (night_nurse and thrid_shift))*. The LORAAM engine replaces these role names by logical predicates, as defined in the header:

- *day_nurse* is replaced by *functional(nurse) and function(day_nurse)*. Indeed, *day_nurse* has at least all the privileges of *nurse*. The same hold for *night_nurse*.
- *first_shift* is replaced by *hour(H) and H>=4 and H<12*. The same holds for *second_shift* and *third_shift*.

The resulting formula (under disjunctive form) is *(functional(nurse) and functional(night_nurse) and hour(H) and H<4) or (functional(nurse) and functional(night_nurse) and hour(H) and H>=20) or (functional(nurse) and functional(day_nurse) and hour(H) and H>=4 and H<12) or (functional(nurse) and functional(day_nurse) and hour(H) and H>=12 and H<20)*. The LORAAM engine checks if the dynamic user profile logical formula implies this formula. As the user profile is *functional(nurse) and functional(night_nurse) and position(150,45) and hour(23)*, we can see that the implication holds. Therefore, access is granted.

4 DISCUSSION

Our proposal makes it possible to take into account RBAC access control to information systems straight into the logical object data model. We presented the generic LORAAM language, which contains two parts. The header allows specification of roles categories and hierarchies. The body part allows specification of authorisations at the method level, by use of logical connectors in order to build more complex ones. We also presented the functional part of LORAAM, which relies on a first-order logic engine.

Software quality best practises recommend the specification of access control constraints at the very beginning of the design process. Thanks to LORAAM, the information system architect can thus directly integrate authorizations in his logical data model in a declarative way, without worrying about the corresponding underlying mechanisms.

This methodology implies that the architect must conduct the role engineering process prior to specifying the information system data model, thus auditing the target internal organization, as well as contextual information system usage (temporal constraints, mobile access, etc.).

We currently work on automatic translation into LORAAM of UML diagrams expressed in specific security models [1,2]. LORAAM can indeed be used as a target language for a CASE supporting a RBAC-based design method, such as SecureUML. We currently plan to validate this approach using our prototype, a LORAAM to C++ preprocessor, with the Foundstone SecureUML Visio template [12].

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DHCP MESSAGE AUTHENTICATION WITH AN EFFECTIVE KEY MANAGEMENT

HongIl Ju and JongWook Han
Home Network Security Research Team,
Electronics and Telecommunications Research Institute,
161 Gajeong-Dong, Yuseong-Gu, Daejeon, 305-700, KOREA
Tel. +82-42-860-5988, Fax. +82-42-860-5611
e-mail: juhong@etri.re.kr

ABSTRACT

In this paper we describes the authentication for DHCP (Dynamic Host Configuration Protocol) message which provides the efficient key management and reduces the danger replay attack without an additional packet for a replay attack. And the authentication for DHCP message supports mutual authentication and provides both entity authentication and message authentication. We applied the authentication for DHCP message to the home network environments and tested through a home gateway.

1 INTRODUCTION

In recent years with the rapid development of the wireless internets and mobile communication systems, the use of notebook computers, PDAs and portable systems is gradually increasing and has become popular. And most of the users may want to access the internet from anywhere in the world. However, when these mobile hosts move from one network to another, users have to change system configuration, including host IP address, default gateway, and name servers. In order to support the automatic configuration changes on these hosts, several technologies such as dynamic host configuration mechanisms or mobility support in the IP layer have been developed[1]. The DHCP can be used to automatically assign IP addresses, to deliver TCP/IP stack configuration parameters such as the subnet mask and default router, and to provide other configuration information such as the addresses for printer, time and news servers[2]. The DHCP is an internet protocol that lets network administrators centrally manage and automate the assignment of IP addresses in an organization's network. Without the DHCP, the IP address must be entered manually at each host in an organization and a new IP address must be entered each time a host moves to a new location on the network.

However, some network administrators may wish to provide authentication of the source and contents of DHCP message during an exchange between a DHCP server and a DCHP client. And they may want to constrain the allocation of addresses to authorized hosts to avoid denial of service attacks in “hostile” environments where the network medium is not physically secured such as wireless networks[1][3]. So, the authentication for DHCP message is necessary securely to assign IP addresses in these environments. The document RFC3118 defines a technique that can provide both entity authentication and message authentication and current security mechanisms for DHCPv4.

2 DHCP

The DHCP is an internet protocol for automatically assigning TCP/IP information to computers and other network devices that use the TCP/IP protocol. Client computers configured to use DHCP for IP assignment do not need to have a statically assigned IP address. In addition, they generally do not need to have addresses configured for DNS servers or WINS servers, as these are also set by the DHCP serverPlease submit your manuscript electronically for review as e-mail attachments.

2.1 DHCP Overview

The DHCP is based on a client-server model and is an extension of an earlier network IP management protocol, BOOTP(Bootstrap Protocol), adding the capability of automatic allocation of reusable network addresses and additional configuration options. And the DHCP provides two services. The first is to provide persistent storage of network parameters for network clients. The model of DHCP persistent storage is that the DHCP service stores a key-value entry for each client, where the key is some unique identifier and the value contains the configuration parameters for the client. The client’s unique identifier may be an IP subnet number and a unique identifier within the subnet. The second is the allocation of temporary or permanent network addresses to clients. The allocation mechanism guarantees not to reallocate that address within the requested time and attempts to return the same network address each time the client requests an address. It means that DHCP should not assign the same IP address to more than one host at the same time. And although a host is rebooted, DHCP should maintain the configuration of the host[2].

2.2 DHCP Mechanism

The DHCP supports three mechanisms for IP address allocation. The first is an automatic allocation method which assigns a permanent IP address to a client. The second is a dynamic allocation method which assigns an IP address to a client for a limited period of time or until the client explicitly relinquishes the address. The third is a manual allocation method which allows the network administrator to assign an IP address to a client. A particular network will use one or more of these mechanisms, depending on the policies of the network administrator.

The DHCP starts that the client sends to a DHCP server a broadcast request called DHCPDISCOVER message containing their MAC addresses, looking for a DHCP server to answer. After receiving the DHCPDISCOVER message, the server determines an appropriate address (if any) to give to the client according to availability and usage policies set on the server. Then the server temporarily reserves that address for the client and sends back to the client a DHCPOFFER message with an IP address information and other TCP/IP settings that the client can use to communicate on the network. The client sends a DHCPREQUEST message, letting the server know that it intends to use the address. The server sends a DHCPACK message, confirming that the client has been given a lease on the address for a server-specified period of time. Figure 1 shows the timeline diagram of messages exchanged between a DHCP client and servers when allocating a new network address[2].

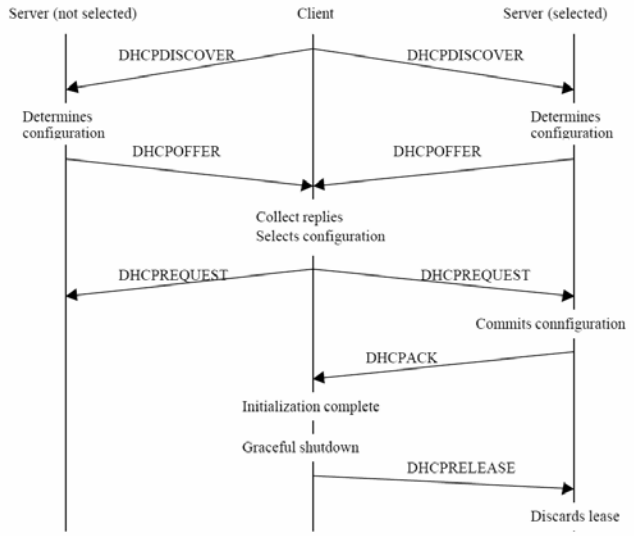

Figure 1. Timeline diagram of messages exchanged between a DHCP client and servers

If a host uses a static IP address, the host is manually configured to use a specific IP address. One problem with static assignment, which can result from user error or inattention to detail, occurs when two computers are configured with the same IP address. This creates a conflict that results in loss of service. So, the DHCP minimizes configuration errors caused by manual IP address configuration, such as typographical errors, as well as address conflicts caused by a currently assigned IP address accidentally being reissued to another host. And the DHCP provides benefits of the reduced network administration. It means that TCP/IP configuration is centralized and automated, network administrators can centrally define global and subnet-specific TCP/IP configurations and clients can be automatically assigned a full range of additional TCP/IP configuration values by using DHCP options.

3 AUTHENTICATION OF THE DHCP MESSAGE

Although DHCP servers are critical to the operation of most enterprise networks, DHCP server security is often one of the most overlooked areas of network security. If there is no authentication processing during an DHCP message exchange between a DHCP server and DCHP client, the DHCP server has no way of knowing if the client requesting the address is a legitimate client on the network, and the client has no way of knowing if the DHCP server that assigned the address is a legitimate DHCP server. The possibility of rogue clients and servers on network can create all kinds of problems. For example, the clients may be subject to DoS(Denial of Service) attacks through the use of bogus DHCP servers, or may simply be misconfigured due to unintentionally instantiated DHCP servers[4].

3.1 DHCP Threat

The threat to DHCP is inherently an insider threat. Regardless of the gateway configuration the potential attacks by insiders and outsiders are the same. The attack specific to a DHCP client is the possibility of the establishment of a "rogue" server with the intent of providing incorrect configuration information to the client. And there is another threat to DHCP clients from mistakenly or accidentally configured DHCP servers that answer DHCP client requests with unintentionally incorrect configuration parameters. The threat specific to a DHCP server is an invalid client masquerading as a valid client. The motivation for this may be for "theft of service", or to circumvent auditing for any number of nefarious purposes. The threat common to both the client and the server is the resource DoS attack. These attacks typically involve the exhaustion of valid addresses, or the exhaustion of CPU or network bandwidth, and are present anytime there is a shared resource[3]. Although it is possible to prepare against the DoS attack with limited IP addresses, there is in need of additional authentication mechanism for preparing against the attack of a rogue DHCP server or DHCP client.

3.2 Authentication Mechanism

In RFC3118, the purpose of the authentication for DHCP message is to protect any interference by malicious hosts and establish secure associations between DHCP servers and clients. In order to validate DHCP message, the receiver checks the MAC(message authentication code) contained in an incoming DHCP message. If the received MAC value does not match the computed MAC value, the receiver discards the following DHCP message. When computing the MAC value, a sender or a receiver uses keyed-hashing for message authentication(HMAC)[5-6]. Figure 2 shows the procedure of message exchanged between DHCP clients and a DHCP server and Figure3 shows the procedure of message exchanged between a DHCP client and DHCP servers.

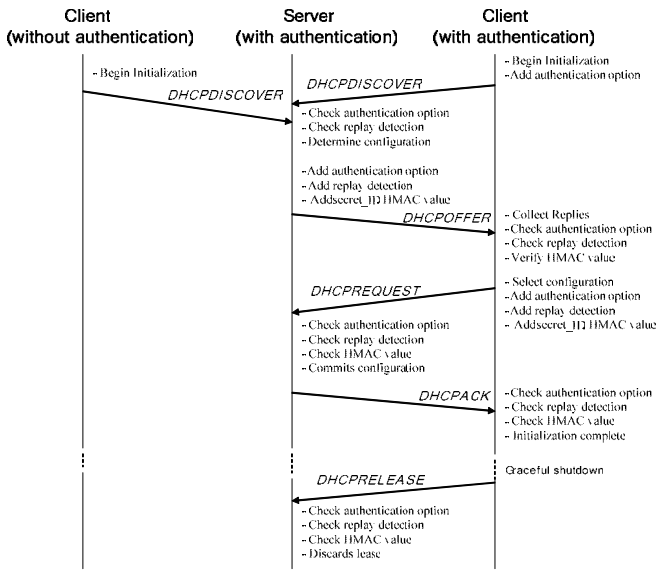

Figure 2. Timeline diagram of message exchanged between DHCP clients and a DHCP server.

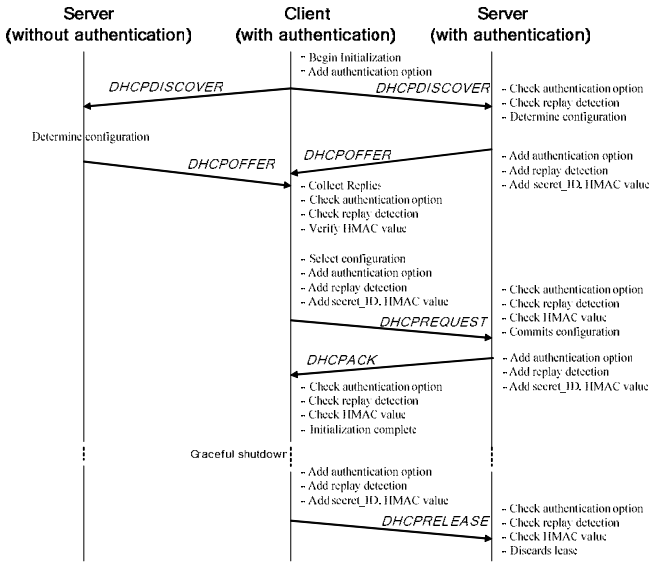

Figure 3. Timeline diagram of message exchanged between a DHCP client and DHCP servers.

In Figure 2, there are one DHCP server and two DHCP clients. Although several DHCP clients may request the IP address, the DHCP server assigns IP address to only the authenticated DHCP client after authentication procedure. In the contrary Figure 3 shows one DHCP client and two DHCP servers. Although several DHCP servers may send a DHCPOFFER message to allocate an IP address, the DHCP client is allocated the IP address by only the authenticated DHCP server after authentication procedure.

4 DESIGN AND IMPLEMENTATION

In this paper we designed and implemented the authentication for DHCP message using keyed one-way function algorithm, HMAC-MD5. And we implemented it in Linux system based on DHCP version 2.0pl5. The authentication method using a HMAC requires a shared secret key for each client on each DHCP server. In other words, each DHCP server has to a shared key for each DHCP client to compute the HMAC of DHCP message. It brings a key management problem of a DHCP server. However, in this paper there is no need the centralized key management in a DHCP server. A DHCP server has only one unique secret master key which can allow to derive all keys for each DHCP client and a DHCP client does not need to have a master key. The unique master key of a DHCP server is generated from the HMAC value which must be unique to that server and generated from server's unique identifier, RN(Random Number) and others. Because a DHCP server has not a shared secret key, if a new client access to a DHCP server, the DHCP server regenerates the shared secret key from a new client identifier and uses to validate an incoming message from a new client.

When each DHCP client is registered on DHCP server, a DHDP server issues the shared secret key which is generated from master key of that DHCP server. That is, SK = HMAC(MK, client identifier), where SK is a share

secret key and MK is a master key. Also, each secret key for each client is unique because a client identifier is unique-id. In DHCP message interaction between DHCP servers and clients, the shared secret key is used for generating a new secret session key which generated from the HMAC value of a random number and a shared secret key. That is, Session_Key = HMAC(RN, SK), where RN is random number generated from a client unique identifier, the current access time and others. In addition the generated session key is used only in current transaction, in the next transaction the new session key is generated and used. In other words, the session key is changed in every transactions and generated from the previous session key. Therefore it allows to protect the replay attack without an additional packet for replay attack and an unauthorized client cannot generate the shared secret key without knowledge of the master key. Figure 4 shows processing of message interaction between a DHCP client and a DHCP server with authentication option.

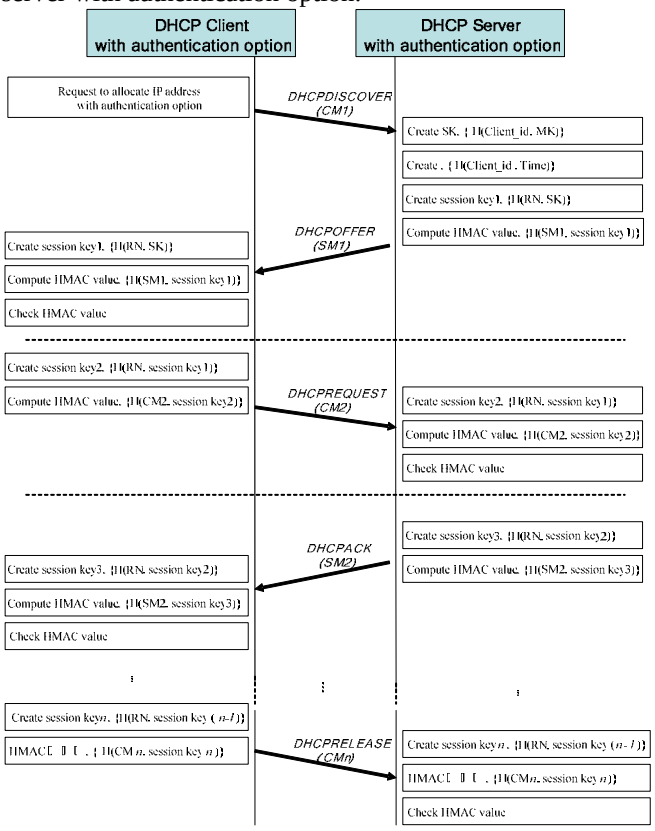

Figure 4. Processing of message interaction with authentication option

5 CONCLUSION

In this paper, we proposed and implemented the authentication for DHCP message which provides the efficient key management and reduces the danger replay attack without an additional packet for a replay attack. And it supports the mutual authentication between a DHCP client and a DHCP server and provides both entity authentication and message authentication. It conforms to RFC3118 which defines current security mechanisms for DHCPv4. And we applied the proposed authentication method for DHCP message to the home network environments and tested through a home gateway. So, this method can be used for the device authentication without an additional authentication methed in home network environments. In future, it is necessary for security mechanisms in DHCPv6.

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PREDNOSTI IN TVEGANJA VPELJAVE PONOVNE UPORABE V PROCESE RAZVOJA PROGRAMSKE OPREME

Gregor Polančič
Fakulteta za elektrotehniko, računalništvo in informatiko
Univerza v Mariboru
Smetanova 17, 2000 Maribor, Slovenija
e-mail: gregor.polancic@uni-mb.si

ABSTRACT

This paper introduces software reuse, which presents key method for improving software development productivity and software quality. Main reuse processes and reuse approaches are introduced. Advantages, disadvantages, risks and reuse success indicators of reuse based development are presented together with a method for reuse insertion into software development processes.

1 UVOD

Projekti razvoja programske opreme se soočajo s številnimi izzivi. Kljub številnim omejitvam, kot so omejeni finančni, človeški, tehnološki in časovni viri, naročniki programske opreme pričakujejo, da bo le ta ustrezala pričakovanim zahtevam (tako iz poslovnega kakor iz tehnološkega vidika). Poleg naročnikov imajo svoj pogled na projekt še razvijalci, ki želijo predvsem maksimizirat produktivnost oziroma dobiček [1].

Strategij razvoja, ki se lahko soočijo z zgoraj predstavljenim problemom, oziroma so istočasno sposobne povečati produktivnost razvoja in kakovost programske opreme, je več. Med najosnovnejše spadajo[1]:

- hitrejši razvoj (8% izboljšave),
- pametnejši razvoj (17% izboljšave) in
- izogibanje razvoju (47% izboljšave).

Izmed vseh, zgoraj omenjenih strategij, zagotavlja strategija izogibanja razvoju *(work avoidance)* največje prihranke [2].

V nadaljevanju je predstavljen koncept, ki omogoča izogibanje razvoju - ponovna uporaba. Tretje poglavje podaja prednosti, slabosti, pokazatelje uspešnosti in tveganja vpeljave ponovne uporabe. Sledi primer metode za vpeljavo ponovne uporabe in zaključek prispevka.

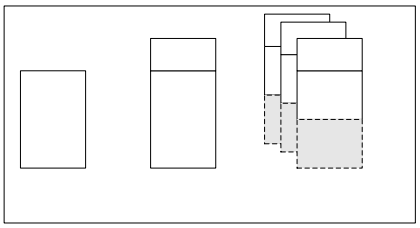
2 PREDSTAVITEV PONOVNE UPORABE

Poglaviten namen ponovne uporabe (v nadaljevanju PU) programske opreme je izboljšanje aktivnosti programskega inženirstva s povečanjem produktivnosti, kakovosti in hitrosti izdelave izdelkov [2]. Leach [4] definira ponovno uporabo kot:

"primer stanj, v katerih se določen programski izdelek uporabi v več kontekstih. Pri tem se pod terminom programski izdelek lahko obravnava vsak izdelek, ki nastane v procesu razvoja programske opreme."

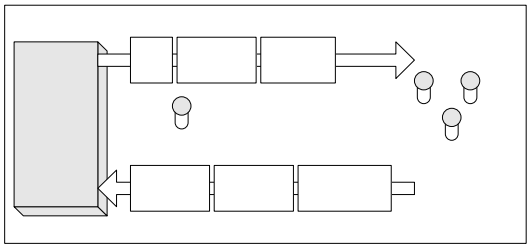
2.1 Aktivnosti ponovne uporabe

Koncept ponovne uporabe je razmeroma preprost. Na eni strani vlagamo dodaten napor (človeške, finančne in ostale vire), da zagotovimo ustrezno okolje, namenjeno razvoju PU izdelkov *(reusable artefacts)*, medtem, ko na drugi strani pričakujemo dolgoročne koristi, ki se odražajo v manjšem naporu, potrebnem za razvoj novih proizvodov, ki temeljijo na PU izdelkih (Slika 1). Kot že omenjeno v definiciji, ponovno uporabni izdelek ni le programski kod, ampak se lahko mednje uvrščajo vsi izdelki, ki nastajajo v procesih razvoja programske opreme (zahteve, uporabniška dokumentacija, procesi ali testni primeri) [4].



Slika 1: *Ilustracija razvoja na osnovi ponovne uporabe*.

Procesi PU so na celovit način obvladovani v modelu REBOOT *(REuse Based on Object Oriented Techniques)*, ki je prikazan na Slika 2 in predstavlja rezultat istoimenskega projekta [5].



Slika 2: *Pogled na organizirano ponovno uporabo (REBOOT pristop) [5]*.

Iz Slika 2 je razvidno, da temelji PU na dveh osnovnih procesih: razvoju PU programske opreme in razvoju na osnovi PU programske opreme. Procesa sta podrobneje predstavljena v nadaljevanju.

[1] V oklepajih so vrednosti, ki predstavljajo izboljšave glede na tradicionalen razvoj, ki ne vključuje omenjene strategije [2].

2.1.1 Razvoj ponovno uporabne programske opreme

Razvoj PU programske opreme *(development for reuse)* ali inženirstvo domene *(domain engineering)*, predstavlja aktivnosti načrtovanja delov sistema programske opreme za uporabo v različnih kontekstih uporabe. Programska oprema, ki je uporabna v različnih kontekstih, se pogosto imenuje PU komponenta *(reusable component)*, ali krajše komponenta. Med komponente lahko uvrščamo poljuben del sistema programske opreme, neodvisno od stopnje zrnatosti in faze življenjskega cikla. »Razvoj za ponovno uporabo« razširja običajne razvojne procese z naslednjimi aktivnostmi:

- analiza raznolikosti zahtev, ki so posledica različnih uporabnikov komponent,
- analiza stroškov in prednosti vključevanja raznolikih zahtev,
- zasnova komponent z ustreznim nivojem splošnosti, ki ustreza vsem trenutnim in potencialnih prihodnjim zahtevam.

Razvoj ponovno uporabne programske opreme je povezan s povratnim inženirstvom *(reverse engineering)*, katerega namen je najpogosteje prav povečevanje stopnje PU.

2.1.2 Razvoj na osnovi ponovne uporabe

Razvoj na osnovi ponovne uporabe *(development with reuse)* ali aplikacijsko inženirstvo *(application engineering)* predstavlja razvoj programske opreme z uporabo PU komponent in vključuje naslednje aktivnosti:

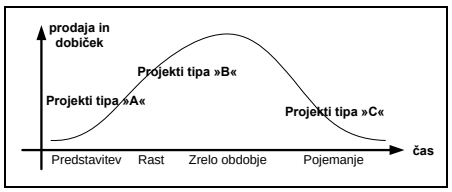
- iskanje množice kandidatnih komponent,
- ovrednotenje množice pridobljenih komponent z namenom izbire najustreznejše komponente,
- prilagajanje izbranih komponent (če je potrebno), z namenom ustrezati specifičnim zahtevam.

Razvoj na osnovi ponovne uporabe je povezan z izdelavo končnih izdelkov za naročnike *(forward engineering)*.

2.2 Vrste projektov, ki temeljijo na ponovni uporabi

Glede na procesa, ki sta bila predstavljena zgoraj, lahko organizacija, katere razvoj temelji na PU, izvaja tri osnovne vrste projektov:

a. Projekte, ki so namenjeni izdelavi PU komponent za domeno, za katero je organizacija sprejela strateško odločitev, da se bo v njej udejstvovala. Projekti tega tipa niso namenjeni razvoju končnih izdelkov, ampak zagotavljajo osnovo za bodoče projekte. Takšni projekti so primerni predvsem za izdelke, ki se nahajajo v začetnem življenjskem obdobju (vpeljava novega izdelka).
b. Projekte, katerih namen je razvoj končnih izdelkov, ki se bodo tržili. V okviru takšnih projektov se uporabljajo predvsem PU komponente, ki jih razvijajo projekti tipa »a«. Prav tako so lahko tudi izdelki, ki nastanejo znotraj samega projekta tipa »b«, PU komponente. Takšni projekti so najbolj primerni za izdelke, ki se nahajajo v najbolj dobičkonosnem obdobju (zrelo obdobje izdelka).
c. Projekte, katerih namen je razvoj končnih izdelkov izključno na osnovi ponovno uporabnih komponent. Ti projekti so primerni za zadnje življenjsko obdobje izdelka, kjer se že močno pozna upadanje zanimanja (dobička) za izdelek.



Slika 3: *Prevladujoči tipi projektov glede na življenjsko obdobje izdelka [5]*.

2.3 Pristopi k ponovni uporabi programske opreme

Projekti, katerih razvoj temelji na PU, lahko realizirajo PU z različnimi pristopi. Mednje spadajo [8]:

a. **Vzorci načrtovanja** *(design patterns)* - abstrakcije, ki se (običajno uspešno) pojavljajo v različnih aplikacijah, se pogosto predstavijo v obliki vzorcev načrtovanja.
b. **Komponentno usmerjen razvoj** *(component based development)* – takšen razvoj temelji na integraciji komponent, ki temeljijo na specifikacijah določenega komponentnega modela.
c. **Programska ogrodja** *(application frameworks)* – predstavljajo sezname abstraktnih in konkretnih razredov, ki se lahko prilagodijo in razširijo z namenom izdelave konkretnih aplikacij. Sestavljeni so iz konceptualno celovite zasnove in delne implementacije. Ogrodja se lahko med sabo močno razlikujejo. Osnovne vrste ogrodij so: infrastrukturna ogrodja *(infrastructure frameworks)*, ogrodja srednjega sloja *(middleware integration frameworks)* in celovita ogrodja *(enterprise application frameworks)*.
d. **Ovijanje obstoječih sistemov** *(legacy system wrapping)* - obstoječi sistemi se lahko ovijejo tako, da se definirajo vmesniki in opredelijo dostopi do obstoječih sistemov preko definiranih vmesnikov.
e. **Storitveno usmerjeni sistemi** *(service oriented systems)* – predstavljajo gradnjo sistemov s povezovanjem obstoječih (lahko zunanjih) storitev.
f. **Serije programskih izdelkov** *(application product lines)* – predstavljajo razvoj družin aplikacij, ki si delijo skupno osnovo in variabilen del, ki je specifičen za posamezne aplikacije znotraj družine.
g. **Integracija COTS** *(COTS integration)* – COTS *(Commercial Of The Shelf)* so obstoječi komercialni programski izdelki, ki zagotavljajo programski vmesnik, preko katerega se lahko integrirajo v preostalo programsko okolje.
h. **Parameterizirane vertikalne aplikacije** *(configurable vertical applications)* – generične aplikacije, ki so se zmožne prilagajati specifičnim zahtevam naročnikov.

i. **Programske knjižnice** *(program libraries)* – Množice razredov ali funkcij, ki na splošen način implementirajo pogoste funkcionalnosti.
j. **Generatorji programov** *(program generators)* – Generatorji programov posedujejo znanje o določeni aplikacijski domeni, na osnovi česar so sposobni generirati rešitve ali delne rešitve (v enaki domeni).
k. **Aspektno usmerjen razvoj programske opreme** *(aspect oriented software development)* – komponente se v času prevajanja na različnih mestih "vpletejo" v končni izdelek *(separation of concerns)*.

Po Frakes-u [6], se lahko zgoraj omenjeni pristopi klasificirajo glede na doseg, vrste sprememb, pristop, domeno, vodenje in predmet ponovne uporabe.

3 VPELJAVA PONOVNE UPORABE V PROCESE RAZVOJA PROGRAMSKE OPREME

Ponovna uporaba je povezana tako s prednostmi, kakor tudi s slabostmi in novimi tveganji. Le PU, ki je v procese razvoja programske opreme vpeljana tako, da na objektiven način vrednoti in usklajuje prednosti in tveganja, rezultira v poslovnem uspehu.

Procesi PU so lahko v organizacije vpeljani na različnih zrelostnih nivojih [5]:

a. **Neformalna PU**. Pristop ne zahteva dodatnih vlaganj. PU ima doseg projekta, sami PU izdelki ne zapadejo pod vpliv procesov PU (priklic, vrednotenje, prilagajanje, preoblikovanje, certificiranje, klasificiranje), zato je dodaten trud minimalen.
b. **Operativna PU**. Pristop zmanjšuje stroške razvoja predvsem s tem, da povečuje produktivnost na osnovi obstoječih in preizkušenih gradnikov. PU je vpeljana na nivoju organizacije in procesov razvoja PO, ki zahtevajo dodatne mehanizme (skupni repozitorij komponent, poenotena pravila testiranja in dokumentiranja in podobno.
c. **Strateška PU**. Pristop prestavi odločitve, povezane s PU, na strateško in vodstveno raven. Namen PU ni samo zniževanje stroškov, temveč pridobivanje strateških prednosti, ki izhajajo iz PU.

Z namenom vzpostavitve in ocene zrelosti ponovne uporabe, so se v zadnjih letih razvili številni zrelostni modeli PU, izmed katerih so nekateri skladni z obstoječimi standardi, kot je CMM *(Capability Maturity Model)* [7].

3.1 Prednosti in slabosti ponovne uporabe

Po začetno vloženem trudu in prehodnem obdobju, zagotavlja pravilni (organiziran in celovit) pristop k PU številne prednosti, ki vplivajo na kakovost programske opreme in produktivnost razvoja, predvsem zaradi [4]:

a. **Povečane zanesljivosti** *(dependability)* programske opreme, zaradi večkratnega testiranja in uporabe PU artefaktov.
b. **Zmanjšanih projektnih in produktnih tveganj** pri razvoju programske opreme, zaradi obstoječih in že preizkušenih delov končnega izdelka.
c. **Nižjih stroškov razvoja,** zaradi skupnih programskih okolij in ponovno uporabnih izdelkov.
d. **Učinkovitejšega dela razvijalcev in hitrejšega razvoja** programske opreme, ker so isti programski izdelki uporabljeni več krat.
e. **Povečane skladnosti** s standardi, zaradi zahtev po čim večjem številu ponovnih uporab.

Težave, ki nastanejo zaradi vpeljave PU, so pogosto vezane na pristop (glej poglavje 0), ki ga izberemo [10]. Neodvisno od pristopa so poglavitne težave (ali vsaj potencialne težave oziroma tveganja[2]) naslednja:

a. **Povečani začetni stroški –** preden se lahko pričakujejo koristi od PU, zahteva njena vpeljava dodatno investicijo.
b. **NIH** *(not invented here syndrome)* - številni razvijalci pogosto ne odobravajo vključevanja tuje kode v njihov programski kod.
c. **Iskanje ustrezne komponente** – ponovno uporabno komponento, ki povsem ustreza zahtevam, je pogosto težko najti. V primeru, ko se ustrezna komponenta ne najde, se je potrebno zavedati, da so spremembe na generični komponenti lahko dražje kot razvoj specifične komponente (ki je povsem skladna z zahtevami).
d. **Razumevanje komponente** – sama komponenta je pogosto nerazumljiva. Zato je nujno, da s komponento pridobimo še izdelke, ki omogočajo njeno preizkušanje in vrednotenje.
e. **Spreminjanje komponente** – razvoj komponente, ki bo ustrezala vsem prihodnjim zahtevam, je nemogoč. Zato se morajo komponente nenehno prilagajat novim zahtevam. Povečan delež sprememb na komponenti zvišuje stroške razvoja in pogosto zmanjšuje kakovost komponente.
f. **Sestavljanje komponent** – pogosto je sliko končnega izdelka, ki temelji na različnih komponentah, nemogoče realizirati na osnovi obstoječih komponent (velja tudi obratno).
g. **Pravni vidik** – »kdo je odgovoren, če pride na izdelku ki vsebuje PU komponento do okvare?«, »kakšne so lahko pravne posledice licenc komponent?«, »kako je z dolgoročnim vzdrževanjem komponent?«, so le nekatera izmed vprašanj, ki lahko nastopijo pri (predvsem med-organizacijski) PU.

Zelo obsežen seznam tveganj, povezan z vpeljavo PU, navaja »Software Productivity Consortium« [9], ki tveganja klasificira po naslednjih področjih:

- tveganja organizacijske strukture in politike,
- tveganja, povezana s sposobnostmi organizacije in osebja,
- tveganja procesov razvoja programske opreme,

[2] Tveganje je potencialna škoda, ki je posledica obstoječih procesov ali prihodnjih dogodkov.

- tveganja upravljanja z viri projekta,
- tveganja upravljanja s konfiguracijo,
- tveganja sistema vodenja kakovosti,
- tveganja posameznih faz življenjskega cikla programske opreme (analiza, načrtovanje, implementacija, itd.)
- tveganja izdelka (arhitektura, algoritmi, ipd.)

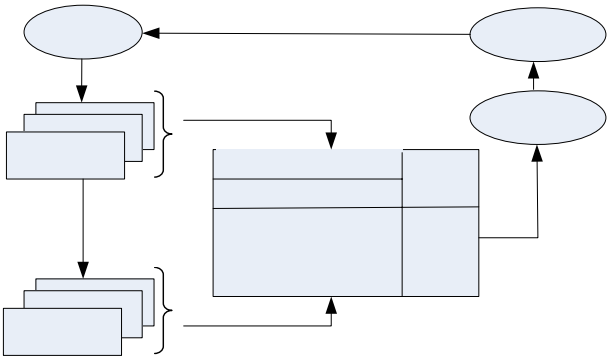
3.2 Pokazatelji uspeha ponovne uporabe

Neodvisno od pristopa PU, obstajajo pokazatelji, ki vplivajo na uspeh oziroma neuspeh PU (Tabela 1). Kritičen dejavnik, ki vpliva na uspeh PU je predvsem domena, znotraj katere želimo izvajati procese PU.

Tabela 1: *Faktorji (ne)uspešne ponovne uporabe [7].*

Faktorji uspeha (vidik domene)	***Faktorji tveganja (vidik domene)***
Ozka, standardizirana	Široka, takšna, ki pokriva več aplikacijskih področij.
Stabilna.	Hitro spreminjajoča.
Obstajajo standardni vmesniki.	Povezovanje komponent zahteva dodaten programski sloj.
Potencial za PU je velik.	Potencial za PU je majhen.
Zanesljiva infrastruktura.	Nezrela, nestandardizirana infrastruktura.
Podpora s strani vodstva.	Neopredeljenost podpore vodstva.
Odobravanje vpeljave PU s strani razvijalcev.	Nesklepčnost pri vpeljavi PU s strani razvijalcev.

Zaradi tveganj, povezanih s PU, so se oblikovale številne metode, namenjene (nadzorovani) vpeljavi PU v procese razvoja programske opreme. Ena izmed metod je metoda kritičnih dejavnikov uspeha, ki jo je razvil Wasmund [11]. Omenjena metoda temelji na več korakih (Slika 4). Zastavljen cilj (učinkovita vpeljava PU v organizacijo v zastavljenem času) se najprej razčleni na posamezne faktorje, ki predstavljajo pogoje za uspešno dosego cilja (glej tudi Tabela 1). Identificirani faktorji se nato, preko matrike, povežejo z aktivnostmi, ki realizirajo definirane faktorje (cilj). Namen matrike je omogočiti identifikacijo, glede na aktivnosti, nepokritih faktorjev, kakor tudi identifikacijo odvečnih aktivnosti. Primer: Na matriki slike 4, podpre aktivnost 1 enake faktorje kot aktivnost 3 (A in B). Posledično se lahko aktivnost 1 izpusti.
Zadnji korak metode predstavlja izvedba aktivnosti, ki so ostale v matriki, kar predstavlja izvršitev zastavljenega cilja.



Slika 4**:** *Koraki metode »kritičnih faktorjev uspeha« [11].*

4 ZAKLJUČEK

V prispevku je bila podrobneje predstavljena ponovna uporaba, njena osnovna procesa in pristopi k njeni realizaciji. V nadaljevanju so bile predstavljene prednosti in pomanjkljivosti vpeljave ponovne uporabe. Predstavljeni so bili dejavniki, ki se lahko obravnavajo kot pokazatelji uspeha ali neuspeha vpeljave ponovne uporabe, skupaj s primerom metode vpeljave ponovne uporabe.

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PRIMERJAVA PRISTOPOV K DOKUMENTIRANJU OGRODIJ

Andrej.Krajnc[1], Marjan Heričko[2]
[1]Iskratel d.o.o., Ljubljanska cesta 24a, 4000 Kranj
[2]Fakulteta za elektrotehniko, računalništvo in informatiko, Univerza v Mariboru, Smetanova ulica 17, 2000 Maribor, Slovenija
e-mail: a.krajnc@iskratel.si, marjan.hericko@uni-mb.si

POVZETEK

Kljub temu, da se ogrodja uporabljajo že precej dolgo, še vedno ne obstaja nek pristop k dokumentiranju ogrodij, ki bi bil širše sprejet. Namesto tega se pojavlja veliko različnih pristopov, ki vsak na svoj način opisujejo podobne koncepte. V prispevku so opisani različni pristopi k dokumentiranju ogrodij, pri čemer so prikazane prednosti in slabosti posameznih pristopov. Kot najboljši pristop se pokaže uporaba jezika UML z nekaterimi dodatnimi razširitvami, ki opisujejo razširitvene točke.

1 UVOD

V zadnjem času predstavlja ogrodje vse bolj pomemben koncept pri razvoju programske opreme [1]. Ogrodje ni konkretna aplikacija, temveč predstavlja skelet za aplikacije, ki bodo zgrajene z uporabo tega ogrodja. Določene so osnovne funkcije, ki so skupne za več aplikacij, specifične funkcije za določeno aplikacijo pa dopolnijo uporabniki ogrodja sami [2].
Čeprav koncept ogrodij zelo spominja na druge koncepte ponovne uporabe, kot so komponente, knjižnice razredov in vzorci, obstajajo med njimi določene razlike. Ogrodja se od knjižnic razredov razlikujejo po tem, da ponujajo ponovno uporabo na višjem nivoju abstrakcije in granulacije. Čeprav lahko na ogrodja gledamo tudi kot na komponente, pa v splošnem velja, da so ogrodja bolj razširljiva kot komponente, definiran pa imajo tudi bolj kompleksen vmesnik. V ogrodjih je ponavadi vključenih več komponent in implementiranih več različnih vzorcev.

2 DOKUMENTIRANJE OGRODIJ

2.1 Pomen dokumentiranja ogrodij

Dokumentiranje je ena od najpomembnejših aktivnosti pri razvoju programske opreme. Brez ustrezne dokumentacije si ni mogoče predstavljati uporabe programske opreme v praksi.
Ker sodijo ogrodja med najbolj zahtevne programske produkte, je dokumentacija še toliko bolj pomembna. Četudi je ogrodje še tako dobro, brez ustrezne dokumentacije ne bo zaživelo v praksi.
Dokumentiranje ogrodij ima dva namena. Prvi namen je podajanje informacij o načrtovanju ogrodij in ostalih informacij, povezanih z razvojem ogrodij. Drugi namen dokumentiranja je posredovanje informacij, potrebnih za uporabo ogrodij pri razvoju aplikacij. Če bo uporabniku ogrodja na voljo dovolj informacij o ogrodju, potem bo njegov razvoj aplikacij veliko lažji. Če pa je dokumentacija ogrodja pomanjkljiva, potem se lahko pojavi veliko težav, v najslabšem primeru lahko to pripelje tudi do opustitve uporabe ogrodja.
Kljub temu, da se ogrodja uporabljajo že precej dolgo, pa lahko ugotovimo, da še vedno ne obstaja nek pristop k dokumentiranju ogrodij, ki bi bil širše sprejet. Namesto tega se pojavlja več različnih pristopov, ki vsak na svoj način opisujejo podobne koncepte. To predstavlja velik problem pri uporabi ogrodij, saj uporabniki tako težje spoznavajo ogrodja in se ne odločajo za njihovo uporabo v tolikšni meri kot, če bi imeli poenoten pristop k opisovanju ogrodij.

2.2 Pristopi k dokumentiranju ogrodij

Vzporedno z razvojem ogrodij so se od samega začetka razvijali tudi različni pristopi k dokumentiranju ogrodij.
Uporabo prvega ogrodja Model-View-Controller (MVC) so dokumentirali v obliki »kuharice« (Cookbook) [3], kjer niso bile predstavljene podrobnosti ogrodja, temveč predvsem način, kako uporabiti ogrodje.
Ker se je koncept ogrodij najprej razvil v skupnosti, ki se ukvarjala z razvojem vzorcev, se je na začetku uveljavil tudi pristop k dokumentiranju z uporabo vzorcev.
Relativno hitro so se začeli pojavljati tudi prvi jeziki za opisovanje ogrodij, kot je npr. FDL (Framework Description Language) [4].
Z uveljavitvijo jezika za modeliranje UML (Unified Modeling Language [5]) kot de-facto standardnega načina modeliranja objektno-orientiranih aplikacij so se ogrodja začela opisovati z uporabo tega jezika.
Ker pa UML ni v celoti primeren za opisovanje ogrodij, posebej za opisovanje razširitvenih točk, so se pojavile razširitve, ki naslavljajo ta problem. Najpomembnejši razširitvi sta UML profila UML-F [6] in F-UML [7].
Pomanjkljivosti verzije UML 1.5 naj bi odpravil pred kratkim sprejet UML 2.0, s katerim bo, ko bodo dokončno razvita orodja, mogoče veliko bolje opisovati ogrodja.
Ena od najpomembnejših novih iniciativ, ki se dotikajo dokumentiranja ogrodij, je tudi iniciativa RAS (Reusable

Asset Specification [8]), ki naslavlja opisovanje različnih ponovno uporabnih pridobitev, med drugimi tudi ogrodij.

2.2 Uporaba kuharice

Pristop k dokumentiranju ogrodij z uporabo »kuharice« (Cookbook) [3] temelji na opisu aktivnosti, potrebnih za uporabo ogrodij pri razvoju aplikacij. Dobra lastnost tega pristopa je, da se na enostaven način predstavi namen uporabe ogrodja in prikažejo primeri uporabe. Način uporabe ogrodja je prikazan v pogovornem jeziku, za različne funkcionalnosti pa se uporabljajo različni »recepti« (recipe). Glavni očitki temu pristopu so, da je jezik preveč neformalen, da se je težko odločiti, kaj vključiti v kuharico (ni možno pokriti vseh primerov uporabe) ter da ni podpore za avtomatizacijo v orodjih. Kuharico so uporabljali predvsem za opisovanje prvih generacij ogrodij.

2.3 Uporaba vzorcev

Vzorci obstajajo v najrazličnejših oblikah in nekatere od njih so primerne tudi za opisovanje ogrodij. Johnson [9] je leta 1992 kot prvi predlagal pristop k opisovanju ogrodij z uporabo vzorcev. Definiral je dokumentarne vzorce, ki opisujejo, na kakšen način je možno uporabiti ogrodje. Takšni vzorci prinašajo obliko za opis vsakega »recepta« ter organizacijo celotne »kuharice«. Najpogostejši recepti so predstavljeni na začetku, podrobnosti načrta ogrodja pa so predstavljene na koncu. Pristop je bil uspešno uporabljen za opis ogrodja za grafično urejevanje HotDraw.

Da bi Johnsonove dokumentarne vzorce ločili od načrtovalskih vzorcev (design patterns) [10], sta Lajoie in Keller [11] za te vzorce uvedla nov termin – motif. Lajoie in Keller sta definirala predlogo za opis motifov, v predlogi pa so predvideni ime in namen, opis situacije za ponovno uporabo, potrebni koraki za prilagoditev, ter povezava z drugimi motifi in načrtovalskimi vzorci. Načrtovalski vzorci se uporabljajo za opis interne arhitekture, s čimer dobijo uporabniki vpogled v odločitve glede načrtovanja ogrodij.

Pri opisovanju ogrodij si lahko pomagamo tudi z uporabo meta vzorcev (metapatterns) [12]. Meta vzorci opisujejo na kakšen način je realizirana fleksibilnost ogrodij. Vsak vzorec opisuje povezavo med razširitveno točko v ogrodju in konkretno implementacijo v aplikaciji.

Uporaba vzorcev pri dokumentiranju ogrodij je lahko v veliko pomoč predvsem pri razumevanju delovanja ogrodij. Podobno kot pri prejšnjem pristopu tudi za ta pristop velja, da je omejena avtomatizirana uporaba v orodjih za dokumentiranje.

2.4 Uporaba jezika za opis ogrodij FDL

Prvi formalni jezik za dokumentiranje ogrodij je bil FDL (Framework Description Language). FDL definira predlogo za opis ogrodja, ki vsebuje podroben opis, kako lahko ogrodje uporabimo. Predloga vsebuje opis razredov, katerih primerke moramo oz. lahko naredimo, opis razredov, ki jih moramo dedovati, ter opis razredov, ki se uporabljajo interno v ogrodju. Posamezne razrede opisujemo s predlogo FCD (Framework Class Description), ki je različica navadnega C++ razrednega zaglavja (C++ class header). Poleg opisa ogrodja v obliki FDL je potrebno k dokumentaciji dodati še razredne diagrame, primere programov in prej omenjene »recepte«. Čeprav je FDL ponudil kar nekaj novosti na področju dokumentiranja ogrodij, v praksi ni nikoli zaživel, najverjetneje, ker je bil vezan predvsem na skupnost programskega jezika C++.

2.5 Uporaba jezika UML

Najbolj poznana tehnika za modeliranje objektno-orientiranih aplikacij je jezik UML (Unified Modeling Language), ki ga je standardizirala organizacija OMG (Object Management Group). Dandanes skorajda ni več aplikacije, kjer ne bi za dokumentiranje uporabili katerega od diagramov, ki jih definira UML. Med najbolj poznane diagrame sodijo diagram primerov uporabe (use-case diagram), razredni diagram (class diagram), komponentni diagram (component diagram), diagram zaporedja (sequence diagram) in diagram aktivnosti (activity diagram). V UML diagrame lahko vključujemo tudi vzorce, kar je za opisovanje ogrodij zelo pomembno.

Lahko rečemo, da UML v veliki meri zelo dobro dokumentira ogrodja, vendar pa se pojavljajo tudi pomanjkljivosti. Sam koncept ogrodij namreč ni tako eksplicitno izpostavljen kot nekateri drugi koncepti, npr. objekt, razred, komponenta, vmesnik. Še posebej je UML pomanjkljiv pri opisovanju razširitvenih točk, saj ne obstaja standardni opis razširitvenih točk ogrodij.

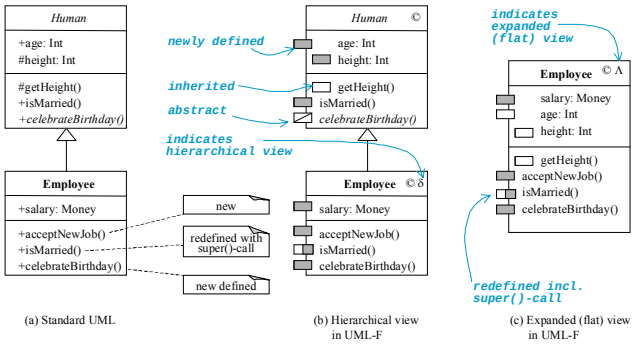
Da bi se izognili temu, da vsak razširitvene točke opisuje po svoje, se je pojavilo nekaj iniciativ, ki naslavljajo ta problem. Najpomembnejši iniciativi sta UML-F in F-UML, ki poskušata standardizirati dokumentiranje ogrodij z razširitvami jezika UML.

2.5.1 Profil UML-F

UML-F je razširitev jezika UML (UML profile), ki je namenjena za dokumentiranje načrtovalskih vzorcev in ogrodij. Kot osnovo za dokumentiranje ogrodij uporablja UML-F notacijo jezika UML, dodan pa je označevalni mehanizem (tag mechanism) za opisovanje razširitvenih točk ogrodja. Ta označevalni mehanizem je implementiran z uporabo standardnih konceptov jezika UML, kot so stereotipi (stereotypes) in označevalne vrednosti (tagged values). UML-F razširja le standardne razredne in objektne diagrame ter diagrame zaporedij.

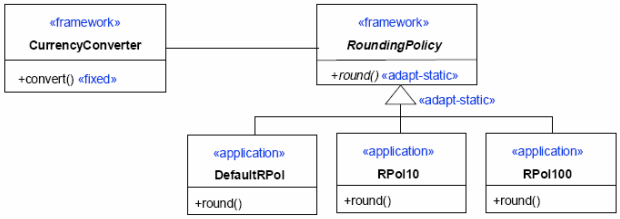
UML-F vsebuje tri vrste označb (tags): predstavitvene označbe (presentation tags), osnovne označbe za modeliranje (basic modeling tags) in bistvene označbe vzorcev (essential pattern tags).

Predstavitvene označbe dopolnjujejo standardne diagrame z novimi vizualnimi elementi. Slika 1 prikazuje primer modeliranja razreda Employee z uporabo standardnega razrednega diagrama in razširjenega razrednega diagrama.



Slika 1: Uporaba predstavitvenih označb jezika UML-F [6]

Za razliko od predstavitvenih označb, ki so vezane na katerikoli objektno-orientiran model, pa so osnovne označbe za modeliranje vezane predvsem na ogrodja. Slika 2 prikazuje razrede, ki spadajo v ogrodje in razrede, ki spadajo v aplikacijo. Prav tako so prikazani opisi razširitvenih točk. Stereotip «fixed» označuje razrede in metode, ki se ne smejo spremeniti, stereotip «adapt-static» pa označuje razrede in metode, ki se lahko spremenijo, npr. z uporabo dedovanja.

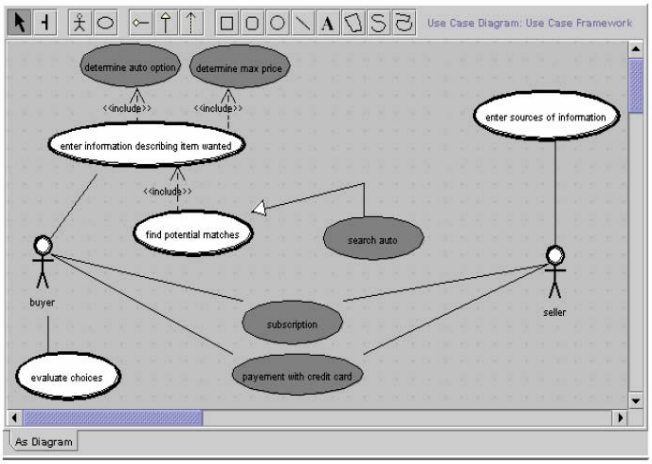


Slika 2: Uporaba stereotipov za modeliranje

Čeprav se o jeziku UML-F precej govori in so na voljo tudi že orodja za modeliranje, pa na drugi strani lahko ugotovimo, da predvsem med najpomembnejšimi akterji na področju modeliranja ni najbolj zaživel.

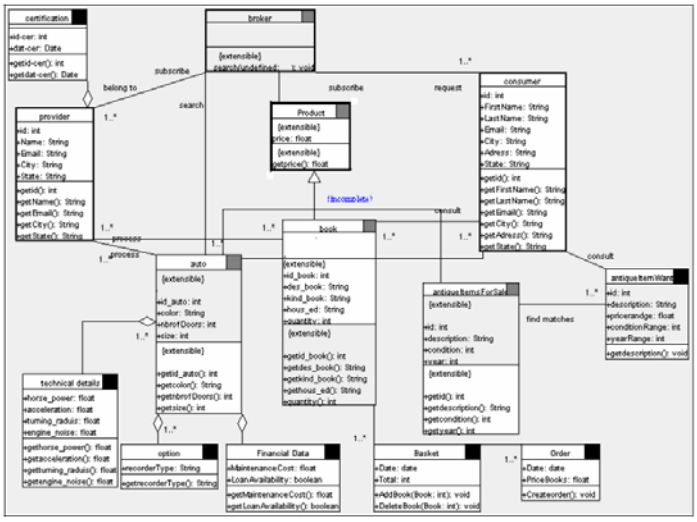
2.5.1 Jezik F-UML

F-UML je prav tako razširitev jezika UML, katerega namen je definirati jezik za dokumentiranje ogrodij. V F-UML je načrt ogrodja sestavljen iz štirih UML diagramov: diagram primerov uporabe, razredni diagram, diagram vzorcev (pattern diagram) in diagram zaporedja.
Diagram primerov uporabe določa obseg in cilj ogrodja ter domenske omejitve. Standardni diagram primerov uporabe je razširjen z razširjenimi grafičnimi elementi: sivo obarvan primer uporabe oz. akter nakazuje razširitveno točko ogrodja, odebeljen rob primera uporabe oz. akterja pa nakazuje jedro ogrodja. Primer prikazuje slika 3.



Slika 3: Diagram primerov uporabe v jeziku F-UML [7]

Razredni diagram opisuje statično arhitekturo ogrodja. Razširitve razrednega diagrama omogočajo uporabniku razlikovanje med razredi v samem jedru ogrodja in razredi, ki predstavljajo razširitvene točke. Na sliki 4 odebeljen rob razreda predstavlja razred v jedru ogrodja, črno obarvan kot razreda predstavlja črno razširitveno točko (blackbox hot-spot), sivo obarvan kot razreda pa belo razširitveno točko (whitebox hot-spot). Črne razširitvene točke se uporabljajo z uporabo kompozicije, bele razširitvene točke pa z implementacijo metod oz. razredov.



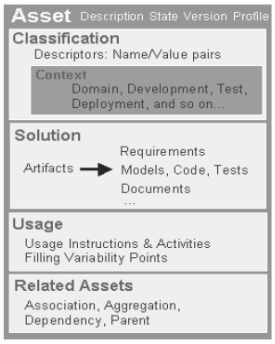
Slika 4: Razredni diagram v jeziku F-UML [7]

Za delo z jezikom F-UML je bila definirana tudi načrtovalska metoda FBDM (Framework Based Design Method), na voljo pa je tudi orodje za modeliranje F-UMLTool. Ker je jezik F-UML relativno mlad, je v praksi še dokaj nepoznan.

2.6 RAS (Reusable Asset Specification)

Specifikacija RAS (Reusable Asset Specification) je projekt, ki so ga najprej zastavili pri podjetju Rational, dokončno pa standardizirali v okviru organizacije OMG. Osnovni namen specifikacije RAS je definiranje

standardnega načina opisovanja najrazličnejših izdelkov oz. pridobitev, ki so nastale med razvojem programske opreme in so lahko ponovno uporabne v drugih projektih. Ne gre le za ponovno uporabo razredov, komponent, ogrodij in vzorcev, kot je to tipično pri razvoju objektno-orientiranih projektov, temveč se kot ponovno uporabni izdelki lahko pojavljajo tudi najrazličnejše druge stvari, kot so spletne storitve, XML sheme, dokumenti, standardi itd.
RAS je razdeljen v dva dela, in sicer jedro RAS (Core RAS) ter profile (Profiles). Jedro RAS definira osnovne elemente specifikacije pridobitev, profili pa opisujejo razširitve teh osnovnih elementov. Trenutno sta že definirana dva profila, in sicer profil za opis komponent (Default Component Profile) ter profil za opis spletnih storitev (Default Web Service Profile). Verjetno bodo nastali še drugi profili, ki bodo opisovali druge vrste pridobitev.
Vsako pridobitev je potrebno opisati po štirih kriterijih (glej sliko 5). V opisu klasifikacije (Classification) je potrebno navesti množico deskriptorjev za klasificiranje pridobitve ter podati opis konteksta. V opisu rešitve (Solution) je potrebno navesti vse izdelke pridobitve. Opis uporabe (Usage) vsebuje pravila za namestitev, prilagajanje in uporabo pridobitev. Opis povezanih pridobitev (Related Assets) opisuje povezave z drugimi pridobitvami.



Slika 5: Opis ponovno uporabne pridobitve

Čeprav je RAS relativno mlad standard, pa ime že podporo v Rationalovih orodjih. Obstaja tudi dodatek (plug-in) za metodo RUP (Rational Unified Process). Dodatek definira dodatne aktivnosti, akterje in dokumente za delo z ponovno uporabnimi pridobitvami.
Čeprav RAS ni namenjen eksplicitno za dokumentiranje ogrodij, ga je smiselno uporabiti, še posebej, če želimo ogrodja uporabljati skupaj z drugimi vrstami pridobitev.

5 ZAKLJUČEK

V prispevku so bili predstavljeni različni pristopi k dokumentiranju ogrodij.
Trenutno še vedno ne obstaja nek pristop k dokumentiranju ogrodij, ki bi bil širše sprejet, ogrodja pa morajo biti dokumentirana, saj se sicer ne bodo uporabljala. Verjetno najboljši pristop je uporaba jezika UML z nekaterimi dodatnimi razširitvami, ki opisujejo razširitvene točke. Pri tem se ne smemo nasloniti zgolj na opis statične strukture, temveč je potrebno vključiti tudi opise dinamičnega obnašanja, saj bomo lahko le tako vedeli, kaj se dogaja v ogrodju. Takšen opis z uporabo jezika UML je obvezen praktično za vsako ogrodje.
Za razvijalce, ki želijo ogrodja čimprej uporabljati pri gradnji aplikacij, je smiselno ustvariti dodatno dokumentacijo, ki jim bo omogočala hitro uporabo. Za to je najprimernejši pristop v obliki kuharice, kateremu dodamo primere aplikacij, zgrajene z ogrodjem.
Če želimo ogrodje razširiti, moramo dobro razumeti njegovo notranjo zgradbo. Za to je zelo primerno dodatno dokumentiranje z uporabo vzorcev, ki lahko velikokrat bolje od jezika UML predstavi višjenivojske koncepte, na katerih temelji ogrodje.

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SISTEMATIČNO ISKANJE PRIMERNIH REALIZACIJ ENOSTAVNIH IN SESTAVLJENIH NAČRTOVALSKIH VZORCEV

Simon Beloglavec, Marjan Heričko
Inštitut za informatiko
Fakulteta za elektrotehniko, računalništvo in informatiko Maribor
Smetanova ulica 17, 2000 Maribor, Slovenija
Tel: +386 2 2355116; fax: +386 2 2355134
e-mail: simon.beloglavec@uni-mb.si

POVZETEK

Prispevek predstavlja tehniko za iskanje najprimernejše dopustne realizacije enostavnega vzorca oz. nabora vzorcev, ki tvorijo sestavljen vzorec. Tehnika implicitno zahteva od načrtovalca, da upošteva pri izbiranju realizacije vzorca celoten nabor dopustnih realizacij vzorca. Namenjena je nadgradnji obstoječih načrtovalskih in razvojnih orodij. V okviru tehnike predstavljamo dve novi metriki, ki vrednotita lastnosti izbranih realizacij vzorcev in nov pristop k opisovanju množice dopustnih realizacij z uporabo formalnega jezika TLA+. Definirali smo metriki vzorcev, ki vrednotita pokrivanje načrta z realizacijami vzorcev in medsebojno prekrivanje realizacij vzorcev v sestavljenem vzorcu. V prispevku predstavljamo razvit primer implementacije podpornega orodja, ki ga zahteva opisana tehnika.

1 UVOD

Uporaba načrtovalskih vzorcev pri razvoju informacijskih sistemov omogoča ponovno uporabo idejnih rešitev, ki so se v praksi izkazale za učinkovite. Posamezni načrtovalski vzorec ne predstavlja konkretnega gradnika načrta, ampak postavlja ogrodje rešitve, ki dopušča množico realizacij. Obstoječa načrtovalska in razvojna orodja ne omogočajo pregleda nad dopustnimi realizacijami, zato realizacijo vzorca izbira načrtovalec na osnovi lastnih izkušenj. Manj izkušeni načrtovalci se mnogokrat poslužujejo referenčnih primerov iz katalogov vzorcev, ki praviloma predstavljajo najsplošnejšo realizacijo (npr. katalog GoF [1]). Taka realizacija vsebuje opcijske gradnike in gradnike, ki jih je možno prilagoditi brez da pri tem spreminjamo idejno rešitev vzorca. Te prilagoditve imenujemo dopustne spremembe realizacij vzorca. Odsotnost dopustnega prilagajanja realizacij vodi v strukturno in komunikacijsko kompleksnost, ki sicer lahko poveča univerzalnost grajene komponente, vendar ta v mnogo primerih ni zahtevana, ampak se izkaže za nezaželeno iz vidika vzdrževanja in testiranja. Izbira primerne realizacije vzorca, brez ustrezne informacijske podpore, je tako odvisna od izkušenj načrtovalca. Načrtovalec si pri izbiri realizacije načrtovalskega vzorca ustvarja pregled nad množico dopustnih realizacij in njihovimi možnimi vnosi v načrt. Ob uporabi vzorca se v načrt vnesejo novi gradniki in dopolnijo nekateri obstoječi gradniki v načrtu. V primeru uporabe kompleksnejšega in sestavljenega vzorca je takih možnosti veliko in jih ni možno vrednotiti brez ustreznega podpornega orodja. Vsako vneseno realizacijo ali množico realizacij (v primeru sestavljenega vzorca) lahko dodatno vrednotimo z naborom metrik, ki izpostavijo lastnosti opazovanega dela načrta po aplikaciji vzorca. Metrični rezultati predstavljajo vodilo pri izbiranju ustrezne realizacije. Izvedba opisanega postopka zahteva naslednje aktivnosti:

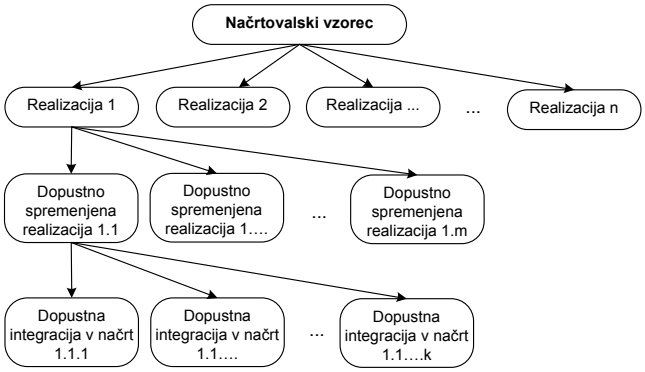
- Ustvarjanje množice vseh dopustnih realizacij izbranega vzorca.
- Predvidevanje možnih vnosov posameznih realizacij v načrt.
- Vrednotenje možnih vnosov realizacij in njihova primerjava.

Navedene aktivnosti tvorijo tehniko sistematskega iskanja realizacij enostavnih in sestavljenih načrtovalskih vzorcev, ki jo predstavljamo v prispevku. V drugem poglavju predstavljamo naš predlog za opisovanje množice dopustnih realizacij, v tretjem poglavju vrednotenje možnih vnosov realizacij s pomočjo metrik vzorcev in metrik kode in v četrtem poglavju predstavljamo primer informacijske podpore, ki je nujna za učinkovito vrednotenje in primerjavo v okviru iskanja ustrezne realizacije.

2 DOPUSTNE REALIZACIJE VZORCEV

Obstoječi katalogi načrtovalskih vzorcev [1,3,4] nudijo v okviru opisa posameznega vzorca referenčno realizacijo za posamezen programski jezik. Realizacija vzorca je zaradi prisotnosti različnih programskih konstruktov specifična za posamezen programski jezik. Iz tega sledi, da se tudi velikost množice dopustnih realizacij razlikuje med programskimi jeziki in jo je potrebno obravnavati ter

vrednotiti ločeno. Obstoječi pristopi k opisovanju vzorcev, semi-formalni [5,6] in formalni [7,8], naslavljajo osnovno idejo vzorca, medtem ko ostajajo dopustne realizacije nenaslovljene.



Slika 1: *Možnosti pri vnašanju realizacije v načrt.*

Ob vnašanju realizacije v načrt izbere načrtovalec realizacijo, jo po potrebi dopustno prilagodi in predvidi še dopustne integracije z obstoječimi gradniki v načrtu (Slika 1). Posamezni vzorec lahko nudi več osnovnih oblik realizacije. Na primer vzorec adapter [1] nastopa v dveh osnovnih oblikah (razredni in objektni). Primer dopustne spremembe predstavlja primer, ko spremenimo splošen predpis funkcionalnosti za objekte iz programskega konstrukta za vmesnik v konstrukt abstraktni razred. Po podobnih spremembah se posega z namenom, da se zagotovi boljša integracija z obstoječimi gradniki v načrtu. Idejna rešitev v izbranem vzorcu pomensko sovpada z namenom obstoječih gradnikov v opazovanem delu načrta. Smiselno je, da se gradniki realizacije v čim večji meri integrirajo v že obstoječe gradnike in jih dopolnjujejo ali preoblikujejo z dodatno funkcionalnostjo. "Slepo" ustvarjanje novih gradnikov vodi v strukturno in komunikacijsko kompleksnost.

Z namenom, da se izognemo ugibanju ustrezne realizacije, oziroma odpravimo odvisnost od izkušenj načrtovalca, zagotovimo opis celotne množice dopustnih realizacij posameznega vzorca za ciljni programski jezik in njeno vrednotenje. Naš pristop obravnava vzorec kot dinamično strukturo, ki se lahko spreminja od najbolj splošne k specifični. Vzorec predstavljamo kot sistem z množico stanj. Posamezna stanja predstavljajo dopustne realizacije vzorca. Prehodi so opisani s pravili, ki jih postavlja vzorec sam in s pravili ciljnega programskega jezika.

Za opis takega sistema uporabljamo formalni jezik TLA+ [2]. Jezik TLA+ izhaja iz slovnice, ki jo je postavil avtor Pnueli že leta 1977. Temelji na začasni logiki prvega reda in teoriji množic. Uporabna je za opisovanje različnih vrst diskretnih sistemov. Njena razumljivost in primernost za računalniško obdelavo sta se izkazali tudi v primeru predstavljene tehnike, ko jo uporabljamo za opisovanje dopustnih realizacij vzorcev. Opis vzorca z jezikom TLA+ sestavljajo definicija konstant, spremenljivk in možnih operacij (obnašanja). Pri opisovanju množice realizacij vzorca predstavljamo razpoložljive programske konstrukte (npr. razred, abstraktni razred, vmesnik ipd.) kot konstante in gradnike realizacije kot spremenljivke, ki zavzamejo eno izmed vrednosti, definiranih v konstantah. Nadaljnja definicija vsebuje opis dopustnih sprememb vsakega gradnika realizacije vzorca. Za vsak gradnik v realizaciji navedemo seznam vrednosti, ki jih lahko zavzame. Sledi opis začetnega stanja vzorca, v katerem je realizacija vzorca predstavljena z vsemi opcijskimi deli in najsplošnejšimi konstrukti. Definicije prehodov med stanji vsebujejo operacije, ki dopustno spreminjajo vrednosti posameznih spremenljivk (gradnikov realizacij). V primerih nekaterih vzorcev je lahko posamezen gradnik ponovljiv. V primeru vzorca kompozicija [1], ki predstavlja drevesno strukturo, se lahko pojavlja v realizaciji množica različnih vrst listov. V takih primerih je pred ustvarjanjem množice dopustnih realizacij smiselna določitev številnosti ponovljivih gradnikov.

Opis dopustnih realizacij s TLA+ predstavlja primerno vhodno obliko zapisa za podporno orodje, ki na podlagi tega zgradi vse dopustne realizacije, predvidi dopustne vnose v načrt v skladu s pravili izbranega programskega jezika, jih ovrednoti in izbere najustreznejšo v skladu z zahtevami načrtovalca.

3 VREDNOTENJE VNOSOV REALIZACIJ

V množici dopustnih vnosov realizacij identificiramo najprimernejše iz stališč dobre integracije z načrtom in skladnosti s pričakovanimi lastnostmi načrta. Dobro integracijo z načrtom skušamo zagotoviti tako, da aplikacija vzorca v čim večji meri dopolnjuje načrt in ustvarja nove gradnike načrta le ko je to nujno. V primeru uporabe sestavljenih vzorcev oziroma nabora vzorcev, ki naslavljajo skupno problemsko področje, skušamo izbrati integriran nabor realizacij. To pomeni, da iščemo nabor realizacij, katerih funkcionalnost je skladna in se v čim večji meri nadgrajuje v okviru skupnih gradnikov. V takih primerih lahko govorimo o prekrivanju vzorcev oziroma prekrivanju njihovih realizacij. Prekrivanje je smiselno, ko je tudi vsebinsko. Sestavljeni vzorci kot je na primer MVC[1] pokaže, da so dopustne realizacije v takih primerih prekrite. Drugo merilo primernosti vnosa realizacije predstavlja njen vpliv na opazovani del načrta. Vpliv lahko vrednotimo skozi uveljavljene nabore metrik kode, ki izpostavljajo lastnosti posamezne razvojne paradigme [9].

Za namen analize prekritosti vzorcev v sestavljenem vzorcu oziroma naboru vzorcev, ki naslavljajo skupno problemsko domeno smo vpeljali dve metriki vzorcev, ki pomagata pri eliminaciji dopustnih vnosov, v katerih gradniki posameznih realizacij niso tesno integrirani. Uporaba prve metrike vzorcev – pokritost načrta z realizacijami, služi kot osnova za računanje druge metrike − prekritosti realizacij vzorcev. Računanje pokrivanja in prekrivanja vzorcev zahteva natančno organizacijo podatkov o uporabljenih načrtovalskih vzorcih v načrtu. Izračun je zaradi raznolikosti programskih konstruktov

specifičen za posamezen programski jezik oziroma za razvojno paradigmo z enakim naborom konstruktov. Primer izračuna v nadaljevanju je bil pripravljen za objektno orientirano razvojno paradigmo.

Posamezen sestavni element v dopustni realizaciji lahko predstavlja razred, vmesnik, metodo ali atribut. Metode in atributi, predpisani s strani načrtovalskega vzorca, predstavljajo gradnike razredov in vmesnikov. V nadaljevanju jih naslavljamo kot pod-elemente, medtem ko razredi in vmesniki predstavljajo elemente realizacije načrtovalskega vzorca. Posamezen načrtovalski vzorec sestavlja množica dopustnih realizacij: $p = <p^s_1, ..., p^s_i, ... p^s_n >$. Posamezno realizacijo načrtovalskega vzorca naj predstavlja izraz $p^s_i = <e^s_1,...,e^s_j >$, v katerem predstavlja p^s posamezno specifikacijo realizacije načrtovalskega vzorca in e^s_x posamezni element (razred, abstraktni razred ali vmesnik) te realizacije. Za vsak element e^s_x obstaja množica pod-elementov, ki predstavljajo metodo, abstraktno metodo ali atribut: $e^s_x = <s_1,...,s_j>$. Načrt, v katerega vnašamo realizacijo načrtovalskega vzorca, je predstavljen podobno. Izraz $d=<e^d_1,...e^d_m>$ predstavlja načrt ali del načrta, v katerega se vnaša realizacija vzorca. Za vsak element načrta (razred, abstraktni razred ali vmesnik) velja: $e^d_x=<s^d_1,...,s^d_n>$. Vsak element načrta sestavljajo pod-elementi (metode, abstraktne metode ali atributi). Posamezen element načrta e^d_x je lahko pokrit z več elementi različnih vzorcev. Navedene podatke predstavljamo v matrični shemi, v kateri predstavljajo stolpci elemente oziroma pod-elemente načrtovalskega vzorca in vrstice elemente oziroma pod-elemente načrta. Pokrivanje načrta z načrtovalskimi vzorci definiramo kot število vlog oziroma elementov in pod-elementov realizacij načrtovalskih vzorcev, ki so vključene v obravnavani načrt.

$$(1)\ \mathrm{cov}_{sub-sub}(s^d_x, s_y) = \begin{Bmatrix} 1 & s_y \to s^d_x; s^d_x \in d \wedge s_y \in p \\ 0 & ostalo \end{Bmatrix}$$

Nivo pod-elementov lahko vsebuje samo vrednosti 0 in 1. Formula (1) vrednoti pokrivanja *cov* (*coverage*) za opazovan pod-element načrta s^d_x in realizacije načrtovalskega vzorca s_y. Vrednost 1 nastopi, kadar se pod-element realizacije s_y načrtovalskega vzorca *p* odraža v pod-elementu s^d_x načrta *d*. V preostalih primerih nastopa vrednost 0. Označbe *sub* (pod-element), *main* (element), *pattern* (celotna realizacija načrtovalskega vzorca) in *design* (načrt) določajo nivo, za kateri je računano pokrivanje.

$$(2)\ \mathrm{cov}_{main-sub}(e^d_x, s_y) = \begin{Bmatrix} 1+\sum_i \mathrm{cov}_{sub-sub}(s^d_i, s_y); \exists j : s_y \to s^d_j \\ 0 \qquad ostalo \end{Bmatrix}$$

Formula (2) vrednoti pokrivanje elementa načrta e^d_x s pod-elementom realizacije načrtovalskega vzorca s_y. Če obstaja v elementu načrta e^d_x pod-element s^d_j, katerega pokriva opazovan pod-element s_y realizacije načrtovalskega vzorca, se pokrivanje izračuna kot vsota števila pokrivanj s pod-elementom s_y v elementu e^d_x in vrednosti 1, ki predstavlja pokrivanje samega elementa načrta z elementom realizacije načrtovalskega vzorca. Veljajo še formule (3-5):

$$(3)\ \mathrm{cov}_{main-main}(e^d_x, e_y) = \sum_i \mathrm{cov}_{main-sub}(e^d_x, s_i); \forall s_i \in e_y$$

$$(4)\ \mathrm{cov}_{main-pattern}(e^d_x, p) = \sum_i \mathrm{cov}_{main-main}(e^d_x, e_i); \forall e_i \in p$$

$$(5)\ \mathrm{cov}_{design-pattern}(d, p) = \sum_i \mathrm{cov}_{main-pattern}(e^d_i, p); \forall e_i \in p$$

Formula (5) vrednoti celotno pokrivanje načrta *d* z realizacijo načrtovalskega vzorca *p*. V primeru, da je v načrt vnesena samo ena realizacija *p*, je vrednost enaka številu elementov in pod-elementov opazovane realizacije, če je vnos pravilen.

Prekrivanje obravnavamo podobno kot pokrivanje načrtovalskih vzorcev. Naj bosta s_x in s_y pod-elementa, e_x in e_y pa elementa kombinacije realizacij izbranih načrtovalskih vzorcev p^x in p^y. Kombinacija realizacij vsebuje par realizacij, ki pripadata različnima vzorcema. V posamezni načrt je možno posamezen vzorec vnesti večkrat. V takem primeru se pri analizi načrta obravnavata kot vnosa različnih realizacij. Različni realizaciji načrtovalskih vzorcev sta prekriti, kadar obstaja vsaj en element ali pod-element, ki ima vlogo v obeh opazovanih načrtovalskih vzorcih. Za računanje vrednosti prekrivanja načrtovalskih vzorcev veljajo v nadaljevanju podane formule, pri čemer vedno velja $p^x \neq p^y$:

$$(6)\ ovl_{sub-sub}(s_x, s_y) = \begin{Bmatrix} 1 & s_x \to s^d \wedge s_y \to s^d; \exists s^d \in d \\ 0 & ostalo \end{Bmatrix}; s_x \in p^x \wedge s_y \in p^y \wedge p^x \neq p^y$$

Formula (6) vrednoti prekrivanje med pod-elementoma opazovane kombinacije realizacij načrtovalskih vzorcev. Na nivoju pod-elementov sta možni le dve vrednosti: Ko zasledimo prekrivanje, nastopi vrednost 1 in v ostalih primerih 0. Analogno pokrivanju veljajo za prekrivanje formule (7-10):

$$(7)\ ovl_{sub-main}(s_x, e_y) = 1 + \sum_i ovl_{sub-sub}(s_x, s_i); s_x \in p^x \wedge e_y \in p^y \wedge p^x \neq p^y$$

$$(8)\ ovl_{main-main}(e_x, e_y) = \sum_i ovl_{sub-main}(s_i, e_y); e_x \in p^x \wedge e_y \in p^y \wedge p^x \neq p^y$$

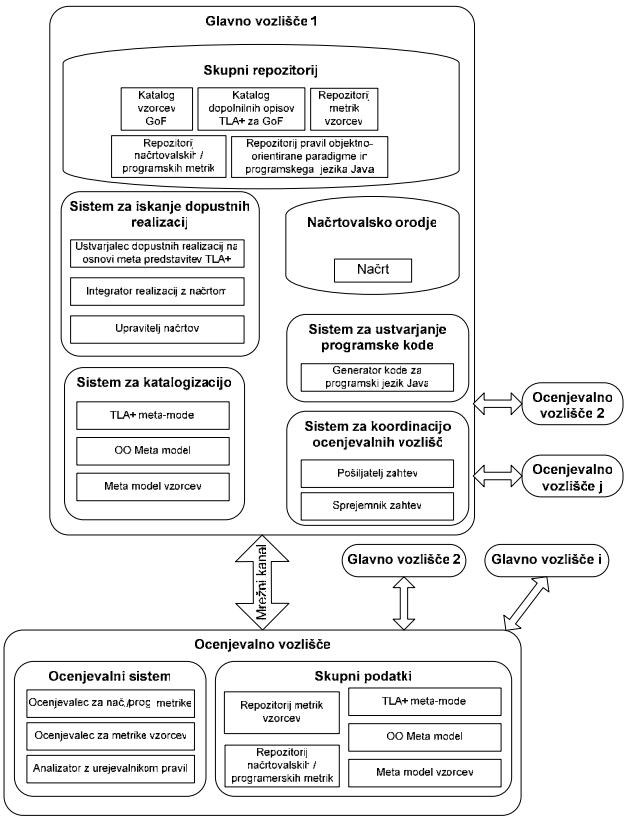
$$(9)\ ovl_{main-pattern}(e_x, p^y) = \sum_i ovl_{main-main}(e_x, e_i); e_x \in p^x \wedge e_i \in p^y \wedge p^x \neq p^y$$

$$(10)\ ovl_{pattern-pattern}(p^x, p^y) = \sum_i ovl_{main-pattern}(e_x, p^y); p^x \neq p^y$$

Predstavljeni metriki omogočata identifikacijo močno prekritih realizacij. V povezavi z metrikami kode, s postavljanjem intervalov pričakovanih metričnih vrednosti, pridobimo obvladljiv nabor oziroma posamezno ustrezno realizacijo. Postopek vrednotenja in primerjanja je časovno zahteven in je smiseln v navezavi z ustreznim podpornim orodjem.

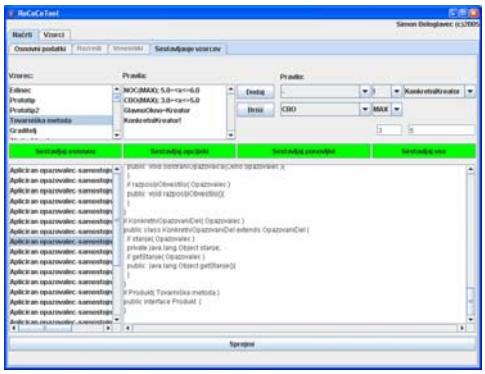
4 INFORMACIJSKA PODPORA

Skladno s potrebami predstavljene tehnike smo razvili prototip podpornega orodja, ki avtomatizira predvidevanje možnih vnosov dopustnih realizacij v izbran načrt in omogoča njihovo metrično vrednotenje. Namen razvoja orodja je bil ponuditi referenčno implementacijo s potrebnimi mehanizmi na primeru objektno-orientirane razvojne paradigme in programskega jezika Jave.



Slika 2: *Struktura podpornega orodje*

Razvito podporno orodje (Slika 2) je oblikovano kot omrežna aplikacija, ki vključuje razpoložljiva omrežna vozlišča v postopek ocenjevanja z namenom zagotavljanja sprejemljivega odzivnega časa pri iskanju ustrezne realizacije. Glavna vozlišča, s katerimi upravlja neposredno načrtovalec, vsebujejo načrtovalsko orodje, s katerim se gradi meta-model za implementacijo informacijske rešitve. Pri gradnji meta-modela uporablja orodje repozitorij, ki vsebuje definicije posameznih vzorcev, dopolnilne opise dopustnih realizacij, metrik vzorcev in kode. V zgrajenem primeru smo podprli temeljni katalog načrtovalskih vzorcev GoF[1]. Hrambo definicij v repozitoriju nadzira sistem za katalogizacijo, ki vsebuje definicijo meta-modela za ciljno razvojno paradigmo in definicije za izbran programski jezik. Sistem za iskanje dopustnih realizacij na podlagi definicij v repozitoriju oblikuje množico dopustnih realizacij in na podlagi nje množico dopustnih vnosov realizacij v grajeni načrt. Na podlagi zgrajenega meta-modela načrta lahko ustvarimo programsko kodo v podprtih programskih jezikih.



Slika 3: *Podporno orodje za iskanje primernih realizacij.*

Slika 3 prikazuje del uporabniškega vmesnika, v katerem načrtovalec podaja želene lastnosti ciljne realizacije v obliki pričakovanih metričnih rezultatov in pridobiva realizacije, ki ustrezajo podanim kriterijem.

5 ZAKLJUČEK

Opisana tehnika predstavlja nov pristop k iskanju realizacij, ki vključuje obvladovanje dopustnih realizacij vzorcev in uporabo metrik kode ter vzorcev. Možnost predvidevanja dopustnih realizacij in njihovega vrednotenja omogoča načrtovalcem obvladovanje kompleksnejših in sestavljenih vzorcev. Manj izkušenim načrtovalcem pa omogoča predvsem pregled nad možnostmi, ki jih nudi posamezen vzorec.

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UPORABA ONTOLOGIJ PRI OPISOVANJU IN SVETOVANJU O NAČRTOVALSKIH VZORCIH

Igor Brejc[1], Marjan Heričko[2]
[1]HERMES Softlab d.d., Zagrebška c. 104, 2000 Maribor, Slovenija
[2]Fakulteta za elektrotehniko, računalništvo in informatiko, Univerza v Mariboru, Smetanova 17, 2000 Maribor, Slovenija
e-mail: igor.brejc@hermes.si, marjan.hericko@uni-mb.si

ABSTRACT

APPLICATION OF ONTOLOGIES FOR DESIGN PATTERNS DESCRIPTION AND ADVISEMENT

In this paper we discuss and compare existing presentations of design patterns, including informal canonical presentations, descriptions of patterns in UML, and presentation of patterns using formal specification languages such as OCL. We argue that these presentations of design patterns are not suited for development of automatic support for pattern recognition, generation, reconstruction, and advising. Instead, we suggest that a new approach which uses ontologies for description of design patterns is more appropriate. We present a "Web of Patterns" project and show how it can be extended to offer additional information for automatic support.

1 UVOD

Načrtovalski vzorci so uspešne rešitve ponavljajočih se problemov v določeni domeni inženirstva programske opreme. Opisujejo znanje, prečiščeno s strani izkušenih ljudi poklica, o določenem vidiku domene.
Vzorci so v splošnem namenjeni ročni človeški uporabi, kot strukturirana ampak neformalna dokumentacija, večinoma sestavljena iz naravnega jezika, obogatenega s primeri kode in diagrami. Zadnja leta je programski razvoj s pomočjo vzorcev postal splošna praksa v skupnosti razvijalcev. Posledica tega je vse večje in večje število načrtovalskih vzorcev. Zaradi tega ročna uporaba vzorcev ni več učinkovita rešitev. Nadaljnji razvoj načrtovalskih vzorcev postaja odvisen od obstoja in tudi motivira razvoj orodij za avtomatsko organizacijo, pregledovanje, opisovanje in pomoč pri uvajanju vzorcev.

2 PREDSTAVITVE NAČRTOVALSKIH VZORCEV

2.1 Neformalne predstavitve načrtovalskih vzorcev

Načrtovalski vzorci so v splošnem predstavljeni v naravnem jeziku in so običajno izdani v tiskanih katalogih [5]. Takšni dokumenti so strukturirani ohlapno v t.i. kanonski formi, strukturi, ki se sestoji od niza polj, pomen katerih je predstavljen z neformalnimi definicijami ali opisi.
Slaba lastnost takšne predstavitve vzorcev je dejstvo, da le-ta slabo podpira upravljanje in izmenjavo znanja [9]. Neformalne predstavitve, zasnovane na kanonskih formah, ne morejo podpreti takšnega nivoja avtomatizacije, ki bi si ga želeli. Za kaj takega potrebujemo boljše strukturirane predstavitve.

2.2 Načrtovalski vzorci in jezik UML

V jeziku UML so načrtovalski vzorci predstavljeni s pomočjo razrednih diagramov in diagramov interakcij ter s pomočjo bolj specifičnih parametriziranih diagramov sodelovanja, ki omogočajo variranje vlog okoli določene kolaboracije.
Čeprav so te predstavitve uporabne za razumevanje načrtovalskega vzorca in vodenje skozi njegovo implementacijo, vendarle izražajo le strukturalne vidike vzorcev. Te predstavitve ne pomagajo razvijalcu razumeti višjenivojske vidike, kot so namen, uporabnost in posledice. Poleg tega predstavitev načrtovalskih vzorcev in njihove uporabe ter povezave med tema nivojema s pomočjo parametriziranih diagramov sodelovanja v UML ni natančno definirana in se jo zaradi tega lahko interpretira na različne načine [11].

2.3 Formalne predstavitve načrtovalskih vzorcev

Sproženo je bilo več iniciativ, da se formalizirajo nekateri vidiki predstavitve načrtovalskih vzorcev. Formalizacija je usmerjena k nekaterim od najosnovnejših lastnosti vzorcev (invariant vzorcev) s pomočjo specifikacijskih jezikov kot je jezik za specifikacijo objektnih omejitev (*Object Constraint Language, OCL*).
Jeziki za omejitve in ontologije so komplementarni pri predstavitvah vzorcev [9]. Omejitve in ontologije delujejo pri različnih fazah – izrazi, ki so predstavljeni v jezikih omejitev, postanejo uporabni potem, ko se je razvijalec odločil o rešitvah.

3 SEMANTIČNI SPLET IN ONTOLOGIJE

Semantični splet je mreža informacij, povezanih na takšen način, da omogoča enostavno strojno procesiranje v globalnih razmerah. Na njega lahko

gledamo tudi kot na učinkovit način predstavitve podatkov na svetovnem spletu ali pa kot na globalno povezano podatkovno bazo.
Semantični splet sestoji iz standardov in orodij za te standarde:

- Jezik **XML** definira sintakso strukturiranih dokumentov, vendar ne postavlja nobenih semantičnih omejitev glede pomena teh dokumentov in **XML shema,** jezik za omejevanje strukture dokumentov XML.
- Ogrodje **RDF** je podatkovni model za objekte (vire) in relacije med njimi. RDF definira enostavno semantiko za ta podatkovni model, ki ga je možno predstaviti v sintaksi XML. RDF je zasnovan na ideji o izdelovanju izjav o virih v obliki **osebek** (angl. *subject*) - **povedek** (angl. *predicate*) – **predmet** (angl. *object*). Ta oblika se v terminologiji RDF imenuje **trojček** (angl. *triple*).
- **RDF shema** je besednjak za opis lastnosti in razredov virov RDF s semantiko za generalizacijo in hierarhije takšnih lastnosti in razredov.
- **OWL** definira dodatni besednjak za opisovanje lastnosti in razredov: med drugimi tudi relacije med razredi (npr. disjunkcija), kardinalnost, enakost, bogatejše tipiziranje lastnosti, značilnosti lastnosti (npr. simetrija) in naštevalne razrede.

3.1 Pojem ontologij

Ontologija je produkt poskusa, da se formulira izčrpna in rigorozna konceptualna shema o določeni domeni. Ontologija je tipično hierarhična podatkovna struktura, ki vsebuje vse relevantne entitete, njihove relacije in pravila znotraj domene. Ontologije se v praksi uporabljajo na spletnih portalih, multimedijskih zbirkah, pri upravljanju s korporativnimi spletišči, načrtovalski dokumentaciji, medicini, biomedicini itn.

4 PROJEKT »WEB OF PATTERNS« IN JEZIK ODOL

Leta 2004 je nastal projekt pod imenom »Web of Patterns« [3]. Cilji projekta so:

- Ustvariti programsko ontologijo, ki bi se dala uporabiti za opisovanje modelov objektno orientirane programske opreme.
- Predstaviti načrtovalske vzorce, protivzorce in preoblikovanja (angl. *refactorings*) z uporabo konceptov iz te ontologije.
- Ponuditi fleksibilno ogrodje, ki bi se dalo uporabiti v skupnosti inženirstva programske opreme za izmenjavo znanja o načrtovanju.
- Raziskati kako bi se dalo uporabiti orodja za branje in obdelovanje razvitih modelov načrtovanja.
- Razviti orodja, ki bi bila koristna ljudem na področju inženirstva programske opreme.

Projekt se sestoji od treh delov:

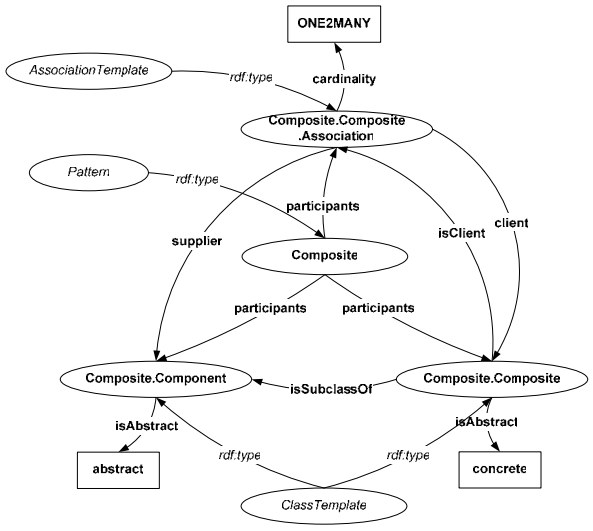
1. Jezika ODOL (angl. *Object Oriented Software Design Ontology*) – ontologije za objektno orientirano programsko načrtovanje.
2. Opisov načrtovalskih vzorcev in katalogov v jeziku ODOL.
3. Orodja WOP Pattern Scanner, ki analizira kodo v jeziku Java in v njej išče načrtovalske vzorce.

4.1 Jezik ODOL

Jedro projekta je ontologija za objektno orientirano programsko načrtovanje (ODOL). Trenutno je to dokaj majhna množica konceptov in relacij, ki se uporabljajo v vseh pomembnejših objektno orientiranih programskih jezikih. ODOL vsebuje: osnovne koncepte OO (kot so razredi in metode), koncepte objektno orientiranega načrtovanja kot so asociacije in koncepte višjega nivoja, kot so vzorci, kategorije vzorcev, agregacije in njihove relacije, npr. dodelava (angl. *refinement*). Ti koncepti so bili modelirani s pomočjo jezika OWL.

4.2 Opisi načrtovalskih vzorcev v jeziku ODOL

Trenutno je v okviru projekta WOP opisano deset načrtovalskih vzorcev iz nabora vzorcev GoF [5]: AbstractFactory, Adapter, Bridge, Composite, Prototype, Proxy, Singleton, Strategy, TemplateMethod in Visitor. Poleg tega so opisani tudi nekateri dodatni vzorci ali pa podvzorci naštetih vzorcev.



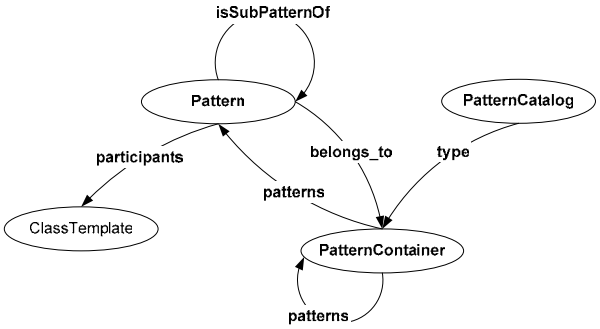
Slika 1: graf RDF opisa vzorca Composite v jeziku ODOL

5 RAZŠIRITVE IN RAZVOJ ORODIJ, TEMELJEČIH NA JEZIKU ODOL

5.1 Večnivojska hierarhična struktura katalogov vzorcev

Izvorna ontologija ODOL vsebuje pojme **načrtovalskega vzorca** (Pattern) in **kataloga vzorcev** (PatternCatalog). Takšna dvonivojska struktura ne zadostuje, ko se število načrtovalskih vzorcev v katalogu začne povečevati. Dodatni razlog pa je dejstvo, da so obstoječi nabori vzorcev strukturirani v večnivojske hierarhije. Kot primer lahko navedemo, da so vzorci GoF grupirani v tri skupine (ustvarjalni, strukturalni in vedenjski vzorci).

Če želimo to hierarhičnost obdržati tudi v definicijah teh vzorcev v ODOL, moramo razširiti ontologijo. Zato smo v jezik ODOL dodali novi koncept, imenovan **vsebnik vzorcev** (PatternContainer). Kot kaže spodnja slika, vsebnik vzorcev postane osnovni razred za vsebovanje vzorcev in prevzame vse lastnosti kataloga vzorcev, le-ta pa postane samo njegov podtip.



Slika 2: RDF graf razširjenih definicij konstruktov Pattern, PatternContainer in PatternCatalog

V opise ODOL kataloga vzorcev GoF smo dodali tudi definicije za omenjene tri podskupine. Za obstoječe definicije vzorcev v jeziku ODOL, ki večinoma pripadajo naboru GoF, smo dodali še definicije, kateri skupini pripadajo.

5.2 Podpora svetovanju o primernosti vzorcev

Naslednji vidik, s katerim smo želeli razširiti definicijo jezika ODOL, je podpora svetovanju o uporabnosti določenega vzorca za problem, ki ga razvijalec želi rešiti. Odločili smo se za dokaj preprosto razširitev, ki bi omogočila, da za vsak vzorec, opisan z jezikom ODOL, dodamo seznam vprašanj in možnih odgovorov na njih. Vzorcu pripada vprašalnik o uporabnosti. Vsak vprašalnik je sestavljen iz vprašanj. Vsako vprašanje ima utež v obliki decimalne vrednosti. Vprašanje ima več možnih odgovorov. Vsak odgovor ima pripadajočo utež v obliki decimalne vrednosti.

Na osnovi uteži vprašanj in uteži izbranih odgovorov je možno izračunati gotovost uporabnosti načrtovalskega vzorca.

5.3 Spletni pregledovalnik načrtovalskih vzorcev

Pripravili smo tudi spletno aplikacijo za pregledovanje načrtovalskih vzorcev, ki so opisani v jeziku ODOL. Ta spletni pregledovalnik prikaže drevesno strukturo načrtovalskih vzorcev z katalogi vzorcev na vrhu, vsebniki vzorcev in načrtovalskimi vzorci pa na dnu hierarhije. Ko uporabnik izbere kakšnega od vzorcev, se mu na desni strani zaslona prikažejo osnovni podatki o tem vzorcu: opis, avtorstvo, kje je bil objavljen itn.

Poleg teh informacij ima uporabnik na voljo dve dodatni povezavi: izpis podrobnosti vzorca (Pattern details) in zagon vprašalnika o uporabnosti (Pattern applicability).

Podrobnosti vzorca prikažejo seznam udeležencev (Participants) in seznam podvzorcev (Subpatterns).

Pri vprašalniku o uporabnosti vzorca uporabnik odgovori na vprašanja (kakšno od vprašanj lahko pusti tudi neodgovorjeno), aplikacija pa mu poda oceno gotovosti, koliko je ta vzorec uporaben za njegovo situacijo.

5.4 Urejevalnik DPEX (DPEX Editor)

Urejevalnik DPEX (oz. DPEX Editor) je osnutek Windows aplikacije, ki naj bi bila namenjena splošnemu delu z definicijami ODOL in ki bi ponudila različna orodja za delo z jezikom ODOL.

Osnutek aplikacije trenutno ponuja uvoz in razčlenitev definicij ODOL iz datotek XML. Orodje omogoča, da določimo seznam datotek, ki bodo uvožene.

Na osnovi teh uvoženih definicij načrtovalskih vzorcev v jeziku ODOL urejevalnik DPEX omogoča, da avtomatsko generiramo izvorno kodo v jeziku C#.

Najprej izberemo korensko mapo na disku, kamor bo orodje shranilo generirano kodo. Potem zaženemo orodje in se v posebnem oknu prikaže dnevnik generiranja, kjer lahko vidimo, katera vozlišča definicij ODOL so bila razčlenjena, kateri deli definicij niso bili upoštevani in seznam ustvarjenih datotek z izvorno kodo.

Kako deluje ta generator? Najprej vzame uvožene definicije v jeziku ODOL in jih pretvori v graf konstruktov jezika C#. Primeri teh konstruktov so razred, metoda, tip itn. Tukaj orodje poskusi po najboljši moči preslikati konstrukt ODOL v jezik C#. Pri večini konstruktov ODOL je to trivialno, vendar pa ostaja nekaj konstruktov, ki so bodisi preveč abstraktno definirani ali pa so premalo specificirani za jezik C#. Problem je v tem, da jezik ODOL predstavlja nekakšno posplošitev konceptov objektno orientirane paradigme, ko pa te koncepte želimo preslikati v konkreten programski jezik, včasih naletimo na neskladje med koncepti ODOL in tega programskega jezika. Potencialnih rešitev za ta problem je lahko več:

- Dodatni koncepti v jedru jezika ODOL, ki bi pokrili vse oz. večino posebnosti posameznih programskih jezikov.

- Definiranje razširitev jezika ODOL za posamezne programske jezike.
- Definiranje preslikav konceptov jezika ODOL v izvorno kodo posameznih programskih jezikov.

Ker je orodje za generiranje izvorne kode še v razvoju, smo se za zdaj odločili, da neskladne koncepte bodisi poskusimo preslikati v sorodne koncepte jezika C# ali pa jih v skrajnem primeru ignorirati.
Enkrat, ko je graf konstruktov jezika C# ustvarjen, lahko začnemo s postopkom generiranja izvorne kode. Za vsak razred se naredi posebna datoteka. Imena imenskih področij, razredov, metod, parametrov itn. ustvarimo na osnovi imen izvornih konceptov opisov vzorcev, npr. udeleženca AbstractFactory .ConcreteFactory preslikamo v razred z enakim imenom, kot je vidno na naslednji sliki:

```
using System;

namespace AbstractFactory
{
    public class ConcreteFactory : AbstractFactory
    {
        public override AbstractProduct Creator ()
        {
            //TODO:
            throw new NotImplementedException
                ("AbstractFactory.ConcreteFactory.Creator()
method.");
        }
    }
}
```

Slika 3: primer generirane izvorne kode za razred AbstractFactory.ConcreteFactory

Izboljšava orodja za generiranje izvorne kode bi bila, da uporabnik orodju poda dodatno datoteko s preslikavami imen konceptov v imena v izvorni kodi v stilu šablon. Na ta način bi uporabnik že pred generiranjem kode orodju lahko povedal, v katera imena razredov, metod, polj itn. naj se preslikajo konstrukti.
Kako orodje pripravi ogrodje metod? Vsaki metodi doda komentar in sprožanje izjeme NotImplementedException, kar razvijalcu pomaga, ko dejansko začne implementirati procesno logiko, ker je vidno, katere metode so že implementirane, katere pa ne.
Koda, ki jo dobimo z generiranjem iz obstoječih definicij načrtovalskih vzorcev GoF v jeziku ODOL, je precej trivialna. Razloga za to sta dva: prvi je, da so vzorci nabora GoF sami po sebi precej enostavni, drugi pa, da obstoječe definicije ODOL ne pokrivajo nekaterih višjih abstraktnih konceptov, ki bi dali dodatno informacijo o dejanskem načinu implementacije vzorca.

6 ZAKLJUČEK

V tej raziskavi smo predstavili različne načine predstavitve načrtovalskih vzorcev. Ocenili smo uporabnost teh predstavitev z vidika razvoja informacijske podpore in ugotovili, da nobena od obstoječih rešitev ne izpolnjuje vseh zahtev, potrebnih za razvoj inteligentnih orodij.
Zato smo se obrnili v svet semantičnega spleta in predstavili projekt »Web of Patterns«, ki poskuša najti novo rešitev preko ontologije načrtovalskih vzorcev. Na osnovi te ontologije smo potem predstavili nekaj prototipov orodij, s čem smo poskusili nakazati smeri, v katere je možno peljati nadaljnji razvoj ontologije načrtovalskih vzorcev in orodij, temelječih na le-tej.

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INTEGRATION PATTERNS EFFICIENCY OPTIMIZATION FOR WEB SERVICES AND E-BUSINESS

Matjaž B. Jurič[1], Kimmo Salmenjoki[2], Marjan Heričko[1]
[1]University of Maribor, Faculty of Electrical Engineering and computer Science, Slovenia
[2]University of Vaasa, Finland
e-mail: {matjaz.juric, marjan.hericko}@uni-mb.si, ksa@uwasa.fi

ABSTRACT

Integration patterns present sound solutions for common design and architectural challenges in integration. In this article we present partial results of a bilateral project between Slovenia and Finland on efficiency optimization of integration patterns related to web services and e-business. the objective of the project has been the definition and optimization of efficiency of integration patterns. We present the three important optimized integration patterns for web services and e-business: Integration Wrapper, Integration Mediator, Virtual Service, and Process Automator.

1 INTRODUCTION

In this paper we present the partial results of a bilateral project between University of Maribor, Slovenia and University of Vaasa, Finland. The scope of the project relates to the research in the field of integration patterns with the objective to define integration patterns and improve the efficiency of integration for web services and e-business.

Defining robust application integration architecture is the major challenge in EAI. Integration patterns, which describe proven methods and processes used for integration within enterprise or beyond, provide valuable guidance. Integration patterns emerge from classification of common integration solutions. The patterns that are described are so called design and architectural patterns and allow selection of the best solutions for integration problems.

The review of the field of integration patterns reveals that nothing much has been done, especially on the definitions of the design and architectural integration patterns. The authors in [2] define two integration patterns, the Access Integration and the Application Integration. They are process patterns, and cannot be compared to the design and architectural patterns, which are the topic of this paper. The author of [3] defines the Data Access Object (DAO) pattern for accessing the data of integrated systems. The DAO pattern has been included in the J2EE Design Patterns catalog, maintained by the Sun Microsystems. The DAO pattern is a basis for the integration patterns presented in this paper. In [4], again two process patterns are presented, the Scenario Partitioning, and the State Machine Integration. In [5], the author gives a very short description, in one single paragraph, of the Direct Data Mapping pattern, which is comparable to our Data Mapping pattern; the Hierarchical Multi-Step Pattern, comparable to our Integration Mediator pattern; the Direct Request Pattern, comparable to our Integration Façade pattern; and the Peer Service Pattern, comparable to our Integration Mediator pattern. The descriptions in [5] are given without the necessary formal description of the pattern design and the other usual elements of a pattern description. In [6] the author presents four B2B patterns. The Direct Application B2B pattern presents how to directly integrate applications between enterprises. The Data Exchange B2B pattern shows XML based architecture for data transfers between enterprises. Closed Process Integration B2B pattern identifies the principal participant responsible for the managing processes. Open Process Integration B2B pattern introduces the notion of shared processes. The latter two are process patterns, therefore not comparable to the patterns in this paper. The Direct Application and Data Exchange patterns, on the other hand, focus on point-to-point integration and are not formally defined. They are also very much different from the patterns in this paper, which are broker and mediator based. Additionally, the patterns we present can be used for inter and intra-EAI problems.

In the next chapters we will present the following integration patterns: Integration Wrapper, Integration Mediator, Virtual Service, and Process Automator.

2 INTEGRATION WRAPPER PATTERN

In order to reuse the functionality of the existing applications and to develop new solutions, it is important to enable the programmatic access to the existing applications. The existing applications may not have the APIs available, or the provided APIs might not be sufficient for the integration purpose. The following list gives a set of objectives that need to be met when wrapping several applications:

- For integrating and reusing the existing applications we need to access them in a programmatic way
- Through the API access we can reuse data and functionality of the existing applications
- Accessing the application through the APIs is better than going into the database directly, because we do not avoid the business logic

The Integration Wrapper pattern is a layered approach to adding APIs to the existing applications. This way the services and the functionality of the existing applications

are exported to the other applications, thus enabling interoperability and integration. Its motivation lies in the Adapter pattern (GoF) [1], however the goal of Integration Wrapper is to provide reusable interfaces for multiple clients to access the wrapper simultaneously. To develop the wrappers, we build a layer around the existing application and add the necessary interfaces. The added application interface is called a wrapper and the modified existing application is called a "wrapped existing application". The Integration Wrapper has two major objectives. First, it provides open, reusable interoperability interfaces. Second, it converts the calls to reuse the services and the functionality of the existing application. For the latter, the Integration Wrapper can reuse the already provided APIs, or such an APIs needs to be added.

We have to identify the operations through which we will access the existing application functionality. The analysis of the existing application will yield such a list of operations. During the analysis we must focus on what we actually need. The Integration Wrapper pattern is tightly related to the Integration Broker pattern. The structure of the wrapper depends on the type of communication. For example, if we use synchronous communication style, such as remote method invocation, then the infrastructure will force typed communication and will check the operation signatures. When using the asynchronous communication, the wrapper is responsible for decomposing the messages.

The consequences of using the Integration wrapper pattern are the following:

- It reduces the complexity and decouples the clients
- It enables the reuse of the services and the functionality of the existing applications
- Integration Wrapper enables programmatic communication with existing applications
- It hides the details of internal structure of the existing applications, their technologies, the programming model, and the communication details
- The possible disadvantages of this pattern are:
- Interfaces of wrappers have to be designed carefully, otherwise we will not be able to reuse the interfaces once existing applications get replaced with new generation systems
- Existing applications have often not been designed for many concurrent users. Wrappers provide programmatic access to existing applications, thus increasing the number of total users. Therefore we have to pay attention to scalability of existing applications.
- When developing several layers of wrappers, we have to think about the overhead, introduced to the whole system.
- Particularly when wrappers access existing applications through user interface we have to be sure that we include all possible exceptions.

3 INTEGRATION MEDIATOR PATTERN

The integration logic needs to be separated from all the involved applications to be integrated and also needs to be encapsulated. This way the dependencies are minimized, the possibility to reuse is increased, and the maintenance is simplified.

There are many cases where we have the existing applications to be integrated with each other, or where a common functionality is distributed among several applications and/or duplicated in several existing applications. In these cases we need the integration logic, which will solve these problems and represent a service or functionality in a common way to its clients. The clients should not be aware of the complexity inside the mediator.

The following list gives a set of objectives that need to be met:

- The existing applications often need to be integrated among each other
- The functionality is distributed among more than a single existing application
- The functionality is duplicated in more than one existing application
- The interaction between the applications is complex
- The clients should not be aware of the mediator complexity

The Integration Mediator acts like a controller for the existing applications and provides an interface for the clients. It should be aware of the existing applications and include the interaction logic to fulfill certain higher-level operations, which require complex interaction with the existing and/or newly developed applications. The integration logic of the Integration Mediator can be used for different integration levels. For example, it can be used for the data level integration or the function and method level integration. However, the Integration Mediator should not directly access the existing applications. Rather, it should use the integration wrappers.

Generally, the integration mediators come in two different forms: Single step or Stateless; and Multi step or Stateful. Stateless mediators are used where the maintenance of the state during an interaction with the existing applications is not necessary. In this case the way the mediator functions depends only on the response from the existing applications. Examples are routing and brokering, and vocabulary transforming. An example of a stateless mediator is an XSLT engine.

The Stateful Integration Mediator, on the other hand, is used when the record of the previous interactions with applications needs to be kept. The mediator records the data about the previous interactions and uses them for further interactions. Stateful Integration Mediators are based on events – they remember the past events. Only after all the required events have been triggered, they perform a certain action.

Stateful Integration Mediators need to have the management of the state; it sometimes needs to be

persistent. State persistence might be needed for the long-lasting interactions with the existing applications. Thus, the interactions must be able to survive system shutdowns. The interactions can last from a few minutes to hours or even days and might be very complex.

The consequences of using the Integration Mediator pattern are the following:

- The integration logic is encapsulated and decoupled from the participating existing applications and new clients
- Maintenance is simplified as the integration logic is centralized rather than distributed among existing applications
- Services can be built on top of the functionality, provided by the mediator, thus they do not have to be aware of the complexity of the existing applications
- Application dependencies are minimized

The possible disadvantages are:

- We have to be sure to include only integration logic into the mediator.
- We have to identify the most efficient way for chaining the mediators.
- Stateful mediators have to implement recovery algorithms to be able to recover from a system failure or crash.

4 VIRTUAL SERVICE PATTERN

The way of accessing the services of integrated information system can vary, especially if the integration system uses several different existing applications, implemented in different technologies. Accessing these services in a direct way directly requires the availability of the knowledge about the internal structures of the information system on the client's side. A way around this problem is to use the Virtual services, which provide a common, unified access point to the services. Virtual services act as a façade to the existing applications. The following list gives a set of objectives that need to be met:

- Client should use high level services
- Existing applications do not provide the high level services and functionalities, required by the clients
- Clients should not be aware of the complexity of the information system

The Virtual Service pattern is aimed towards the integration. It provides the reusability and the ability to re-engineer and replace the applications behind the virtual service with the actual, modern implementations. The pattern has its motivation in the Façade pattern [1]. An integrated information system that is based on the Virtual Service pattern is a system that looks completely like a new information system, but in fact it reuses the functionality of the existing applications.

The virtual service masks the complexity of the existing applications. The high-level business functionality is implemented in the background. Virtual services are deployed on the business logic tier. They will be built in step by step during the integration. The different virtual services will expose the interfaces that will offer different abstraction levels to access the functionality. The virtual services will therefore be organized into several sub tiers on the business logic tier.

The virtual services are typically used for any one or a combination of the following functions:

1) The functionality of existing applications is encapsulated by the virtual services.

2) Lower level virtual services implement the code that translates the method invocations into one or more calls to APIs of the existing applications and databases accesses.

3) Virtual services can provide a higher-level interface and in this way mask how the existing applications implement their APIs.

4) Virtual services can encapsulate several existing applications and help to maintain the transaction integrity and the security.

5) Virtual services are also useful to encapsulate or abstract persistent data.

6) Virtual services can provide a unified access to several EIS databases and can handle different combinations of databases in the background.

7) Virtual services will often be layered, thus the higher level virtual services will aggregate the behaviors of the lower level virtual services and provide the higher level of abstraction required for multiple levels of abstraction of EIS application functionality.

The consequences of using the Virtual Service pattern are the following:

- A unified view on the services and the functionality of integrated information system is provided by the virtual services
- Virtual services abstract the details of the information system, thus providing a sort of façade to the clients
- Virtual services provide high level, business process oriented interfaces for interoperability
- They enable the replacement of old components with the newly developed components as long easily, as long as the interfaces remain unchanged

The possible disadvantages of the Virtual Service pattern are:

- Virtual Services should not include the functionality of integration mediators and wrappers.
- When dealing with transactions and security, virtual services can get complex. They can be broken into several layers, which can introduce communication overhead.
- The interfaces have to be carefully designed in order to keep the interfaces constant when replacing virtual services with new developed components.

5 PROCESS AUTOMATOR PATTERN

The process controller should hide and abstract the system interactions. The dependencies between the business

process controllers and the system logic of the information system should also be minimized.

The clients should see the services of an integrated information system only through the high level methods, which reflect their business processes. An interaction with different virtual services and integration mediators is typically required by a business process method. The interaction should not be delegated to the clients since this solution increases the complexity, complicates the maintenance, and does not allow the use of the declarative transaction management.

The following list gives a set of objectives that need to be met:

- Services of the integrated system should be exposed as high-level business process methods
- The business process interaction logic should be abstracted and encapsulated on the middle tier
- Clients should not make the necessary operation invocations
- Business process logic should be performed inside the transactions
- The dependencies between the process automation control and the information system technology should be minimized

The Process Automator pattern gathers and encapsulates the business process logic. This way the dependencies between the business process automation logic and the information technology system logic are minimized. The process automator controller hides all the interactions. By using this pattern the quality of the business processes improves, the process execution costs is reduced and also the necessary time is reduced. Therefore, this pattern is highly appropriate for definition of the integration process within and between the companies.

The Process Automator pattern sequences the activities of a business process and delegates the tasks to the corresponding parts of the integrated information system. This is done by the virtual services and the integration mediators, through which the automator components access the functionality of the existing applications. The process automator can of course access the newly developed components as well.

The Process Automator pattern is commonly used for the definition of the business activities, the timers, and the process context informators. It comes in two variations: Closed Process Automator; and Open Process Automator. The difference is only in the semantic understanding of both types of the processes. The Closed Process Automator implements a process that is managed internally and externalizes the key process activities only through the data exchange. The clients are able to monitor the activities within the process, but cannot actively participate in their execution. The Open Process Automator, on the other hand, enables sharing of business process between the clients. Such processes are managed by more than one client and are particularly useful for inter EAI, or B2B integration, where a single process is shared by more than one company.

The consequences of using the Process Automator pattern are the following:

- The architecture eases the analysis of the business processes, their bottlenecks, utilization, and downtime
- The business processes are redefined flexibly
- The process automator components are aligned with the business managers' view. This was the semantic gap between the IT and the management is reduced
- Highly flexible integration architecture can be defined with the connection to the virtual services and the integration mediators.

The disadvantages include:

- The development of Process Automation components can get complex, thus there is a possibility of errors, which influence the whole information system.
- Particularly when used for inter-EAI, it is necessary to guarantee high availability of process automation components, which can be realized with clustering and replication.
- Process automation components are the entry points to the integrated information system, therefore we have to identify possible security holes.

6 CONCLUSION

In the paper we have presented four integration patterns as the result of a bilateral project: Integration Wrapper, Integration Mediator, Virtual Service, and Process Automator patterns. These patterns have been designed to improve the efficiency of integration using web services and other e-business related technologies and are based on the service oriented approach to integration. Patterns have been identified by systematical analysis of the common integration problems. They can be used for the common integration problems and have been successfully implemented in some pilot integration projects. In the future work we will improve these and define new integration patterns, and perform quantitative measurements of integration efficiency.

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METHOD FOR AUTOMATIC CONTRACT-FIRST WEB SERVICES FORMATION

Marko Hrovatič, Matjaž B. Jurič
Institute of Informatics, FERI
University of Maribor
email: marko.hrovatic@rsh.si

ABSTRACT

This article outlines the method of automatic web service formation based on its description (interface) stored inside WSDL (Web Services Description Language). It provides information about two approaches developers encounter when building web services. These are code-first and contract-first approaches. In article we focus on contract-first approach and how to use it to automate web service development. Specifically we show some techniques and code how to convert WSDL file into abstract and concrete service server-side classes and its corresponding proxy class. Contract-first approach plays a major role in services oriented infrastructure where interface (that is WSDL file) is the base for entire web service development process. for entire web service development process.

1 INTRODUCTION

Web services are one of the most widely used technologies for business process integration and business application integration. This article will discuss certain aspect of web services creation, i.e. developing a web service using contract-first approach. With the initial release of web services (not initial release in the same sense as a some sort of product, but more like broad acceptance of this technology) developers focused mostly on implementation, not so much on the description of the service itself. Code-first approach was and still is most widely used approach when implementing web services. Reason for this is obvious. Most tools were developed with code-first approach in mind. One of the very first tools for web services development, Visual Studio.NET by Microsoft, has a special project called ASP.NET Web Service Project for developers to use and start coding the service right away. When development is complete, VS.NET or, more precisely, .NET Framework generates WSDL description (file) on the fly the first time someone contacts the web service [1].

However, contract-first approach has some advantages over code-first approach, which over the years brought up some issues or limitations that the industry has already seen in the world of COM (Component Object Model). WSDL serves as an interface provider in web services world, much like IDL (Interface Definition Language) did in the world of COM. Interfaces are the most important part for connecting two different, possibly distributed and most probably proprietary applications together. Interface provides a description of what certain application does. Any kind of communication goes through the interface, which effectively shields users of an application from the code that is used behind scenes to implement the application (service). Code can be changed, programming language can be changed and other aspects of implementation can change without affecting the end user. Code-first or contract-first dilemma happened back then in COM and it is happening again. We can decide to have our web service available only to clients using, for instance, Windows and .NET Framework, because our web service is written upon those two platforms but that's not what web services are all about [1, 2].

With contract-first approach we are able to to control versions of an interface, we are able to write WSDL file in a way that would be most appropriate for others to use. Bear in mind that we have to think about types on other platforms. When we are finished constructing our contract, we can decide what platform to use and what programming language to use for development. We still have indenpendence between interface and code, meaning as long as interface doesn't change everyone will be able to use our service even if the code behind changed completely. Clients will not even notice it. With contract-first development we get painless integration and true availability of our service for everyone.

Tools that we used when developing COM applications created IDL on the fly just as VS.NET creates WSDL file on the fly for us if we decide to go with code-first approach. The problem with this approach is that developer has very little control over versions of an interface and types being used. Code-first approach is very self-centered and contracts (interfaces) by their definition have to be "shared", meaning types and method signatures should be chosen and written with other systems and platforms in mind too. With code-first approach we decide to have our application (service) focused mainly on the clients we choose to have. Those are probably clients that use the same platform as service developer does and probably even use the same programming language to develop proxy classes. Tools for web services

development that are in use today still focus on code-first approach but with new tools usage of contract-first approach will rise, especially in areas where higher degree of integration and availability is necessary [1, 3].

2 INTERFACE STRUCTURE

First step of developing web service through contract-first approach is constructing WSDL file. Each WSDL file is in fact XML file and has a structure that is defined according to WSDL specification, namely WSDL 1.1 specification [4]. With contract-first approach special care has to be taken to write abstract definitions that follow characteristics of various platforms and type libraries. This ensures that web service interface stays compatible with clients which invoke the service from different platforms and are developed in different programming languages. We can describe the process of converting WSDL operations into web methods implemented by the web service server-side class.

One of the most important parts of WSDL file is <types> element. It includes wellformed and valid XML Schema which defines the types used by operations. Each operation has formal parameters. Parameters use types defined in schema from <types> element. To implement a web method based on operation from within WSDL file we need to have a signature for it. We have to parse through WSDL file, read in operation signature, what types it uses and where are those types defined (they can also be imported besides being in <types> element). To be able to do that we have to go into schema and check for referenced types. Each type has to be recursively solved down to an array of simple types. We can then decide how to represent those simple types to be available to web methods. Most common approach is to transform XML Schema complex types into classes. For example, if we want to convert one complex type into a structure that can be used in an application, we basically form a class with the name of that complex type and have class variables within that class for resolved simple type elements within that complex type. This means we need some sort of recursive parser for our schema or use one of the tools provided by the platform. WSDL files do not provide any details about operations' implementation, so we only have to correctly translate operation signature into web method signature and provide implementation ourselves at a later time or automate the process and push the implementation inside of a web method while creating web service server-side class .

2.1 Automatic formation of web service server-side file

To automate the process of creating server-side file for a specific web service we need tools to parse the types schema and read operation details. The process consists of the following steps:

1. **Collect the list of operations from WSDL file**
2. **Collect information about their signatures**
3. **Solve each complex type used as a parameter down to simple types in types schema**
4. **Use binding and service information provided in WSDL file to decide on the details such as web service style (RPC, document) and encoding (literal, encoded)**
5. **Provide implementation details to web methods, either from some other source (text files) or some form of default implementation**

First step can easily be accomplished by going through the WSDL file with an XML parser (or custom WSDL parser) and check each <portType> for operations it defines. Each operation is then checked for input and output message (or any other message exchange pattern). We then check input and output messages and perform schema parsing and thus accomplish steps 2 and 3. Step 4 is important to ensure that SOAP messages are constructed in a way that both the service and its clients understand them. This is defined in WSDL file. The author of WSDL file has decided what style should the web service use and how it should construct its messages. Web method signatures are indenpendent from style and encoding decision, but their inputs and outputs are very much dependent on decisions made in WSDL file. XML serialization plays a major role in serializing and deserializing objects provided to/by the web methods. This is where we have to take into account what style of service does the WSDL file specify and what encoding for XML (SOAP) messages should we use. Specifics of serializing and deserializing objects according to different style/encoding combinations are beyond the scope of this article. We already said implementation details are unknown to clients, because they are not included in WSDL file and as such they are unknown to code generators too. We have to provide implementation details ourselves or choose to implement only default implementation by which we mean just the return sentence. Default implementation would include a return sentence with a null value for reference types and default value of a type for value types. Or we could use an alternate source of implementation code and inject that code in to appropriate web method. If we choose not to implement anything, we are left with an abstract class. It is impossible to use an abstract class in any kind of testing. At least default implementation should be done to be able to test the behaviour of a web service [5].

2.2 Proxy class formation

Creating proxy classes is very similar to creating web service server-side classes. All the steps are the same and there is no need for step 5, because no custom implementation is neccessary. Proxy class has methods named after the operations in WSDL file. It also has additional methods which we can use to perform asynchronous communication. Asynchronous execution of web methods is handled by methods that start with word "Begin" and "End" followed by a method name.

3 IMPLEMENTING AUTOMATIC WEB SERVICE FORMATION IN .NET FRAMEWORK

Microsoft .NET Framework 1.1 offers rich and robust API where developers can find various classes that support most of the technologies used in conjunction with web services. The System.Web.Services namespace is a place where most of those classes reside, although there are plenty of useful classes from other namespaces. There are three of those classes that we use the most. These are ServiceDescription, ServiceDescriptionImporter and DiscoveryClientProtocol classes which handle most of the specifics when it comes to reading WSDL file.

System.Web.Services.Description.ServiceDescription

ServiceDescription class represents a structure that holds WSDL data. It has properties that are equivalent to structures that we find in WSDL file. We can use those properties to read loaded WSDL file (parse it) or we can use other .NET Framework classes (especially ServiceDescriptionImporter) to make a web service server-side class out of it, which actually is what we want to do. To load WSDL file into ServiceDescription class we use the ServiceDescription.Read() method.

System.Web.Services.Description.ServiceDescriptionImporter

ServiceDescriptionImporter class allows us to import WSDL files the same way we would do it using wsdl.exe tool. We use this class to actually create web service server-side class (or proxy). Attribute ServiceDescriptionImporter.Style holds information what kind of class do we want to create, server-side or proxy class.

System.Web.Services.Discovery.DiscoveryClientProtocol

DiscoveryClientProtocol enables us to resolve connections and import elements inside WSDL file and extend description beyond the scope of just one file. Its usage is similar to using the disco.exe tool. To get references to other files we use methods Discover() and DiscoverAny(). References are then added to the References list. To resolve them we use ResolveAll() or ResolveOneLevel() methods. Our method of automatic web service formation relies heavily on System.Xml, System.Reflection and System.CodeDom namespaces. Explanation of classes from these namespaces would be beyond the scope of this article, however we will show how to use CodeDOM for code generation [5].

Here we will show only a small portion of code that has been written to support our method. Figure 1 shows how to use ServiceDescriptionImporter class to load WSDL description. We could also use custom parser (here shown as WsdlReader class) and also do something with WSDL description ServiceDescription class. However, the example below only shows how to create a root CodeNamespace instance for our web service server-side class.

```
WsdlReader wr = new WsdlReader();

string strWsdl = http://feri.uni-
mb.si/Services/MathService.wsdl;

ServiceDescription sd =
wr.CreateServiceDescription(strWsdl);

if(sd == null)

      return null;

sdi = new ServiceDescriptionImporter();


wsdlNamespace =
GetNamespaceFromURI(strWsdl) +
".Services";

CodeNamespace cns = new
CodeNamespace(wsdlNamespace);

CheckForImports(strWsdl);

sdi.Style =
ServiceDescriptionImportStyle.Server;

sdi.ProtocolName = protocolName;

sdi.Import(cns, null);
```

Figure 1: Loading WSDL with ServiceDescriptionImporter

Code generation is done using ICodeGenerator interface and CSharpCodeProvider in a way that is shown in Figure 2.

```
CSharpCodeProvider cscp = new
CSharpCodeProvider();

ICodeGenerator icg =
cscp.CreateGenerator();

StringBuilder srcStringBuilder = new
StringBuilder();

StringWriter sw = new
StringWriter(srcStringBuilder);

icg.GenerateCodeFromNamespace(cns, sw,
cop);

serviceSource =
srcStringBuilder.ToString();

sw.Close();
```

Figure 2: Code generation

To compile generated code we use ICodeCompiler interface and CompilerResults class. CompilerResults class holds information about the state of compilation and compiler errors. The process is shown in Figure 3.

```
ICodeCompiler icc =
cscp.CreateCompiler();

CompilerResults cr =
icc.CompileAssemblyFromSource(cp,
serviceSource);

foreach(CompilerError err in cr.Errors)

{

      MessageBox.Show(err.ErrorText +
"\n" + err.Line + "\n" +

            err.FileName);

}

assembly = cr.CompiledAssembly;
```

Figure 3: Compiling code

4 CONCLUSION

In this article we have defined a method for contract-first automatic web service formation based on WSDL descriptions. We have defined best-practices for implementing the method and have actually implemented it using the .NET Framework together with Web Services Enhancements, which has very few limitations. Our implementation is able to read and parse WSDL files, create abstract and concrete service server-side files. It also provides proxy classs generation. We have implemented support for message exchange on two protocols, namely TCP and HTTP. We have used WSDL's inline schema for SOAP message format, which is essential. The support for SOAP headers exist and it is done through the use of Web Services Enhancements. User interface for additional SOAP headers has not been implemented but it is a matter of time rather than complexity [6-8]. We have implemented a custom SOAP extension which can provide additional functionality especially when sending and receiving SOAP messages. SOAP extension enables us to access the raw SOAP data as it has been encoded by the framework. These data can be altered, erased or modified in some other way depending on our needs. We have used .NET Framework's TCP classes to implement TCP listener (simple TCP server) which receives SOAP messages through TCP/IP on a port that we define. For HTTP IIS was used and we implemented a class which registers newly generated web service inside IIS web server. We have also implemented simple queue which holds received SOAP messages on the server side and enables us to delay response (asynchronous behaviour).

There are a lot of possibilities and with new platforms like .NET Framework 2.0 or Indigo (Microsoft's Longhorn-based web services platform) new approaches will emerge and a lot of what today has to be done (programmed) manually will be included in new tools.

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PRISTOPI ZA MODELIRANJE POSLOVNIH PROCESOV

Jurij Laznik [1]*, Matjaž B. Jurič* [2]
[1] HERMES SoftLab d.d., Zagrebška 104, 2001 Maribor, Slovenija
[2] Fakulteta za elektrotehniko, računalništvo in informatiko, Smetanova 17, 2000 Maribor, Slovenija

POVZETEK

V tem prispevku bomo prikazali trenutno stanje in raziskave pri modeliranju poslovnih procesov. Predvsem se bomo osredotočili na dve glavni tehnologiji: MDA in BPEL. MDA v tem primeru nastopa kot arhitektura za razvoj programske opreme, BPEL pa kot platforma za izvajanje poslovnih procesov s pomočjo spletnih storitev. Podali bomo tudi smernice za nadaljne raziskave na tem področju.

1 UVOD

Spletne storitve danes igrajo pomembno vlogo v informacijski tehnologiji. Zaradi razširjenosti spletnih storitev se je pojavila potreba po orkestraciji spletnih storitev predvsem v poslovnem svetu. V ta namen je bil predstavljen jezik za opisovanje poslovnih procesov BPEL[1]. Ker so poslovni procesi zelo kompleksni za sam razvoj se uporablja kot pomoč pri razvoju programske opreme arhitektura MDA[2]. Ta arhitektura omogoča definiranje platformsko neodvisnega model, ki se nadalje pretvori v platformsko odvisen model, le-ta pa se pretvori v izvorno kodo. Tako ločimo poslovno logiko od same implementacije rešitve.
V prihodnjih letih bo takšen pristop vsekakor postal "de facto" standard pri razvoju in implementaciji poslovnih procesov v programskih rešitvah.

2 MODELSKA ARHITEKTURA

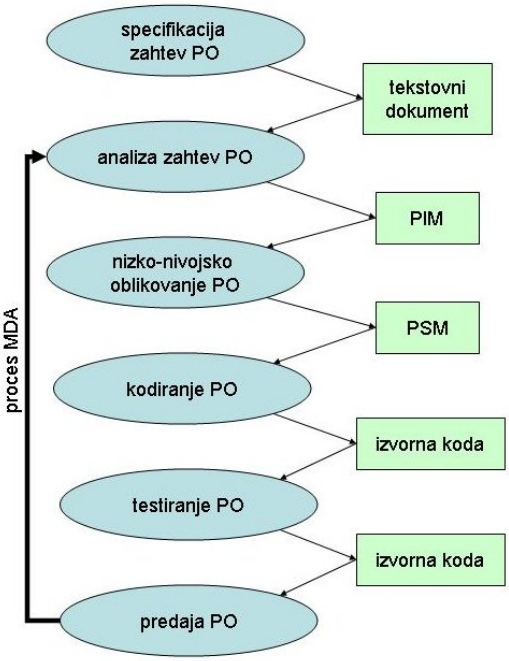
Modelska arhitektura (an. Model–Driven Architecture) MDA je bila zasnovana z namenom ločitve poslovne in aplikacijske logike od platforme za katero se rešitev izvaja. V tem kontekstu lahko rečemo, da tehnologija MDA omogoča razvoj programske rešitve neodvisno od izbire platforme na kateri se bo programska rešitev izvajala. Tehnologija MDA omogoča tudi ločitev poslovne in aplikacijske logike. Poslovna logika se tako spreminja skladno s spremembami poslovnih procesov, aplikacijska logika pa se spreminja glede na tehnološke spremembe.

2.1 Modeliranje MDA

Razvojni cikel programske opreme v MDA je podoben tradicionalnemu razvojnemu ciklu programske opreme. Razvoj programske opreme po MDA (Slika 1) tako sestavlja šest faz [3], ki so:

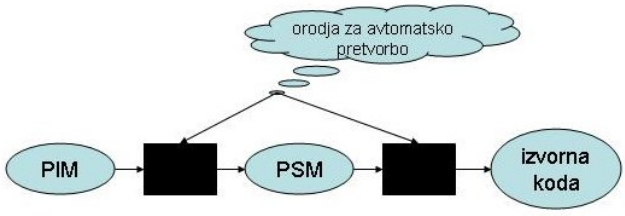
- specifikacija zahtev programske opreme (SZPO),
- analiza zahtev SZPO,
- nizko-nivojsko oblikovanje programske opreme,
- kodiranje programske opreme,
- testiranje programske opreme in
- predaja programske opreme.

Modeliranje MDA poteka od faze analize zahtev SZPO do testiranja programske opreme. Glavni trije postopki modeliranja so izdelava platformsko neodvisnega modela (Platform Independent Model – PIM), izdelava platformsko specifičnega modela (Platform Specific Model – PSM), ter pretvorba iz modela PSM v izvorno kodo izbrane platforme na kateri se bo izvajala programska oprema.



Slika 1: *Razvojni cikel programske opreme po MDA.*

Razvijalcem programske opreme je olajšan razvoj programske opreme do te mere, da morajo le-ti poskrbeti za izdelavo platformsko neodvisnega model medtem, ko za izdelavo platformsko specifičnega modela in pa generiranje kode poskrbijo orodja za avtomatsko pretvorbo, kar je prikazano na sliki 2. Nekaj teh orodij bomo tudi opisali v nadaljevanju.



Slika 2: *Avtomatizacija pretvorbe modelov.*

2.2 Platformsko neodvisni model

Platformsko neodvisni model predstavlja modeliranje programske opreme z visoko stopnjo abstrakcije. To modeliranje je neodvisno od platforme na kateri bo programska oprema delovala. Pri izdelavi platformsko neodvisnega modela se razvijalci programske opreme bolj osredotočijo na poslovni vidik programske opreme in jih ne zanima, kako bo programska rešitev rešena s tehnološkega vidika.
Najpogostejši zapis platformsko neodvisnega modela je v jeziku UML [4] s pomočjo profilov. Enega od profilov za modeliranje poslovnih procesov je predstavilo podjetje IBM. Ta profil je razširitev jezika UML v smislu dodajanja stereotipov, ki omogočajo opise poslovnih procesov v smislu tehnologije BPEL4WS.

2.3 Platformsko odvisni model

Platformsko odvisni model predstavlja pretvorbo iz platformsko neodvisnega modela v model, ki je bližje platformi na kateri bo izvedena programska rešitev. Platformsko odvisni model že vsebuje konstrukte, ki so bolj tesno povezani s končno tehnološko rešitvijo. Tako lahko v platformsko odvisnem modelu že zasledimo izraze, kot so: tabela, relacija, primarni ključ, razred, vmesnik, sejno zrno in podobno. Povsem razumljivo je, da je platformsko odvisen model razumljiv tistim razvijalcem, ki že poznajo platformo na kateri se bo programska rešitev izvajala. Iz enega platformsko neodvisnega modela lahko izdelamo tudi več platformsko odvisnih modelov glede na tehnologije, ki jih uporabljamo za programsko rešitev.
Platformsko odvisni modeli so tako prirejeni za relacijske baze, .NET platformo, poslovna javanska zrna (EJB), BPEL in podobno. Za modeliranje poslovnih procesov je najbolj aktualen prav platformsko odvisni model za tehnologijo BPEL.

2.4 Izvorna koda

Zadnji korak pri pretvorbi modelov je pretvorba platformsko odvisnega modela v izvorno kodo. Ker je platformsko odvisno model dokaj tesno povezan z končno tehnološko rešitvijo, je ta pretvorba dokaj enostavna.
Kot rezultat pretvorbe iz platformsko odvisnega modela BPEL v izvorno kodo dobimo BPEL opis procesa.

3 JEZIK ZA OPISOVANJE POSLOVNIH PROCESOV

Jezik za opisovanje poslovnih procesov (Business Process Execution Language for Web Services – BPEL4WS) je bil predstavljen pod okriljem konzorcija Oasis, ki je ena od organizacij, ki skrbijo za standardizacijo računalniških tehnologij. Pri razvoju jezika sodelujejo največja podjetja v računalniški industriji, kot so: IBM, BEA Systems, Microsoft, SAP AG, Siebel Systems. Ker podroben opis jezika presega okvire tega članka, bomo opisali samo glavne značilnosti jezika za opisovanje poslovni procesov, kot so prikazani na sliki 3.

Slika 3: *Glavni gradniki jezika za opisovanje poslovnih procesov.*

Aplikacijske rešitve, ki so zasnovane s pomočjo jezika za opisovanje poslovnih procesov BPEL, imenujemo tudi procesno orientirane aplikacijske rešitve. Struktura takšni aplikacij se dokaj jasno razdeli na dva sloja, kot je prikazano na sliki 4:

- **zgornji sloj**, ki predstavlja poslovni proces opisan v BPEL in logiko poteka aplikacijske rešitve in
- **spodnji sloj**, ki predstavlja funkcijsko logiko, to je spletne storitve aplikacijske rešitve.

Slika 4: *Razslojevanje aplikacijske rešitve s pomočjo BPEL.*

3.1 Partnerji

V vsakem poslovnem procesu sodelujejo partnerji. Vsak partner definira vloge katere igra v poslovnem procesu. Lahko se definira vloga katero sprejme kot partner v poslovnem procesu, lahko pa definira tudi vlogo, ki jo mora partner sprejeti, da lahko poslovni proces teče. Slednja vloga zagotavlja, da partner s sprejemov vloge tudi zagotavlja implementacijo spletne storitve.

3.2 Vsebniki, lastnosti in korelacije

Vsebniki v jeziku za opisovanje poslovnih procesov označujejo poslovni kontekst. To je običajno pomembno zaradi pravilnega usmerjanja sporočil pri izvajanju poslovnega procesa. Lahko se namreč zgodi, da se pojavita dve enaki sporočili, ki pa nimata enakega pomena za različne partnerje.

Pri izmenjavi sporočil med partnerji v poslovnem procesu, sporočila pogosto nosijo s sabo vrednosti, ki se uporabljajo pri nadaljnem izvajanju poslovnega procesa. Ker se pogosto uporablja ista vrednost lastnosti v več sporočilih v poslovnem procesu, se lastnosti definirajo kot ločena entiteta.
V poslovnih procesih ne moremo vedno zagotoviti enovitega poimenovanja sporočil. Iz tega razloga lahko v jeziku za opisovanje poslovnih procesov poimenujemo eno sporočilo z več imeni, kar poenostavi samo preglednost procesa.

3.3 Aktivnosti

Aktivnosti v poslovnem procesu definirajo akcije, ki se morajo izvesti v toku poslovnega procesa. Lahko tudi rečemo, da aktivnosti definirajo sam potek poslovnega procesa. Aktivnosti definirajo vrsto gradnikov s katerimi se lahko vpliva na tok poslovnega procesa. Tako lahko definiramo katera sporočila določena aktivnost sprejme, kot tudi kako se naj aktivnost odzove glede na rezultat izvajanja spletne storitve. Aktivnost lahko namreč vrne podatke, lahko se zaključi ali pa sproži izjemo, kar bomo opisali v naslednjem podpoglavju.

3.4 Obravnavanje izjem

Jezik za opisovanje poslovnih procesov nudi vrsto mehanizmov za obravnavanje izjem. Mehanizmi omogočajo prekinitev izvajanja poslovnega procesa, razveljavitev že izvedene aktivnosti v poslovnem procesu, razveljavitev celotnega poslovnega procesa. Za to skrbijo strežniki napake ("fault handlers"), ki se ustrezno odzovejo glede na izjemo, ki se je zgodila.

4 PRISTOPI ZA MODELIRANJE POSLOVNIH PROCESOV S POMOČJO MDA

Za modeliranje poslovnih procesov lahko uporabimo mnogo platformsko neodvisnih modelov. Nekaj teh bomo spoznali v nadaljevanju. Prav tako obstaja tudi več orodij oziroma jezikov, ki omogočajo pretvorbo iz platformsko neodvisnega modela v platformsko odvisni model. Tudi nekaj teh jezikov bomo spoznali v nadaljevanju.

4.1 Tipi platformsko neodvisnih modelov

Najpogosteje uporabljen tip platformsko neodvisnega modela je diagram aktivnosti UML. Diagrami aktivnost predstavljajo tok sistema. V našem primeru lahko rečemo sistemu tudi poslovni proces.
Delovne aktivnosti ("workflows") so pogosto modelirane kot model stroja prehajanja stanj ("state machine model"). Stanja v modelu predstavljajo partnerje v jeziku BPEL, prehodi stanj pa so v jeziku BPEL predstavljeni kot aktivnosti.
Metodologija, ki se je najbolj uveljavila pri načrtovanju poslovnih procesov med podjetji (B2B) je UMM (UN/CEFACT Modeling Methodology) [5]. Ker so elementi metodologije dokaj transparentni, je pretvorba iz modela UMM v BPEL relativno enostavna.

4.2 Jeziki za definiranje pravil

Glede na tip platformsko neodvisnega modela uporabljamo različne jezike za definiranje pravil. Namen pravil je jasno in enoznačno določiti obnašanje sistema. Kot primer vzemimo diagrame UML. Pri razvoju programske opreme le-ti ne zadostujejo, zato z pomočjo jezika za definiranje pravil enolično določimo obnašanje sistema. Jezik za definiranje pravil v UML tehnologiji se imenuje OCL (Object Constraint Language) [6]. V tem jeziku najpogosteje zapišemo pravila, kot so:

- vhodna pravila, ki opisujejo katerim pogoje mora biti zadoščeno, da se aktivnost lahko prične in
- izhodna pravila, ki opisujejo katerim pogoje mora biti zadoščeno, da je aktivnost uspešno zaključena.

Primer pravila v jeziku OCL je naslednji:

```
context Bankomat::Dvig(): Object
    pre pin: isValid() = true
    post denar : result = self@pre.isMoney()
```

kjer vhodno pravilo (predpogoj) preverja ali je vneseni PIN pravilen, medtem ko izhodno pravilo (po-pogoj) preverja ali je na računu dovolj denarja.
Kot odgovor jeziku za definiranje pravil OCL je bil razvit jezik ATL (Atlas Transformation Language) [7], ki omogoča formalno pretvorbo iz platformsko neodvisnega modela v platformsko odvisen model. Naslednji primer prikazuje pravilo za pretvorbo iz diagrama aktivnosti UML v proces BPEL:

```
rule Ag2P{
  from ag: UML!ActivityGraph
  to pc: BPEL!Process
  mapsTo ag(
    name <- ag.name,
    targetNamespace<-
    "http://www."+ag.name+".com",
    abstractProcess <- false,
    xmlns <- "http://schemas.xmlsoap.org/" +
    "ws/2003/03/business-process/"
   )
}
```

Za potrebe avtomatizacije in interoperabilnosti spletnih storitev je bila razvita platforma Self-Serv [8]. Na tej platformi lahko definiramo pravila za povezovanje spletnih storitev. Ta pravila nato preslikamo iz platformsko neodvisnega modela v platformsko odvisen model.

5 NADALJNE RAZISKAVE

Nadaljne raziskave bodo vodile v smeri izdelave predloga platformsko neodvisnega modela in platformsko odvisnega modela skladno z arhitekturo MDA za jezik za procesiranje poslovnih procesov BPEL. Predvsem nas bosta zanimala dva vidika pretvorbe iz platformsko neodvisnega modela v platformsko odvisni model in nadalje v izvorno kodo:

- pretvorba iz modela PIM v model PSM velja za najbolj kompleksno nalogo pri pristopu načrtovanja programske opreme po MDA, zato bomo tej pretvorbi namenili večjo pozornost.
- pri pretvorbi iz PSM v izvorno kodo se bomo osredotočili predvsem na generiranje izvorne kode za dve danes najbolj razširjeni platformi, to sta: Java in .NET.

Takšna zasnova PIM in PSM bodo omogočali razvijalcem hitrejše, cenejše predvsem pa lažje modeliranje poslovnih procesov.

6 ZAKLJUČEK

V tem članku smo spoznali pristope za razvoj programske opreme s pomočjo arhitekture MDA. Ta arhitektura nam pomaga ločiti poslovno logiko od implementacije programske rešitve. Nadalje smo spoznali jezik za opisovanje poslovnih procesov BPEL, ki je danes tudi najbolj razširjen. V nadaljevanju smo spoznali tudi pristope za modeliranje poslovnih procesov po MDA. Pri tem smo se osredotočili na tipe platformsko neodvisnih modelov in na jezike za definiranje pravil.
Podali smo tudi iztočnico za nadaljne raziskovanje pretvorb modelov PIM v PSM ter iz PSM v izvorno kodo.

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Zbornik 8. mednarodne multikonference
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Vzgoja in izobraževanje v informacijski družbi

Education in Information Society

Uredil / Edited by

Vladislav Rajkovič, Tanja Urbančič, Mojca Bernik

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Predgovor:

Zavedamo se, morda vsak nekoliko po svoje, pa vendar, da informacijsko komunikacijske tehnologije (IKT) spreminjajo svet. Trenutno se nahajamo v fazi informacijske družbe, t.j. družbe, kjer je informacija pomembno in dragoceno blago, ki ga je moč kupiti, prodati, shraniti ali zamenjati. Vemo, da informacija in znanje nista eno in isto. Želimo ne le informacijsko družbo, ampak tudi družbo znanja, kjer se znanje širi in prenaša in je vsem ljudem omogočen dostop do znanja in do koristi, ki jih prinaša izobrazba. Izobraževanje je osrednja tema družbe znanja. Vzgojitelji imajo pri tem pomembno vlogo in poslanstvo.

Letos poleti je v kraju Stellenbosch v Južni Afriki potekala 8. svetovna konferenca o računalnikih v izobraževanju, z naslovom "40 years of Computers in Education, What Works?". Vlogo organizatorja je imel IFIPov (International Federation for Information Processing) komite o izobraževanju (IFIP TC3). Na tej konferenci je bila oblikovana deklaracija o integraciji IKT v izobraževanje, kot pripomoček vsem, ki se želijo vključiti v procese pri pripravi na družbo znanja. Deklaracija je objavljena na http://www.ifip.org/home/TheStellenboschDeclaration.pdf. V naslednjih vrsticah bomo povzeli le nekaj poudarkov.

Deklaracija obravnava tematiko v sklopu šestih področij: digitalna solidarnost, učenci in vseživljenjsko učenje, strategije za odločanje, mrežno povezovanje, raziskave in učitelji. Za vsako od teh področij so oblikovana priporočila in predlogi ukrepov, ki zadevajo tri poglavitne ravni: družbeno raven, raven učenja in poučevanja ter raven tehnologije in infrastrukture.

»Digitalni razkorak« med ljudmi je prisoten tako na globalni kot lokalni ravni. IKT so omogočile veliko število zgodb o uspehu, eksperimentov in inovacij, izboljšale so dostop do izobraževanja in znanja. Na področju izobraževanja naj bi IKT pomagale razviti digitalno solidarnost. Digitalna solidarnost zadeva dostop do IKT infrastrukture na eni strani in dostopnost do digitalnih vsebin in medijev na drugi. Pomembno je soglasje vseh vpletenih za reševanje problemov dostopa do tehnologije, projektnega sodelovanja in posredovanja izobraževalnih vsebin, vendar ne brez spoštovanja lastninskih pravic.

V družbi znanja učenec ni le formalno vpisan učenec ali študent. Vseživljenjsko učenje je postalo bistven element družbe znanja. Vsak učenec je vseživljenjski učenec, ki se mora prilagoditi družbi temelječi na znanju in aktivno sodelovati na vseh ravneh socialnega, kulturnega in ekonomskega življenja ter prevzeti večji nadzor nad svojo prihodnostjo. Vsebina in metode začetne izobrazbe morajo upoštevati priprave na vseživljenjsko učenje. S tem pripadata šoli in vzgojiteljem nova vloga in novo poslanstvo. IKT je ključno orodje pri razvoju vseživljenjskega učenja.

Da bi pomagali odločevalcem sprejemati odločitve, ki so v skladu z dejanskimi potrebami, in izboljšati položaj izobraževanja, kakor tudi IKT v izobraževanju, je potrebno oblikovati ustrezne odločevalske procese in stratgije. Ključnega pomena je povezovanje raziskovalnega dela, prakse in inovacij z odločanjem. Odločevalci naj bolje uporabijo izkušnje ljudi iz prakse in ugotovitve raziskovalcev. Naloga ljudi iz prakse in raziskovalcev pa je zagotoviti vidnost in uporabnost njihovih ugotovitev in rezultatov za potrebe odločevalcev. Proces odločanja naj temelji na sistemskem pristopu. Ustvari naj se občutek lastništva in skupne odgovornosti v povezavi z razvojem in udejanjanjem IKT ukrepov v vzgoji in izobraževanju.

Ena izmed poglavitnih značilnosti družbe znanja je povezovanje v mreže, kar pomeni, da aktivnosti niso več organizirane na hierarhičen ali piramidni način. Najboljši primer je internet, kjer so informacije dostopne po principu mrež, ki so lahko tudi kontekstno zaokrožene kot npr. Slovensko izobraževalno omrežje (http://SIO.edus.si). Mrežna struktura družbe ima vpliv tako na politiko in organizacijo sistemov kot seveda tudi na izobraževalne sisteme.

Raziskave in razvoj morajo dajati trdne teoretične okvire, ki lahko botrujejo pozitivnim izkušnjam, le-te pa lahko predstavljajo zanesljive inovativne refrenčne modele. Potrebno je prenoviti raziskovalne prioritete in premostiti vrzel med tehnologijo in pedagogiko. Na področju učenja podprtega z IKT se pedagogiko in tehnologijo običajno obravnava ločeno. Pedagogika pogosto temelji na tem, kaj naj bi tehnologija dopuščala in ne na popolni integraciji, ki služi kot osnova tehnološkemu načrtovanju.

Informacijska družba znanja zahteva nenehne spremembe vloge in poslanstva učiteljev. Učitelj v družbi znanja potrebuje določene nove sposobnosti: ravnanje z novim znanjem in načini dostopanja do znanja, mrežno sodelovanje, vseživljenjsko učenje. Učitelji so ključni »agentje« v izobraževalnem sistemu in razvoju izobraževanja. IKT spreminja poučevanje in učenje, vendar tehnologija ni glavna težava. Velja si zapomniti, da je tehnologija velikega pomena, vendar imajo učitelji in dobro poučevanje večji pomen. Vzpodbujati je potebno inovativnost učiteljev ne le v neposredni praksi, ampak tudi pri sodelovanju v raziskovalnih projektih. Potrebno je razviti mednarodne mreže učiteljev in učencev in tako prispevati, da oboji postanejo tudi državljani sveta.

Tudi prispevkom, ki so pred nami, ni botrovala le več destletna tradicija Slovenije na področju harmonizacije vzgoje in izobraževanja z izzivi informacijske tehnologije, ampak predvsem inovativnost avtorjev, ki se aktivno vključujejo v procese, ki zaznamujejo prehod iz informacijske družbe v družbo znanja.

Vladislav Rajkovič
Tanja Urbančič
Mojca Bernik

Prispevki so v tej publikaciji predstavljeni le s povzetki. V celoti so objavljeni v zborniku na zgoščenki in na spletnem naslovu http://lopes1.fov.uni-mb.si, poseben izbor pa je objavljen v tematski številki revije Organizacija (letnik 38, številka 8, oktober 2005, ISSN 1318-5454).

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Tehnološko podprto izobraževanje – uporabnost in primernost sistemov za upravljanje e-izobraževanja

Tanja Arh [1] , Vladislav Rajkovič [2] , Borka Jerman Blažič [1]

(1) Institut "Jožef Stefan", Laboratorij za odprte sisteme in mreže, Jamova 39, 1000 Ljubljana

(2) Univerza v Mariboru, Fakulteta za organizacijske vede, Kidričeva 55a, 4000 Kranj

tanja@e5.ijs.si, vladislav.rajkovic@fov.uni-mb.si, borka@e5.ijs.si

V času, ko postaja razvoj človeških virov čedalje pomembnejši za nadaljnji razvoj sodobnih družb, se večajo potrebe po izobraževanju, usposabljanju in posodabljanju znanj. Vedno večje so tudi možnosti, ki jih na področju izobraževanja nudijo nove generacije izobraževalnih informacijskih tehnologij. Danes se na trgu pojavljajo številni sistemi za upravljanje e-izobraževanja (ang. Learning Management Systems), ki združujejo širok nabor funkcionalnosti, kar za izvajalce in financerje e-izobraževanja večkrat pomeni dilemo, kako izbrati najboljše in najbolj primerno tehnološko okolje za izvedbo izobraževalnega procesa za določeno ciljno skupino. Predlagani prototip večparametrskega odločitvenega modela za ugotavljanje kakovosti in primernosti sistemov za upravljanje e-izobraževanja se naslanja na teoretična in praktična spoznanja v zvezi s kakovostjo teh sistemov in na zavest o nujnosti uporabe informacijske tehnologije tudi v izobraževalnem procesu.

Ključne besede: e-izobraževanje, sistem za upravljanje e-izobraževanja, uporabnost in primernost, sistemi za pomoč pri odločanju

Technology-Based Education – Usability and Applicability of Learning Management Systems

In accordance with the fact that human resource development has been recognized as one of the most important elements for further development of modern societies, the current demands for new knowledge and skills has being constantly increased. Parallel to the wide range of possibilities offered by new generations of educational technologies, a number of Learning Managament Systems (LMS) to support the e-learning have been developed and available at the market. Nevertheless customers are often faced with the dilemma how to choose the optimum technological environment for the implementation of education process for a definite target group. The proposed prototype of the multi-attribute decision making model for assessments the usability and applicability of Learning Management Systems is based on the theoretical and practical expertise related to the quality assurance of these systems and to the high consciousness of the necessity to use information and telecommunication technology in educational process.

Key words: e-learning, Learning Management System, usability and applicability, decision models

Galerija Prešernovih nagrajencev v Kranju

Marko Arnež, Janko Uhan

Tehniški šolski center Kranj, Kidričeva 55, 4000 Kranj

marko.arnez@guest.arnes.si, janko.uhan@guest.arnes.si

V Galeriji Prešernovih nagrajencev za likovno umetnost v Kranju so razstavljena likovna dela dobitnikov Prešernovih nagrad, najvišjih državnih priznanj za dosežke na področju umetnosti. V galeriji, ki svoje poslanstvo gradi na oblikovnaju stalne zbirke, redno pripravljamo razstave, na katerih se predstavljajo nagrajenci s samostojnimi razstavami. V letošnjem letu je galerija pridobila elektronsko predstavitev v obliki spletnih strani, hkrati pa v elektronski obliki želimo celovito predstavili tudi vse Prešernove nagrade in nagrajence od leta 1947 pa do danes. V referatu bomo predstavili, kako smo na relativno enostaven in učinkovit način uspešno realizirali ta obsežen projekt in kakšen izobraževalen pomen virtualna galerija predstavlja za dijake in učence osnovnih in srednjih šol.

Ključne besede: spletne strani, elektronska predstavitev, internet, virtualna galerija, umetnost

The Prešeren Award Winners Gallery in Kranj

The Prešeren Award Winners Gallery houses works of art made by artists having received this national award. The gallery continues to enlarge the number of exhibits in order to create a permanent collection. The exhibiting artists generously donate one of their works to the existing permanent collection of the gallery. This year the gallery is presented electronically on its own Web site. The final aim of the Web gallery is to present all Prešeren Award winners since 1947. The paper presents an insight into a simple and effective realisation of this project as well as the educational importance the virtual gallery has for the primary and secondary school students.

Key words: web sites, electronic presentation, internet, gallery, art

Multimedijska podpora učinkovitim komunikacijskim tokovom med zdravnikom in pacientom

Zvone Balantič

Univerza v Mariboru, Fakulteta za organizacijske vede, Kidričeva 55a, 4000 Kranj

zvone.balantic@fov.uni-mb.si

Multimedija je kombinacija vizuelne in slušne predstavitve. Take predstavitve lahko vsebujejo tekst, grafiko, zvok, animacijo in video. Multimedijska tehnologija je zaslužna, da se je medicinska informatika prav posebno razvila.
V prispevku je predstavljena multimedijska podpora pregleda dihalnega sistema in pregled testiranj pljučne funkcije. Pri izdelavi multimedijske podpore učinkovitim komunikacijskim tokovom med zdravnikom in pacientom so sodelovali univerzitetni učitelji, pedagogi in računalniški strokovnjaki. Predstavitev preko notranjih povezav omogoča hiter dostop do vsebin. Multimedijska podpora v obliki zgoščenke je primerno računalniško orodje za izobraževanje v medicini in za virtualni pregled testiranja pljučne funkcije. Medtem, ko pacienti čakajo pred laboratorijem, lahko sodelujejo pri interaktivni multimedijski podpori in se seznanjajo s postopki, ki jih čakajo v laboratoriju. Analitična ocena klinične uporabnosti predstavljene zasnove kaže na boljšo pretočnost informacije od zdravnika k pacientu do konca postopka testiranja pljučne funkcije.

Ključne besede: multimedija, pljučna funkcija, izobraževanje, komunikacija, zdravstvo

Multimedia Support to Effective Current in Communications between Physicians and Patients

Multimedia is the combination of visual and audio presentations. These presentations could include elements of text, graphic art, sound, animation, and video. Due to multimedia technologies, the medical information has taken an extraordinary growing. We present a multimedia support to overview of respiration system and to introduce in pulmonary function testing. Multimedia support to communication currents was designed and edited by university teachers, pedagogues and image and computer experts. The presentation stands out with progressive access to the topics through internal links. Stand alone CD with multimedia is an interactive useful software program for medical education and virtual overwiev of human respiratory system testing. During the time that the patients spend waiting in front of the laboratory door they will be able to participate in our interactive multimedia support (IMS) and learn about the procedures awaiting them in laboratory. Evaluation analysis considering clinical applicability of presented concept shows much better flow of information from physicians' office till the end of lung function testing procedure.

Key words: multimedia, lung function, education, communication, health care

Odiseja – e-poštni projekt za učenje nemščine kot tujega jezika

Katja Bradač

Avstrijski institut Ljubljana, Trg francoske revolucije 6, 1000 Ljubljana

katja.bradac@interkultur.de

Predmet raziskave pričujočega članka so možnosti, ki jih ponuja internet pri učenju tujih jezikov - konkretno nemščine - na primeru medkulturne igre »Odyssey« ali po slovensko »Odiseja« Ta projekt namreč internet in njegovo interaktivnost izkoristi dvakratno. Prvič kot komunikacijsko sredstvo (e-pošta) ter drugič kot vir informacij (www). V grški mitologiji je bil Odisej sinonim za pustolovska potovanja, za odkrivanje novih dežel in otokov in prav tako gre pri tem e-poštnem projektu za odkrivanje neznanih dežel oz. mest, spoznavanje drugih kultur, običajev in navad sodelujočih pri projektu. Avtor projekta je le tega poimenoval »kooperativna uganka«, saj si učeči se sami sestavljajo naloge, s tem ko pišejo o svoji deželi oz. mestu, kulturi ipd…in s tem ustvarjajo snov za raziskovanje njihovim partnerjem pri projektu. Učeči se morajo pisati zakodirano in informacije o mestih, iz katerih prihajajo, dajati v ravno pravšnji meri, da njihovi partnerji ne ugotovijo takoj, od kod prihajajo. Pri odiseji je potovanje namreč cilj: s pomočjo informacij, ki jih dobijo od partnerjev po elektronski pošti ugotavljajo od kod le ti prihajajo. Ta projekt torej omogoča prav to kar mora današnji komunikativno naravnan pouk poleg jezikovnega znanja nuditi učečim se: pridobivanje medkulturnih kompetenc, kooperativen karakter ter interdisciplinarno znanje.

Ključne besede: učenje nemščine kot tujega jezika, internet, e-pošta, komunikacija, komunikativno naravnan pouk, medkulturne kompetence, kooperativno učenje

Odyssey - An E-Mail Project For Learning German As Foreign Language

This paper outlines the possibility of using the internet to learn foreign languages – in our case German - considering intercultural game Odyssey as example, which makes double use of the internet as an interactive medium. First the internet is used as a mean of communication (e-mail) and second as a source of information (www). In the Greek mythology Odysseus was the synonym of adventurous travelling, of discovering unknown countries and cities. The participants get to know cultures and customs of their partners. The author of the project calls it »a cooperative puzzle«, because the students create tasks on their own, while they are writing about their countries or cities, culture and so an…So they produce learning stuff for their partners. Students have to write in codes, and give right doses of information so they partners do not found out quickly, where they are from. At the Odyssey the name is its mission: with information, which they get from their partners by e-mail they try to find out, where they are coming from. This project gives the students exactly what they had to get from a modern communicative foreign language lessons besides learning language: getting intercultural competencies, cooperative work and interdisciplinary knowledge.

Key words: learning German as a foreign language, internet, e-mail, communication, communicative lessons, intercultural competencies, cooperative learning

Vloga države in trga pri raziskavah in razvoju

Metod Černetič

Univerza v Mariboru, Fakulteta za organizacijske vede, Kidričeva 55a, 4000 Kranj

metod.cernetic@fov.uni-mb.si

Slovenija je v razvojnem pomenu zaspala. V zadnjih desetih letih je bila njena povprečna gospodarska rast 3,9%, medtem ko so Baltske države rasle s približno 5,5% na leto, Slovaška s 4,3, Poljska pa s 4.0%. Res pa je bila njena rast najbolj stabilna in socialno vzdržna, saj je med naštetimi državami edina, ki ima stopnjo brezposelnosti in revščine nižjo od evropskega povprečja. Neverjetno je, da še 15 let po propadu etatističnega sistema pri vsaki težavi najprej pomislimo, kaj bo naredila država, da jo reši. Država naj bi določala prednostne panoge in namesto podjetij in bank razmišljala o tem, v kaj se splača vlagati. Država naj bi namesto prostega trga razsojala, koliko podjetij potrebujemo na kakšnem področju in kdo naj se ukvarja s takšno dejavnostjo. Država naj bi namesto kapitalskega trga razsojala, kateri lastniki so primerni za kakšno podjetje in kdo ga zna upravljati.Vse skupaj spominja na intervencije gasilcev, ki jih ne pokličemo le, ko zares gori, ampak tudi takrat, če je treba polomiti kakšno ključavnico, izčrpati vodo iz kleti ali pa enostavno narediti veselico. V teoretskih in praktičnih razpravah je odprtih nekaj vprašanj:

- neskončne razprave o nacionalnem interesu in družinski srebrnini,
- prevladujoče prepričanje, da je konkurenčno gospodarstvo v nasprotju s pravičnostjo in da temeljni dobiček na izkoriščanju dela, ki edino ustvarja novo vrednost,
- kdo naj ocenjuje uspešnost inovacij.

Skupni imenovalec zgornjih opredelitev je vprašanje, kako si kdo predstavlja vlogo države v gospodarstvu in sociali. Enotnosti pa ni tudi pri opredeljevanju dejavnikov gospodarske rasti in njihovem pomenu (človeški in naravni viri, znanost in tehnologija, inovativnost in menedžment oziroma podjetništvo. Dejstvo pa je, da se v uspešnih podjetjih zavedajo pomena tehnoloških sprememb, ki jih izzivajo vlaganja v znanosti in aplikativne raziskave. Posebej so poudarjene indistrijske raziskave kot vir tehnoloških sprememb in razvoja rasti podjetij.

Ključne besede: inovacije, tehnologija in trg, inovativno okolje

The Role of State and Market in the Reasearch and Development

Slovenia has fall a sleep in research sense. In the last ten years her average economic growth is 3, 9%, while the growth of Baltic States in approximately 5, 5% per year, in Slovakia 4, 3 and in Poland 4.0% per year. Her growth was the most stable and socially endurable, because among all the counted countries it is the only one, whose degree of unemployment and poverty is lower of European average. It is unbelievable that almost 15 years after decline of statism system, the first think that we though about when thing go wrong is what state should do to, to solve the problem. The state should define priority branches and think about where to invest; even instead of firms and banks. State should - instead of free market - judge how many firm we need, in which area and who should handle this activity. The state should – instead of capital market – judge, which owner are suitable for which firm in who will be able to manage it. All together remind to a fire brigade intervention, which we call not only when fire breaks out, but also when we break a lock, need someone to dry out our basement or simply to organise festival. In the theoretical and practical sense there are few questioning opened:

- Endless discussion about national interest and family jewellery;
- Prevailing conviction that competitive economy is in contrast with justice and that profit it based on exploitation of work, which only creates new value;
- Who is to judge the successfulness of innovation;

Common denominator of definition above is the question, how somebody imagine the role of a state in economy and society. There are no common agreement with definition of factors of economical growth and its meaning (human and natural resources, science, technology, innovation and management or enterprise). A fact is that successful firms are aware of meaning of technological changes, which are result of investment in science and applicable research. The special emphasis is on the industrial researches as a source of technological changes and development of business growth.

Key words: innovation, technology and market, innovation environment

Raziskovalci in razvoj - mladi raziskovalci

Metod Černetič [1] , Brina Černetič [2]

(1) Univerza v Mariboru, Fakulteta za organizacijske vede, Kidričeva 55a, 4000 Kranj

(2) Univerza v Ljubljani, Fakulteta za družbene vede, Kardeljeva ploščad 5, 1000 Ljubljana

metod.cernetic@fov.uni-mb.si, brina.cernetic@yahoo.com

Ob stalnih analizah in reorganizacijah slovenske znanosti, se ne izboljšuje niti njena organizacijska struktura, način organiziranosti in deleži raziskovalcev v tako imenovanem vladnem in gospodarskem sektorju. Mnenja so, da je izključna težava slovenske znanosti na področju tehniških ved in da je težava industrijske nekonkurenčnosti izključno in samo pri inženirjih. Pregled podatkov o izdatkih (delež BDP za RR) oziroma vlaganjih v znanost in pa podatki o številu mladih raziskovalcev pa kažejo:

- Lizbonska strategija vsebuje prave cilje, jasne mehanizme, zaškripa pa pri instrumentih in koordinaciji za njihovo uresničevanje.
- Slovenija se mora zgledovati po novih članicah, ki so že uvedle svoje proračunsko podprte cilje Lizbonske strategije.
- V Sloveniji ne uspemo doseči konsenza nosilcev politične moči od nastanka nove države, kakšna naj bo vloga znanosti (predvsem raziskav in razvoja) in kakšna naj bo povezanost univerz in gospodarstva.

Lizbonska strategije (LS) daje odgovor na vprašanje, kako je lahko EU dolgoročno konkurenčna, s tem da ohrani evropski model življenja z ravnotežjem med ekonomskimi, socialnimi in okoljskimi cilji. Prvi pogoj za ohranjanje socialne vzdržnosti in okoljske prijaznosti pa je gospodarska rast.

Ključne besede: Lizbonska strategija, raziskave in razvoj, delež BDP, mladi raziskovalci

Researchers and Development - Young Researches

Although Slovenian science is permanently subject of analysis and reorganization, there are no evident improvements of its organizational structure or the way it is organize and share of researchers in so called governmental and economic sector. There are opinions that the key problems of Slovenian science are in the field of technical sciences; that the cause of industrial non-competitiveness are engineers. The search of data of expenses (share of GDP for R&D) respectively investments in science and based on the data of number of young researchers in Slovenia show:

- Lisbon strategy incorporate right goals, clear mechanisms – the critical points are instruments and coordination for achieving these goals
- As s model Slovenia has to take new members, which already introduce their own, with budget supported goals of Lisbon strategy;
- Ever since the establishment of new country Slovenia we are not able to reach consensus among all the pillars of political power and decide what should the role of science (primarily of R & D) in what should be relation between universities and economy.

Lisbon strategy gives us the answers to the question how EU can be competitive in long term and at the same time preserve European model of life; that means a balance between economical, social and environmental goals. The first condition for maintenance of social sustainability and kindness towards an environment is economical growth.

Key words: Lisbon strategy, research and development, share of GDP, young researchers

Računalnik in otroci s posebnimi potrebami

Metod Čufar [1] , Vesna Basaj-Gorjanc [1] , Franci Rozman [2]

(1) Srednja šola Jesenice, Ulica bratov Rupar 2, 4270 Jesenice

(2) Gimnazija Kranj, Koroška cesta 13, 4000 Kranj

metod.cufar@guest.arnes.si, vesna.basaj@guest.arnes.si, franci.rozman@guest.arnes.si

Informacijska tehnologija izredno hitro postaja tehnologija, brez katere si številnih izobraževalnih, industrijskih in komercialnih procesov ne moremo več zamisliti. Pri tem se pojavljajo novi problemi, ki zmanjšujejo udobje, ugodje in učinkovitost uporabnikov opreme če so uporabniki invalidne osebe. Prispevek obravnava izobraževanje učencev s posebnimi potrebami v računalniških učilnicah. Področje vzgoje in izobraževanja ureja Zakon o usmerjanju otrok s posebnimi potrebami. Kot učitelji nas je zanimalo stanje tovrstne prilagojene opreme v računalniških učilnicah srednjih šol.

Ključne besede: invalidne osebe, učenci, informacijsko komunikacijska tehnologija, ergonomija

Computers for Children with Special Needs

Informational tecnology is becoming very fast and tecnology without which we cannot imagine any educational, industrial or commercial processes. New problems emerge which decrease comfort and efficience or the equipment users when the users are disabled. The article deals with the education of students with special needs in computer classrooms. The field of education is regulated by special law “Zakon o usmerjanju otrok s posebnimi potrebam”. As teachers we were interested in the state of such adjusted equipment in computer classrooms of secondary schools.

Key words: disabled, pupils, information and communication technology, ergonomy

Ali so levičarji v šoli opredeljeni kot otroci s posebnimi potrebami?

Metod Čufar, Sonja Colja-Čerin, Marija Vidic

Srednja šola Jesenice, Ulica bratov Rupar 2, 4270 Jesenice

metod.cufar@guest.arnes.si

Vsi proizvodi, sem spadajo tudi »ergonomski«, imajo gotovo tudi kakšno slabost ali napačno uporabo. Pri tem računalnik ni izjema. Ker so mnenja glede uporabe računalnika pri delu v slovenskem prostoru deljena, skušamo v prispevku prikazati uporabo IKT v smislu zaščite uporabnika. Pri tem nam bo v pomoč področje ergonomija strojne opreme, ki predstavlja sestavni del komunikacije človek – računalnik in jo uporabljajo pri svojem delu tudi levičarji.

Ključne besede: tipkovnica za levičarje, učenci, informacijsko komunikacijska tehnologija, ergonomija

Are Left-Handed Children Classified as Children with Special Needs?

All the products including the "ergonomic" ones, have some weaknesses or are used in a wrong way. The computer is no exception. Since there are different opinions as to the use of computers at work in Slovenia, we are trying to show, in this article, the use of ICT in the sense of protecting the user. As the help, we are using the field of ergonomic on the computer hardware which is a part of the "human-computer" communication and is used in their work by the left-handed people.

Key words: left handed keyboard, pupils, information and communication technology, ergonomy

Analiza izobraževanja na daljavo za osebe s posebnimi potrebami s pomočjo pretočnega videa

Matjaž Debevc

Univerza v Mariboru, Fakulteta za elektrotehniko, računalništvo in informatiko, Smetanova 17, 2000 Maribor

matjaz.debevc@uni-mb.si

Z razvojem hitrih povezav z internetom tudi v gospodinjstvih se vse bolj uveljavlja tudi uporaba pretočnega videa. Pretočni video skupaj s hkratnim posredovanjem elektronskih prosojnic predstavlja medij, ki s svojim dinamičnim slikovnim in zvočnim prikazom nudi izjemno možnost izobraževanja na daljavo. Pri tem se postavlja vprašanje, kakšne so osnovne zahteve za posredovanje pretočnega videa za osebe s posebnimi potrebami, kot so gluhi in naglušni ter slepi in slabovidni. Zanje so namreč značilne posebne zahteve, ki jih je potrebno upoštevati pri razvoju dinamičnih spletnih aplikacij. Članek tako predstavlja v prvem delu študijo zahtev gluhih in naglušnih ter slepih in slabovidnih za potrebe razvoja spletnih video podprtih predavanj. V drugem delu predstavlja članek možne izvedbe za pripravo, izdelavo in posredovanje video podprtih aplikacij s pomočjo podnapisov, izgovorjenih podnapisov, zvočnega opisa ter s pomočjo znakovnega jezika, kar je v skladu tudi s predlaganimi evropskimi standardi.

Ključne besede: gluhi in naglušni, slepi in slabovidni, izobraževanje na daljavo, e-izobraževanje, informacijske in komunikacijske tehnologije, pretočni video, internet

Analysis Of Distance Education For People With Special Needs Using Streaming Video

Development of high speed internet connections has increased the use of streaming video. Streaming video in simultaneous combination with presentation slides presents a medium, which offers outstanding chance for distance education with its dynamic image and audio presentation. The area rises questions about basic requirements for using streaming video for people with special needs, such as hearing and seeing disabled people. This group of people requires special adjustments, which need to be considered when developing interactive web applications. In its first part, the article presents the analysis of needs of hearing and seeing disabled people for video supported lectures on internet. Second part of the article presents possible realizations of preparation, construction and distribution of video supported applications using subtitles, pronounced subtitles, sonic description and with help of sign language, which is in accordance with suggested European standards.

Key words: deaf and hard of hearing people, blind and hard of seeing people, distance learning, e-learning, information and communication technology, streaming video, internet

Informacijska tehnologija v dijaških domovih

Olga Dečman Dobrnjič [1] , Metod Černetič [2]

(1) Dijaški dom Ivana Cankarja, Poljanska 26,1000 Ljubljana

(2) Univerza v Mariboru, Fakulteta za organizacijske vede, Kidričeva 55a, 4000 Kranj

olga.decman@email.si, metod.cernetic@fov.uni-mb.si

Možnosti, ki jih prinaša informacijska tehnologija, vplivajo na spremembe modelov učenja in poučevanja. Izobraževalni proces postaja informacijsko – komunikacijski proces, multimedijski komunikacijski sistemi pa omogočajo vsestransko uporabo novih tehnologij, ki postavljajo izziv za vpeljavo novih oblik in metod v procesu učenja in poučevanja. V spodnjem tekstu bomo govorili o informacijskih sistemih kot o sestavnemu delu organizacijskih procesov, o opremljenosti dijaških domov kot javnih zavodov z informacijsko tehnologijo ter o vpetosti informacijske tehnologije v organizacijske sisteme dijaških domov. S pomočjo raziskave smo dobili podatke, koliko je v dijaških domovih računalnikov, koliko in kakšne možnosti uporabe računalnikov in interneta imajo vzgojitelji in dijaki, kateri organizacijski sistemi so vodeni s pomočjo računalniških programov, kakšno je stališče ravnateljev do informacijske tehnologije, kako ravnatelji ocenjujejo svoje znanje s področja računalništva ter kakšne prednosti vidijo z vpeljavo informacijske tehnologije v šolskem sistem.

Ključne besede: informacijska tehnologija, informacijski sistem, računalnik, računalniški program, internet

Information Technology In Boarding Schools

Educational process is becoming a process of information and communication, however multimedia systems of communication enable general application of new technologies which set up a challenge for the preparing of new methods in forming learning and teaching processes. In the text below we are going to talk about information systems as component part of organizational processes, about information technology equipment in boarding schools as public institutions and about the presence of information technology in boarding school organizational systems. By the help of research we got statistical data about the number of computers in boarding schools, how many and what chances of use of computers and internet educators and students have, which organizational systems are guided by the help of computer programmes and what is the principals' view on information technology. We also got the answers to how principals value their knowledge in computer science and what advantages bring information technology in the school system.

Key words: information technology, information system, computer, computer programme, internet

Izobraževalni vidiki uporabe internetnih tehnologij v podjetjih

Urška France [1] , Tanja Urbančič [2,3]

(1) Varda 8, 5000 Nova Gorica

(2) Politehnika Nova Gorica, Vipavska 13, Rožna dolina, 5000 Nova Gorica

(3) Institut Jožef Stefan, Jamova 39, 1000 Ljubljana

tanja.urbancic@p-ng.si

Podjetja se vse bolj zavedajo prednosti internetnih tehnologij, s katerimi je možno učinkovito povezati kupce, dobavitelje, poslovne partnerje in zaposlene. Možnosti e-izobraževanja v tem procesu so veliko večje, kot kaže trenutna praksa. Interes za e-izobraževanje sicer narašča hkrati z uveljavljanjem pomena vseživljenjskega izobraževanja tako za posameznike kot za podjetja. Še vedno pa je med preprekami za njegovo širšo uveljavitev na prvem mestu pomanjkljivo poznavanje, zato je potrebno njegovo širjenje podpreti v kombinaciji s tradicionalnimi oblikami izobraževanja, predvsem pa s konkretnejšo predstavitvijo prednosti in posameznih uspešnih primerov potencialnim uporabnikom. Le tako bo podjetjem omogočena lažja presoja potencialnih koristi e-izobraževanja in njegovega vpliva na poslovanje podjetja. Le-ta se lahko močno poveča, če v izobraževanje niso vključeni le zaposleni, pač pa tudi poslovni partnerji in stranke.

Ključne besede: vseživljenjsko učenje, e-izobraževanje, učenje na daljavo, izobraževanje za zaposlene, elektronsko poslovanje, internet

Educational Aspects of Using Internet Technologies in Business Environment

In enterprises, information and communication technologies enable efficient networking and knowledge transfer between employees, customers and business partners. E-leearning has big, yet not sufficiently exploited potential in this process. Increased importance of life-long learning for individuals as well as for organizations increases also the importance of e-learning which provides a form of learning that can be very efficient. Still, its spreading in enterprises is limited due to their insufficient acquaintance with the possible benefits it could bring from the business point of view. Presentation of successful case studies and combination with traditional learning forms are suggested to bridge this problem.

Key words: life long learning, e-learning, distance learning, learning at workplace, e-business, internet

Uporaba informacijske in komunikacijske tehnologije v slovenskih šolah

Ivan Gerlič

Univerza v Mariboru, Pedagoška fakulteta Maribor, Koroška 160, 2000 Maribor

ivan.gerlic@uni-mb.si

Prispevek prikazuje rezultate raziskovalnega projekta »Didaktični vidiki uporabe informacijske in komunikacijske tehnologije (IKT) - poučevanje in učenje«, ki je v globalu zajemal analizo, oblikovanje in definiranje didaktičnih vidikov uporabe sodobne informacijske in komunikacijske tehnologije v slovenskem izobraževalnem sistemu ter analizo, oblikovanje in definiranje didaktičnih oblik, metod, pristopov, modelov poučevanja in učenja ob IKT ter njihova uporabna vrednost in usklajenost s cilji sodobnih izobraževalnih sistemov.

Ključne besede: informacijska družba, izobraževalni system, računalnik v izobraževanju, informacijsko - komunikacijska tehnologija (IKT), računalniška - informacijska pismenost, usposobljeni kadri

Appliance of Information and Communication Technology in Slovenian Schools

Research project “Didactical aspects of appliance of Information and Communication Technology (ICT) - learning and training” has covered the following topics: analysis of ICT, design and definition of didactical aspects of ICT in Slovenian learning system, design and definition of didactical forms, methods, approaches, models of ICT in education and training, their practical value, and compatibility with contemporary educational systems goals.

Key words: information society, educational system, computer in education, information and communication technology (ICT), computer - infomatic literacy, qualification staff

Študij zdravstvene nege na daljavo

Vida Gönc [1] , Vladislav Rajkovič [2] , Olga Šušteršič [3]

(1) Univerza v Mariboru, Visoka zdravstvena šola, Žitna 15, 2000 Maribor

(2) Univerza v Mariboru, Fakulteta za organizacijske vede; Kidričeva 55a, 4000 Kranj

(3) Univerza v Ljubljani, Visoka šola za zdravstvo, Poljanska 26a, 1000 Ljubljana

vida.goenc@uni-mb.si, vladislav.rajkovic@fov.uni-mb.si, olga.sustersic@vsz.uni-lj.si

Izobraževanje na daljavo v zdravstveni negi lahko kot alternativa tradicionalnemu izobraževanju ponudi ustrezne rešitve za časovne, ekonomske in prostorske izzive v izobraževalnem okolju. Izobraževanje na daljavo je posebna oblika izobraževanja, ki je z razvojem informacijske in komunikacijske tehnologije postalo pomemben del družbenih dejavnosti, ter predstavlja eno najhitreje razvijajočih se področij v okviru izobraževanja. Pri tem je zelo pomembna kakovost učnih gradiv in njihova distribucija. V prispevku je predstavljen model študija na daljavo, ki skuša vpeljati nov pristop v izobraževanje medicinskih sester, saj zapolnjuje vrzel med teorijo in klinično prakso ter vključuje več učil, kot so avdiovizualni posnetki, študije primera, naloge za ponavljanje in itd.

Ključne besede: študij na daljavo, izobraževanje na daljavo, zdravstvena nega, informacijska in komunikacijska tehnologija

Education In Nursing Care

As an alternative to traditional education distance learning in nursing care can give solutiones for different challenges in educational environment. Distance learning is a special type of education. With the development of informational and communicational tehnology it became an important part of social activities and it is also one of the fastest evolving areas in education. The quality of learning materials and their distribution are important factors in the proces of distance learning. Here I present a model of distance learning, a new approach in education of nursing staff that is overcomming the distance between theory and clinical praxis by including teaching aids as audiovisual recordings, case studies, exercises to repeat ect.

Key words: distance study, distance education, nursing care, information and communication technology

Izbor zaposlenih za študij ob delu

Cvetka Gregorc

Zavod RS za transfuzijsko medicino, Šlajmerjeva 6, 1000 Ljubljana

cvetka.gregorc@ztm.si

V prispevku je prikazan odločitveni model za izbor zaposlenih za študij ob delu. S pomočjo programa za večparametrsko odločanje DEXi je oblikovano drevo kriterijev, ki temelji na določilih internega pravilnika o izobraževanju in usposabljanju v organizaciji. Model omogoča sistematično vrednotenje načrtovanih izobraževanj in nepristranski izbor zaposlenih oz. izobraževalnih programov, ki ustrezajo potrebam organizacije.

Ključne besede: zaposleni, študij ob delu, kriteriji, večparametrsko odločanje, izbor

Selection of Employess for Part–Time Study

The aticle presents a decision support model for the selection of employess for part-time study. The structure of the multi-attribute model was developed by an expert system shell DEXi, specialised in multi–attribute decision making. The attributes are based on principles contained in internal regulations about education and training in the organization. The model makes possible a systematic evaluation for planning education and a neutral selection of employess and educational programmes, which suit the needs of the organization.

Key words: employess, part-time study, criteria, multi–attribute decision making, selection

E-izobraževanje na Zavodu RS za šolstvo

Janko Harej [1] , Alenka Žibert [2]

(1) TŠC Nova Gorica, ZRSŠ,Cankarjeva 10, 5000 Nova Gorica

(2) Zavod RS za šolstvo, Poljanska 28, 1000 Ljubljana

janko.harej@guest.arnes.si, alenka.zibert@zrss.si

Prednosti e-izobraževanja so številne, zato je uvajanje le-tega na Zavodu RS za šolstvo več kot smiselno. Članek opisuje različne vidike uvajanja e-izobraževanja na ZRSŠ, ki se delijo na tehnični vidik, andragoško didaktični vidik, organizacijski vidik in vidik evalvacije kakovosti e-gradiv.

Ključne besede: internet, upravljanje vsebin, gradiva, e-izobraževanje, evalvacija spletnih učilnic

E-Learning on National Institute of RS for Education

The main weaknes of internet is lack of content. Content management is also one of most important actions when thinking about e-learning and organizational web presentation. Article describes features of Content Management Systems (CMS). Main functions are support for content creation, management, distribution an content publishing.

Key words: internet, content management systems, e-learning, e-content, evaluation of virtual learning systems

Izbira pomočnika ravnatelja

Sabina Hrovatin

Srednja upravno administrativna šola, Poljanska 24, 1000 Ljubljana

sabina.hrovatin@siol.net

S pomočjo lupine DEXi je bil izdelan odločitven model za izbiro pomočnika ravnatelja. Lahko služi za izbiro pomočnika na srednji ali osnovni šoli, kot pomoč ravnatelju pri izbiri ustreznega kandidata. Od leta 2001 ga lahko izbere ravnatelj sam in ob tem ne potrebuje soglasja učiteljskega zbora. 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.

Ključne besede: ravnatelj, pomočnik ravnatelja, DEXi, večparameterski odločitveni model, odločanje

Choice of Headmaster's Assistant

To choose headmaster's assistant we developed a decision model, by the help of expert system shell DEX-i..
DEX-i expert system shell was used for developing a decision model for process of selection of the headmaster's assistant. It serves as a decision support for headmasters on primary or secondary school level. Since 2001 headmaster may appoint its own assistant without an accordance of school teaching staff. Carefully developed decision model may opt for optimal choice. It may be adjusted to headmaster's or school's individual needs.

Key words: headmaster, headmaster's assistant, DEX-i, multi-attribute decision model, decision support

Elektronsko gradivo za učenje kotnih funkcij

Suzana Javšnik [1] , Sonja Krajnc Gubenšek [2] , Eva Jereb [3]

(1) Trubarjeva 53b, 3000 Celje

(2) Srednja strokovna in poklicna šola Celje, Ljubljanska cesta 17, 3000 Celje

(3) Univerza v Mariboru, Fakulteta za organizacijske vede, Kidričeva cesta 55a, 4000 Kranj

suzana.javsnik@volja.net, sonjakg@email.si, eva.jereb@fov.uni-mb.si

Sodobna šola je glede ekonomičnosti poučevanja in zaradi povečanja motivacije učencev vse bolj prisiljena vključevati v pouk moderne posredovalce žive besede in slike. Hkrati moderne tehnologije omogočajo v večji meri uresničevanje osnovnih učnih načel pri pouku, predvsem nazornosti, sistematičnosti, sodobnosti in individualizacijo. Z vedno večjo vlogo četrtega dejavnika pouka – materialno osnovo, se je spremenil način poučevanja. Kljub vsemu pa je učitelj še vedno nenadomestljiv del izobraževalnega procesa. Med materialne osnove sodijo tudi elektronska učila, ki učitelju delo olajšajo in pripomorejo k boljši realizaciji učnih ciljev. Elektronsko gradivo za učenje kotnih funkcij je učilo, ki s pomočjo računalnika posreduje razlago kotnih funkcij za predmet matematike v srednji šoli. Izdelan je na podlagi spoznanj didaktike predmeta in izdelave modernega učila. Narejena je tudi kritična analiza in analiza uporabe gradiva z učenci.

Ključne besede: elektronsko gradivo, didaktika matematike, računalniška učila, kotne funkcije

Electronic Material For Learning Trigonometry

The school has to implement modern aids in teaching process to become economic and achieves better motivation of pupils. Technology especially design for teaching purposes also helps to realize basic teaching principles such as clearness, systematic, individuality and contemporaneity. The fourth factor of teaching process – material basis is becoming more and more important and it changed the way of teaching. However, the teachers remain the irreplaceable and the most important factor. The electronic materials are a logical outcome of technological advances and are made to help teachers to achieve teaching purpose. Electronic material for teaching trigonometry is a computer-based aid that includes explanation and illustration of trigonometry for mathematics in secondary school. We also did the SWOT (strengths, weaknesses, opportunities, troubles) analysis and analysis of using the material by pupils.

Key words: electronic material, didactics, computer teaching aids, trigonometry

Izobraževanje za solastništvo in rast podjetja

Alojz Klaneček

Primit d.o.o., Dunajska 156, 1000 Ljubljana

primit@siol.net

Prispevek prikazuje vpliv solastništva zaposlenih na rast podjetja in v povezavi s tem odnos zaposlenih do dela v podjetju Primit d.o.o. Med zaposlenimi smo izvedli polstrukturirani intervju, študijo primera. Namen in cilj raziskave je bil spoznati in poiskati teoretične in praktične elemente, ki opredeljujejo rast podjetja, ter v okviru ugotovitev podati priporočila za prakso. Raziskavo med zaposlenimi smo izvedli s pomočjo intervjujev, raziskovalno vprašanje se je glasilo: »Kakšen odnos do dela bi imeli, če bi bili solastniki podjetja?« Z analizo odgovorov smo oblikovali kategorije pomembnih elementov, ki vplivajo na zaposlene in razvoj podjetja. Ključne ugotovitve raziskave so, da je pomen solastništva v podjetju zelo velik in da le-to prinaša veliko motiviranost zaposlenih in pripravljenost za boljše delo in da so solastniki zelo pripadni podjetju. Pomemben jim je tudi dobiček podjetja in pa dejstvo, da solastništvo pomeni na nek način razbitje monopola vodenja peščice ljudi v podjetju.

Ključne besede: rast podjetja, izobraževanje, zaposleni, lastniki, Primit d.o.o.

Training for Employees Ownership and Company Growth

The purpose of research, qualitative study of the case, in company Primit d. o. o. was to get known with deeper understanding of employees about influence of shared ownership to growth of company and in connection with it importance of shared ownership to their relations to work.The goal of researching study is to find theoretical basis for determination of growth of company and reasons for its growth as well as to find main categories of reasons for growth of the company that are giving recommendations for practical work according to statements of research.Theoretical starting points for growth of companies that are making possible comparison with categories got by analysis of interviews are determined in this study.Following researching question was set: “What would be your attitude to work, if you are co-owner of the company?” This question was basis for half-structured interviews with three persons.Analysis of the answers was main source for making categories that helped answering researching question. Main statements are that the importance of co-ownership in company is really big and brings motivation of employees as well as make them ready for better working; co-owners are feeling strong personal connection with the company. They put a lot of importance to the profit of the company as well as co-ownership means a kind of breaking monopolism of few leading people in the company.

Key words: growth of company, training, employees, ownership, Primit d.o.o.

Vloga univerz kot ustvarjalk znanja v družbi znanja

Miran Kovač

Politehnika Nova Gorica, Vipavska 13, Rožna dolina, 5000 Nova Gorica

miran.kovac@p-ng.si

V prihajajoči družbi znanja postaja znanje ključni faktor v proizvodnji in distribuciji dobrin in storitev ter v organiziranosti družbe. Širitev znanja po svetu, omogočena z informacijsko-komunikacijskimi tehnologijami (ICT-ji) in uporaba tega znanja bosta imeli vpliv na družbo kot celoto in na vse inštitucije v družbi, vključno z univerzami kot tradicionalno najpomembnejšimi ustvarjalkami znanja. Članek predstavlja nekatera splošna dejstva o družbi znanja, govori o karakteristikah znanja samega in o njegovem merjenju, o spremembah v proizvodnji oz. ustvarjanju znanja in zaključuje s predlogi o vlogah, ki naj jih privzamejo univerze kot proizvajalke znanja, da bi preživele in se uspešno razvijale v prihajajoči družbi znanja.

Kjučne besede: družba znanja, znanje, ustvarjanje znanja, univerza

Role Of Universities As Knowledge Producers In The Knowledge Society

In the coming knowledge society, knowledge is becoming a primary resource in production and distribution of goods and services and in the organization of society.
The spreading of knowledge around the world, enabled by information-communication technologies (ICTs) and utilization of that knowlede will impact the society as a whole and all its institutions – including universities as the – traditionally – main knowledge producers. The article presents some general facts about knowledge society, talks about characteristics of knowledge itself and its measurement, about the changes in the knowledge production and, finally, concludes by suggesting the roles which universities should play as knowledge producers in order to survive and prosper in the coming knowledge society.

Key words: knowledge society, knowledge, knowledge production, university

Računalniško podprto preverjanje in ocenjevanje znanja

Alenka Krapež [1] , Vladislav Rajkovič [2]

(1) Gimnazija Vič, Tržaška cesta 72, 1000 Ljubljana

(2) Univerza v Mariboru, Fakulteta za organizacijske vede, Kidričeva cesta 55a, 4000 Kranj

alenka.krapez@guest.arnes.si, vladislav.rajkovic@fov.uni-mb.si

V prispevku je izpostavljen pomen celostnega načrtovanja učnega procesa. Poudarek je na fazi preverjanja znanja, ko je ključnega pomena izbira ustreznih, merljivih kriterijev, ki omogočajo objektivno in razumljivo izvajanje preverjanja in ocenjevanja znanja. Predstavljen je tudi pomen razumevanja učnih ciljev za načrtovanje uspešnega učenega procesa. Opisano je, kako izbirati operativne cilje in kako kriterije za ugotavljanje stopnje doseganja operativnih ciljev ter katerim pogojem naj kriteriji ustrezajo, da bodo res pripomogli k uspešno izpeljanem učnem procesu. Predstavljen je tudi primer iz učne prakse: od določitve operativnih ciljev do modela za preverjanje in ocenjevanje seminarske naloge. Model je podprt z računalniškim programom za večparametrsko odločanje. Predstavljene so tudi izkušnje pri uporabi tega modela.

Ključne besede: načrtovanje učno-vzgojnega procesa, cilji učno-vzgojnega procesa, preverjanje znanja, ocenjevanje znanja, kriteriji za preverjanje znanja, merila za preverjanje znanja, model za preverjanje in ocenjevanje znanja

Computer Supported Examination and Assessment of Knowledge

The article presents holistic planning of learning process. It stresses the importance of knowledge examination, specially the importance of criteria and standards that enable an objective and understandable examination and assessment of knowledge. Further on the article presents the importance comprehension of educational purposes in order to plan a successful educational process. It describes how to choose operative aims and how to choose the criteria to establish the level of achieved operative aims and the conditions that the criteria should correspond to, so that they really make a contribution to a successful educational process. Case study is also presented. Operative aims and the computer model for student's project work evaluation are described.

Key words: planning of educational process, operative goals, knowledge evaluation and assessment, criteria and measures, knowledge evaluation and assessment model

Motivacijska sredstva pri pouku matematike na svetovnem spletu

Špela Kunčič

OŠ Prežihovega Voranca, Ljubljana

spela.kuncic1@guest.arnes.si

V prispevku uveljavljenim in dobro poznanim motivacijskim spodbudam dodajam nova motivacijska sredstva in predstavljam spletno strani 123matematika, ki je namenjena učiteljem, študentom, vzgojiteljem in staršem, ki želijo utrditi lastno zanimanje ali spodbuditi zanimanje otrok za matematiko. Na strani so dostopna številna motivacijska sredstva, ki jih lahko učitelji uporabljajo pri načrtovanju pouka in preverjanju znanja, učenci pa pri utrjevanju in ponavljanju snovi, v okviru učne enote Aritmetika in algebra, od 1. do 5. razreda 9-letne osnovne šole. Uporabniki lahko brezplačno dostopajo do številnih zanimivih učnih listov, zabavnih matematičnih nalog, matematičnih problemov in računalniških programov. Na strani je predstavljena mapa učenčevih izdelkov in učiteljeva mapa ter domače in tuje spletne strani. Dodane so tudi številne spletne povezave in opisi matematičnih zgoščenk. Z raziskavo sem želela preveriti, ali predstavljena motivacijska sredstva izboljšujejo učno motivacijo, ali ima spletna stran motivacijski vpliv in ali bodo anketiranci stran uporabljali tudi v prihodnje. Zanimale so me povratne informacije obiskovalcev in uporabnikov ter odziv javnosti. Ugotovila sem, da večina anketirancev meni, da uporabljena motivacijska sredstva izboljšajo motivacijo za učenje, da jih stran spodbuja k samostojnemu iskanju različnih motivacijskih sredstev, da je odziv javnosti zelo velik ter da se bo večina anketirancev na stran še vrnila in jo uporabljala.

Ključne besede: motivacija, matematika, motivacijska sredstva, spletna stran 123matematika

Motivational Resources for Effective Teaching/Learnin Process on the Internet

The paper presents some new motivational materials that can be used in mathematics classes in grades one to five as a supplement to the already established and well known ones. They have been collected and presented on the 123mathematics website, where numerous interesting worksheets, amusing tasks, mathematical problems and computer programmes are assembled. The homepage also includes pupil's and teacher's portfolios along with links to other Slovenian and foreign websites on the same subject. A large number of links to other websites are added as well as descriptions of relevant CD-ROMs. A survey has been carried out to establish to what extent motivation is increased by using the presented motivational materials and to find out if the people questioned will use the website in the future as I was interested in the guests' and users' feedback and the response of the public. The obtained results have been compared to the findings based on my own experiences and theoretical predictions. The web counter and the web questionnaire have been used for collecting data. I have established that most interviewed people believe that used motivational materials improve learning motivation, that the website stimulates them to search for additional diverse motivational tools themselves and that they are certain they will continue to use my website.

Key words: motivation, mathematics, motivational materials, 123mathematics website

Model ocenjevanja nadarjenosti učencev

Barbara Maček

MAOP KOMPAS INGPOS računalniški inženiring d.o.o., Moškričeva 39, 1000 Ljubljana

barbara.macek@maop.si

V prispevku je s pomočjo programa DEXi za večparametrsko odločanje razvit večkriterijski odločitveni model za identificiranje in ocenjevanje stopnje nadarjenosti učencev. Obravnava vse bistvene elemente koncepta nadarjenosti in ekspertnih sistemov, ki so tudi vključeni v prakso. Pri gradnji hierarhičnega modela za ocenjevanje nadarjenosti učencev sem si pomagala s kriteriji, ki so podani v ocenjevalni lestvici. S programom DEXi za večparametrsko hierarhično modeliranje je sestavljen model ocenjevanja nadarjenosti učencev, ki pomaga pri ocenjevanju učencev ter nudi možnost takojšnjega vpogleda v področje, za katero je določen učenec bolj nadarjen od drugega. Med nadarjenimi učenci lahko tudi ugotovimo, pri katerih kriterijih (vedenjih) posamezniki izstopajo in pri katerih kriterijih ostajajo v senci. Ugotovljeno je bilo, da ekspertni sistemi poleg svojega prvotnega namena kot pomoč pri ocenjevanju prispevajo veliko k celovitemu, globalnemu, predvsem pa jasnejšemu pregledu problema.

Ključne besede: večparametrsko odločanje, nadarjenost, ocenjevanje, DEXi

Model of Evaluating Students' Talent

The main goal in the article was to use DEXi programme in order to develope criteria for multi-parameter assessment model of identification and evaluation. The aim was to measure the development of pupils' talents. It considered all essentual elements in the theory of talent and expert systems and included them in practical work. I also used the criteria in the evaluation scale which are defined and build the hierarchical model of multiparameter assessment. The DEXi programme is used to make the evaluation of the pupils' gifts noted and checked and this programme also helped me with grading and following the students' progress in different areas as well. It also enables me to find out which students come out because of their knowledge and their behaviour and which ones do not. It was also found out that 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: multi-parameter assessment, talents, grading, DEXi

Kakšni so stroški nezaželene e-pošte in kdo jih plačuje

Marko Molan [1] , Lina Dečman [2]

(1) ORIA Computers d.o.o., Pod hribom 55, 1000 Ljubljana

(2) Iskraemeco, d.d., Savska loka 4, 4000 Kranj

marko.molan@oria.si, lina.decman@siol.net

Dandanes se vse pogosteje srečujemo z nezaželeno pošto in s stroški, ki jih le ta povzroča. Celotni stroški nezaželene pošte naraščajo iz dneva v dan, medtem ko so stroški za pošiljatelje nezažele pošte praktično vedno isti in niso odvisni od količine poslanih sporočil. Ravno zaradi tega število nezaželene pošte še vedno skokovito narašča, saj je za pošiljatelja relativno poceni. Namen tega članka je predstaviti stroške nezaželene pošte z mikroekonomskega vidika. Ravno tako bomo zavzeli kritičen pogled na boj proti nezaželeni pošti, saj le ta v velikih primerih naredi tudi več škode kot koristi.

Ključne besede: nezaželena pošta, anti-spam, stroški, potrošniki, internet, email

Who is Paying the Costs of Spam

Nowadays we are facing with spam and costs related to it. Total costs of spam are growing while costs for spammer are practically the same, and are not dependent on quantity of sent messages. Because of that the spam is growing more and more, because it is relatively cheap for spammer. Goal of this article is to represent costs of spam from microeconomic view, and its effects. We also take a critical look on anti-spam fight, because in some ways it can do more harm than good.

Key words: spam, anti-spam, spammer, cost, customers, internet, email

Model napovedovanja potencialne uspešnosti 8-letnih nogometašev

Robert Murko

Slatina 62, 2282 Cirkulane

robert.murko2@guest.arnes.si

Da bi omogočili kvalitetnejše delo z mladimi nogometaši, moramo povečati sistematičnost dela. Računalniško podprt model izbire nogometašev omogoča , da lahko na podlagi izmerjenih osnovnih in specialnih motoričnih sposobnostih napovedujemo, kateri mladi športniki imajo potencialno večjo verjetnost, da uspejo v nogometu. Pripravljeni model omogoča povezavo rezultatov iz TALENTA s specialnimi (nogometnimi) motoričnimi sposobnostmi. Kriteriji so določeni na podlagi večletnih izkušenj pri delu z mladimi nogometaši v klubu in v šoli. Odločitveni model je izdelan v DEXi-ju in omogoča pregleden grafični prikaz za izbiro nogometašev. S pomočjo analize tipa KAJ-ČE lahko odkrivamo talente tudi med povprečnimi.

Ključne besede: nogomet, nogometaš, reprezentanca U-8, DEX, večparametrski odločitveni model, kaj-če analiza

A Model of Prognosticating Potencial Effectivnes of 8-Year Old Football Players

To enable more qualitative work among young football players we have to increase systematic work. A computer based model for selecting football players enables us to prognosticate which young sportsman has a bigger potential likelihood for achieving good football results based on basic and specific mobile abilities. This prepared model enables us to connect TALENT results with special mobile abilities (in football). The criteria are defined on the basis of several years' experiences in working with young football players in a club or in school. The decision model is made in DEX which enables a clear graphic representation for selecting the football players. A What-if analysis is also made possible to help uncover talents among average football players.

Key words: football, football player, representation U-8, DEX, multi-criteria decision making model, what-if analysis

Uporaba sistema DEXi za pomoč ravnateljem pri izbiri najprimernejšega učitelja za določeno delovno mesto

Tomaž Murn

Osnovna šola Vižmarje Brod, Na Gaju 2, 1000 Ljubljana

tomaz.murn@guest.arnes.si

V prispevku je predstavljena uporaba sistema DEXi kot pomoč ravnateljem pri izbiri najprimernejšega učitelja za določeno delovno mesto. S tem je omogočena večkriterijska ocena in transparentna razlaga odločitve. Taka razlaga je učinkovita povratna informacija in s tem vzpodbuda 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.

Ključne besede: ravnatelj, učitelj, DEXi, večparametrski odločitveni model, odločanje

The Use of System DEXi to Help Headmasters at Selection the Most Suitable Teacher For Certain Workplace

This contribution introduces the use of the system DEXi as headmasters' aid at choosing the most suitable teacher for a certain workplace. 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.

Key words: headmaster, teacher, DEXi, multiparameter decision model, decision support

Hrvaški pesimizem – razvojni scenariji optimistične šole

Marko Mušanović, Sofija Vrcelj

University of Rijeka, Faculty of Philosophy Rijeka, Omladinska 14, 51000 Rijeka, Croatia

marko.musanovic@ri.hinet.hr, sofija.vrcelj@ri.hinet.hr

Prispevek prikazuje rezultate empiričnih raziskav, ki obravnavajo prihodnost šole. V raziskavi je uporabljena kvalitativno-interpretativna metodološka paradigma, saj narava raziskovanega problema zahteva specifične raziskovalne metode in tehnike. Uporabili smo: deskriptivno metodo, tehniko "razvoja scenarijev" in tehniko analize tekstov. Orodje za pridobitev podatkov je bilo v obliki eseja, ki so ga pisali udeleženci raziskave (devetdeset prihodnjih učiteljev, zdaj študentov tretjega letnika), katerega tema je bil scenarij šole prihodnosti. Rezultati kažejo, da z eseji dobljeni scenariji razvoja šole variirajo od optimistično-tehnološko-humanističnih do pesimističnih variant. Optimistični študentje vidijo razvoj šole v novih izobraževalnih ciljih, spodbujanju osebnosti dijakov, njihovega zadovoljstva; sama predavanja pa bodo nadomestile igre, ki bodo komponente kreativnega dela. Udeleženci raziskave vidijo kot glavno temo/nalogo šole prihodnosti socialni odnos med dijaki ter dijaki in učitelji. Odnosi med dijaki in učitelji bodo v prihodnosti osnovani na spoštovanju, kljub starostnim razlikam, razlikam v znanju in družbenem statusu, ob upoštevanju in razumevanju osebnosti. Računalniki bodo učiteljem v pomoč in jim tako omogočili več časa za neposredno delo in sodelovanje z dijaki in ostalimi učitelji – tako lokalno kot globalno. Pesimistični scenarij razvoja šole vidi učitelje kot "vsiljevalce" tehnologije, saj bo prav tehnologija v veliki meri ogrozila človeško komponentno poučevanja ter neposredno interakcijo med udeleženci izobraževalnega procesa. Hitrost razvoja tehnologije lahko privede do poučevanja dijakov v učilnicah virtualne realnosti. Strah, izražen v pesimističnih pogledih, se nanaša na dehumanizacijske učinke tehnologije in na nižjo socialno interakcijo, zdravje, socializacijske procese in življenje brez ljubezni in prijateljstva.

Ključne besede: razvoj šole, scenarij, optimizem, pesimizem, izobraževanje

Croatian Pessimistic – Optimistic School Development Scenarios

This paper reveals results of an empirical research concerning the future of school. The research employs qualitative-interpretative methodological paradigm. Nature of the problem researched calls for specific research methods and techniques. Therefore, a descriptive method, scenario development technique and text analysis technique were used. The instrument used for collecting data was in the form of an essay, written by research participants (ninety future teachers, now 3rd year students) containing a scenario of the school of the future describing new features of the future schools. The results show that various school development scenarios range from optimistically-technologically-humanistic to pessimistic. Optimistic students consider school development in the humanization of student-teacher relationship and creative work. The school of the future will feature new education goals, encouragement of student personality, student satisfaction, and, instead of lecturing, game will dominate as component of creative work. Research participants consider social relationships between students and between student and teacher as major questions in the future school. Relationship between student and teacher will, in the future, be more based on respect (in spite the difference in age, knowledge and social standing), consideration and understanding. A computer will aid the teacher and give him more time for direct work and collaboration with students and other teachers (locally and globally). Pessimistic scenario of school development envisions the teacher as 'enforcer' of technology, because the technology will considerably endanger the human component of teaching, the direct interaction between participants of educational process. The speed of technology development could result in students wearing cybernetic interfaces in virtual reality classrooms. The fear expressed in pessimistic views relates to dehumanizing affect of

technology to social interactions, health, socialization processes and to defining life as a place with lack of love and friendship.

Key words: school development, scenario, optimistic, pessimistic, education

Adaptivno učno okolje na osnovi spremljanja pogleda in koncept oblikovanja ucnih gradiv

Maja Pivec, Juergen Pripfl, Christian Trummer

Department of Information Design, Alte Poststrasse 152, 8020 Graz, Austria
University of Applied Sciences FH JOANNEUM, Graz, Austria

maja.pivec@fh-joanneum.at

Eye-Tracking Adaptable e-Learning and Content Authoring Support

In this paper we describe our ongoing research project called AdeLE, a framework for adaptive e-learning utilising both eye tracking and content tracking technology. Possible areas of application are described, such as using the information about the position of the eye for providing additional context specific information to the learner. We report more in detail about current research challenges where we observe users' learning behaviour in real time by monitoring characteristics such as objects and areas of interest, time spent on objects, frequency of visits, and sequences in which content is consumed. This research is focused on analysing eye-movement patterns during learning and linking these patterns with cognitive processes. The concept of the appropriate authoring tool is outlined as one of the challenges for the future work.

Key words: adaptive e-learning, real time eye tracking, learning research, cognition, authoring

Algoritmi strojnega učenja pri ocenjevanju znanja učencev

Alenka Praprotnik, Irena Nančovska Šerbec, Jože Rugelj

Univerza v Ljubljani, Pedagoška fakulteta, Kardeljeva ploščad 16, 1000 Ljubljana

alenka.praprotnik@pef.uni-lj.si, irena.nancovska@guest.arnes.si, joze.rugelj@uni-lj.si

V prispevku je predstavljena možnost uporabe različnih algoritmov strojnega učenja za modeliranje znanja učencev, ki ga pridobijo ob predstavitvi določenega tematskega sklopa s strani učitelja. Predstavljamo možnost uporabe:

- Algoritmov za razvrščanje (ang. clustering) učencev v skupine uspešnosti za modeliranje skupin učencev s podobnim znanjem o predstavljenem sklopu. Rezultate algoritmov razvrščanja učencev v skupine lahko primerjamo z skupinami uspešnosti, ki smo jih dobili z neposrednim ocenjevanjem testov kot vsota doseženih točk in z oceno, s katero učitelj oceni učenca za določen tematski sklop.
- Algoritmov za ocenjevanje kakovosti atributov s ciljem izbiranja ožje množice nalog, ki najbolj ločijo med različno uspešnimi učenci. Te naloge lahko uporabimo pri realizaciji ustnih izpitov v visokem šolstvu ali kot podlaga za hitro testiranje učencev.
- Klasifikacijskih algoritmov za hitro in nepristransko testiranje učencev z že vnaprej izbrano množico nalog. Lahko primerjamo klasifikacijske točnosti različnih na nivoju črnih škatel, oz. na nivoju vhodno-izhodne preslikave, ne da bi se ukvarjali s strukturo modela.
- Odločitvenih dreves za predstavitev strukture pridobljenega znanja po predstavitvi določenega tematskega sklopa. Odločitvena drevesa so kot modeli zanimiva iz dveh aspektov: za učitelje, kot povratna informacija o uspešnosti posredovanja znanja iz določene teme in za učence kot paradigma za sestavljanje testov, ki se prilagajajo trenutnemu znanju posameznega učenca. Takšni modeli hkrati predstavljajo hierarhijo absorpcije znanja s strani množice učencev, ki smo jih testirali, oziroma povprečno obvladovanje posameznih ciljev, ki jih določena naloga v hierarhiji drevesa preverja.

V prvi fazi realiziramo spletno testiranje učencev s širšo množico vprašanj in nalog, ki se nanašajo na določen tematski sklop. Rezultate testov shranjujemo v skupno podatkovno bazo. Testiranje je anonimno in uporabniku, oziroma učencu omogoča večkratno vrednotenje testov. S pomočjo mehanizmov strojnega učenja v naslednji fazi zgradimo modele, ki predstavljajo znanje učencev v zvezi s tematskim sklopom.

Možnost uporabe metod strojnega učenja potrjujemo na domeni, ki predstavlja množico ocenjenih testov iz osnovnošolske matematike. Za modeliranje uporabljamo programskim paket WEKA. S ciljem, da bi dobili vpogled kako se razvrstijo učenci v skupine (grozde) uspešnosti, glede na uspešnost pri reševanju posameznih nalog, izvedemo razvrščanje učencev ne da bi predhodno učence razdelili v razrede uspešnosti. Razvrščanje naredimo na dva načina z ali brez že vnaprej podanim številom razredov. Učnemu algoritmu prepustimo možnost, da bi določil relativno majhno skupino koherentnih razredov, ki so si med seboj čim bolj podobni. Rezultate takega razvrščanja primerjamo z rezultati testov, ki so dobljeni s klasifikacijo glede na vsoto doseženih točk na testu in ne glede na doseganje ciljev, ki jih pomembnejše naloge predstavljajo. Zastavljamo si vprašanje kakšne so lastnosti tistih učencev, ki jih algoritem za razvrščanje razvrsti »napačno« ali drugače kot, če bi jih razvrstili glede na doseženo število točk? Pri teh učencih poudarjamo potrebo po individualiziran pristopu pri poučevanju. Hkrati vidimo možnost uporabe rezultatov razvrščanja v skupine kot paradigmo za oblikovanje skupin učencev s podobnim načinom absorpcije znanja, ki si lahko med seboj pomagajo pri razumevanju določenih konceptov z izmenjevanjem literature, koristnih URL-jev, nasvetov…Algoritme za ocenjevanje kakovosti atributov uporabimo za izbiranje manjše množice pomembnejših nalog, ki najbolj vplivajo na uspeh učencev.

Lahko tudi preizkusimo klasifikacijsko točnost različnih algoritmov na nivoju vhodno-izhodne preslikave in brez vpogleda v strukturo modela ali vključevanja predznanja učiteljev v proces ocenjevanja uspešnosti. Pri tem primerjamo klasifikacijsko točnost različnih algoritmov: odločitvenih dreves, usmerjenih nevronskih mrež, metode podpornih vektorjev (ang. Support Vector Machine, SVM). Odločitvena drevesa zaradi transparentnosti modela ali ponujene razlage uvrstitve učenca v določeno skupino uspešnosti so dobra podlaga za individualno testiranje učencev in za učitelje predstavljajo povratna informacija o uspešnosti posredovanja znanja iz določene teme. Žal pa njihova klasifikacijska točnost je slabša od npr. metode podpornih vektorjev. Iz teh razlogov, če bi radi izvedli hitro testiranje predlagamo uporabo metod za izbiranje nalog in uvrščanje z uporabo metode z viskoko klasifikacijsko točnostjo, kot je npr. metoda podpornih vektorjev. Izdelani modeli so primerni predvsem za poskusno uporabo s strani učiteljev in učencev, ne pa tudi za dokončno ocenjevanje s strani učiteljev. Učitelj se mora pri oblikovanju ocene opirati predvsem na strokovno presojo, modele pa kritično pretehtati ter jih upoštevati le z določeno zanesljivostjo.

Ključne besede: klasifikacija, odkrivanje znanja iz podatkov, odločitvena drevesa, metoda s podpornimi vektorji, izbiranje atributov, ocenjevanje, tematski sklop, učni cilji

Pomen prenovljene dokumentacije zdravstvene nege v izobraževalnem procesu patronažnega varstva

Jožica Ramšak Pajk, Olga Šušteršič

Univerza v Ljubljani, Visoka šola za zdravstvo, Poljanska c. 26, 1000 Ljubljana

jozica.ramsak@vsz.uni-lj.si, olga.sustersic@vsz.uni-lj.si

V prispevku so prikazana mnenja študentov o prenovljeni dokumentaciji v patronažni zdravstveni negi. Namen raziskave je pridobiti mnenja in stališča študentov o prenovljeni dokumentaciji v patronažni zdravstveni negi, katero so uporabljali tekom prakse v patronažnem varstvu. Kot raziskovalno orodje je uporabljen anketni vprašalnik z 21 trditvami pri 52 študentih tretjega letnika zdravstvene nege na Univerzi v Ljubljani, Visoki šoli za zdravstvo. Rezultati raziskave kažejo, da sodelujoči dokumentiranje in dokumentacijo zdravstvene nege v patronažnem varstvu doživljajo kot pomembno za kakovostno obravnavo pacienta. Sodelujoči se strinjajo, da jih je dokumentacija zdravstvene nege v patronažnem varstvu navajala k povezovanju znanj z drugimi področji. Ravno tako se strinjajo, da je namen dokumentacije v raziskovanju in razvoju zdravstvene nege.

Ključne besede: patronažna zdravstvena nega, dokumentacija, študent

Importance of Revised Nursing Documentation in Educational Proces of Community Health Care

The paper reports student's perceptions of revised community nursing documentation. Documentation in community nursing is an efficient tool to ensure quality nursing care and consequently quality treatment. The aim of study was to get students perceptions of revised documentation within new design, content, structural approach aimed at community health care. The paper deals with the results of a research performed on a sample of 52 students from University of Ljubljana, College of Health studies in Ljubljana, nursing department in the year 2004. They are nursing students in the 5. semester and they tested revised documentation during three weeks of community nursing practice. They had to complete a questionnaire form. The questionnaire consists of 21 statements. The correlations analysis has shown that those who think that the documentation was good structured, also agree that it was good organized, assures continuity of nursing, qualitative treatment of patients and review over performed work. Finally we can conclude that good structured understandable documentation can appear to the quality of work as to the nurses' interpersonal relations.

Key words: community nursing, student, documentation

Ob svetovnem letu fizike

Nada Razpet

Univerza na Primorskem, Pedagoška fakulteta Koper, Cankarjeva 5, 6000 Koper

Univerza v Ljubljani, Pedagoška fakulteta v Ljubljani, Kardeljeva ploščad 16, 1000 Ljubljana

nada.razpet@guest.arnes.si

V svetovnem letu fizike smo naše študente povabili, da sodelujejo pri eksperimentalnem delu. Ponudili smo jim nekaj domačih nalog in nekaj seminarjev, pri katerih so si lahko sami izbrali pripomočke, iz njih sestavili eksperiment in ga razložili. Pri predstavitvah rezultatov pa smo naleteli na nekatere zanimive razlage, ki so verjetno posledica nekritične uporabe informacijske tehnologije.

Ključne besede: informacijska tehnologija, poučevanje, učenje, fizika

At the World Year of Physics

Students will be invited to attend a series of experimental works in the World Year of Physics. Some homeworks and seminars will be offered and students will had opportunity to choose the equipment and to present them in the physical way. An interesting explanation will be appeared on the presentation which could be effected by a non critical use of computer technology.

Key words: computer technology, teaching, education, physics

Poučevanje kakovosti programske opreme s poudarkom na modelu PSP

Igor Rožanc, Viljan Mahnič

Univerza v Ljubljani, Fakulteta za računalništvo in informatiko, Tržaška 25, 1000 Ljubljana

igor.rozanc@fri.uni-lj.si, viljan.mahnic@fri.uni-lj.si

Kakovost programske opreme (PO) je pomembno področje, ki ga morajo na ustrezen način spoznati vsi študentje računalništva. Na naši fakulteti ga na visokem strokovnem študiju Računalništva in informatike poučujemo v okviru predmeta Razvoj programskih sistemov II (RPS II), ki se izvaja v 3. letniku. V prispevku najprej utemeljimo izbiro snovi za ustrezno predstavitev področja kakovosti PO. Primeren način za celovito predstavitev je obravnava uveljavljenega modela za zagotavljanje kakovosti. Model zrelostnih stopenj (CMM) je tak primer, vendar je primeren predvsem za velike organizacije. Za slovenske razmere je primernejši soroden model osebnega procesa razvoja (PSP), ki je namenjen inženirju-razvijalcu PO v organizaciji za razvoj PO. V nadaljevanju članka prikažemo glavne značilnosti PSP-ja, nakar predstavimo izvajanje predavanj in vaj pri predmetu RPS II. Čeprav predmet pokriva tudi druge tematike iz področja tehnologije PO, je osrednja vloga na predavanjih namenjena PSP-ju, na vajah pa študenti praktično uporabljajo PSP pri razvoju manjših spletnih aplikacij. Pri tem izdelajo več PSP dokumentov, na podlagi katerih smo izvedli analizo uspešnosti učenja PSP-ja. Pokazalo se je, da so študentje uspešno spoznali PSP, vendar učinkovita uporaba zahteva disciplino in postopno uvajanje. Na koncu predstavimo še rezultate anonimne mnenjske ankete med študenti, ki pokaže, da je po mnenju večine PSP priljubljen in zelo uporaben model.

Ključne besede: tehnologija PO, kakovost PO, modeli za zagotavljanje kakovosti, model stopenj zrelosti (CMM), osebni proces razvoja PO (PSP), anketa

Teaching Software Quality with Emphasis on PSP

Learning about software quality is a must for any computer science student. At Faculty of Computer and Information Science it is taught at course named Software Development II, which undergraduate students take in their third year. In article we present a discussion on selection of an appropriate quality model to cover software quality area first. Capability Maturity Model (CMM) is a well known and complete model, but it is useful for bigger computer companies mostly. In Slovene case it is better to choose Personal Software Process (PSP) model, which defines process for engineer in software organization. After that the basic characteristics of PSP are presented, and teaching process of Software Development II course explained. Course covers several other Software Engineering themes, but we dedicate our main attention to PSP. A practical exercise is part of course as well, and there students develop a small web application by the PSP principles. Some PSP documents are produced in this way, and those we analyzed at the end of course. We discovered PSP learning was successful, but efficient use demands additional gradual implementation of PSP principles. In last part we present the analysis of anonymous student questionnaire. Results proved that students mark PSP as a useful and practical model.

Key words: software engineering, software quality, quality models, capability maturity model (CMM), personal software process (PSP), questionnaire

Izdelava elektronskega učbenika za fiziko za osnovno šolo

Gašper Sitar [1] , Eva Jereb [2]

(1) Osnovna šola Venclja Perka, Ljubljanska cesta 58a, Domžale

(2) Univerza v Mariboru, Fakulteta za organizacijske vede, Kidričeva cesta 55a, 4000 Kranj

ayrton79@email.com, eva.jereb@fov.uni-mb.si

Zelo pomembna stvar v času, v katerem živimo, je znanje, ki je ključ do uspeha, saj je brez ustreznega znanja zelo težko priti do ustrezne zaposlitve. Ljudje ves čas stremimo k novemu znanju. Vendar pa je včasih pot do znanja naporna, bodisi zaradi pomanjkanja časa, bodisi zaradi težav pri razumevanju snovi. Da bi učencem s takimi težavami omogočili boljše pogoje, smo v okviru predmeta Avtomatizacija pisarniškega poslovanja zanje pripravili elektronski učbenik. Učbenik, ki je namenjen učenju fizike na osnovnošolski ravni, je na voljo na internetu in tako dostopen vsem. Tako si lahko učenci popolnoma sami uravnavajo svoj urnik za dodatno izpopolnjevanje znanja in se učijo, kadar to sami želijo. Učbenik s slikami in razlagami na preprost način omogoča boljšo predstavo, kot jo učenci dobijo v šoli, in tako predstavlja sodoben način učenja. Učbenik je narejen s programom Macromedia Dreamweaver, ki omogoča hitro in enostavno izdelavo spletnih strani. Ko se stran z učbenikom odpre, nam je omogočen takojšen dostop do kateregakoli izmed poglavij, ki nas zanimajo. S povezavami je omogočeno preskakovanje z enega poglavja na drugega. Učbenik ima veliko prednosti, ki zagotavljajo, da bo tak način učenja v prihodnosti izredno učinkovit in uporaben. Najbolj uporabna stvar pa je možnost preverjanja tega, kar smo se že naučili, saj učbenik vsebuje tudi s programom Perception narejene teste z naključnimi vprašanji iz vsakega poglavja posebej ali pa iz celotnega učbenika naenkrat.

Ključne besede: učenje, znanje, elektronski učbenik, Macromedia Dreamweaver, Questionmark Perception

E-Book for Physics for Elementary School

In times we live in, knowledge, which is a key to success, is a very important aspect of life. It is very hard to get an appropriate job without it. All the time, people strive for additional knowledge. However, the path that leads to knowledge is sometimes very difficult, either because of the lack of time or the troubles with understanding the subject that we are learning. To provide students who experience such difficulties with better conditions we created an e-book for physics at elementary school level. It is available on the internet and is, therefore, accessible to anybody. Thus, for the additional upgrading of their knowledge the students can make their own schedule and can study whenever they want. In a simple way, the e-book with pictures and explanations provides a better insight into the subject than the one the students get in school and as such represents a modern way of studying. The e-book is created with the Macromedia Dreamweaver. A web site can be set up very easily and quickly with this program. When the web site with the book opens, we get immediate access to any of the chapters that we are interested in. Jumping from one chapter to another is enabled by the links. The e-book has many advantages which insure that in the future such way of studying will be highly effective and useful. The greatest benefit of the book is a chance to revise what you have already learnt, because it contains the tests with random questions from each separate chapter of the book and from all the chapters together. Tests are set up with the Perception program.

Key words: studying, knowledge, e-book, Macromedia Dreamweaver, Questionmark Perception

Modeli ocenjevnja projektne naloge pri izbirnem predmetu računalništvo v osnovni šoli

Alenka Spasovski

Osnovna šola Grm, Trdinova ulica 7, 8000 Novo mesto

alenka.spasovski@guest.arnes.si

V šolskem letu 2003/04 se je v skladu z Zakonom o osnovni šoli začelo izvajati 9-letno izobraževanje v vseh osnovnih šolah. Ena od pomembnih novosti so tudi izbirni predmeti. Računalništvo je eden od izbirnih predmetov naravoslovno-tehničnega področja in ga sestavljajo trije sklopi: urejanje besedil, multimedija in računalniška omrežja. Pouk poteka v obliki projektnega učnega dela. Končni izdelek pri vseh treh sklopih je projektna naloga, ki jo mora učitelj oceniti s številčno oceno. V prvem delu je opisan pomen opisnih kriterijev pri spremljanju napredka učencev ter njihov pomen pri preverjanju in ocenjevanju. Odgovor na vprašanje, kako in kaj oceniti pri projektni nalogi posameznega sklopa, je podan v drugem delu. S pomočjo računalniškega programa DEXi so, ob upoštevanju kriterijev, predstavljeni trije odločitveni modeli, katerih končni rezultati so ocene projektnih nalog posameznega sklopa. Z vključitvijo portfolia, ki omogoča spremljanje napredovanja učencev skozi daljši čas, pa je poudarjena tudi udeležba učencev, ki pri svojem delu zavestno s pomočjo učitelja ugotavljajo svoja šibka in močna področja in na osnovi povratne informacije skrbijo za nenehno izboljševanje in razvijanje spretnosti, veščin in miselnih navad, za kar so na koncu nagrajeni z najboljšo oceno.

Ključne besede: preverjanje, ocenjevanje, računalništvo, projektna naloga, DEXi, opisni kriteriji, portfolio

Models of Grading Project Work in Information Technology in Elementary School

In accordance with the new law on schools and education, all primary schools in Slovenia started the new 9-year programme of primary school education in 2003/04. One of the important aspects enforced by the new law are additional or chosen subjects, which pupils choose themselves on the basis of their interests, wishes and abilities. Information Technology, which belongs in the group of natural science and technical subjects, is one of those subjects. It consists of three topics, each discussed in separate years; organising texts, multimedia and computer networks. Lessons are carried out in the form of project work. The final product of all three topics is a project, which is graded by the teacher when concluded. The first part of this paper discusses the significance of written reports, from the perspective of keeping track of pupils' work and their impact on the final pre-test checking and grading of their products.

The second part discusses the ways and means of grading pupils' work and clarifies what needs to be graded in each topic. Three models and their criteria are introduced with the help of the Dexi programme. Portfolio, which is also taken into account, enables the teachers to monitor pupils' learning processes during a longer period of time and thus stimulates pupils' activities. With it, pupils become aware of their weak and strong points and, based on the feed back information from their teachers, they strive to improve their performance during lessons. As a result the pupils get rewarded with a better grade.

Key words: pre-test checking of pupils' knowledge, grading, computer science, project work, Dexi, written reports, portfolio

Poglej in preveri

Marina Svečko

OŠ Angela Besednjaka, Celjska 11, 2000 Maribor

marina.svecko@guest.arnes.si

V prispevku predstavljamo projekt, ki ga podpira in sofinancira tudi Ministrstvo za šolstvo in šport Slovenije. Poteka v sodelovanju s Fakulteto za elektrotehniko, računalništvo in informatiko Maribor (FERI). S projektom »Poglej in preveri« želimo s pomočjo izobraževalne komunikacijske tehnologije (IKT) oblikovati načrten pristop do podatkov, ki so vezani na vzgojno-izobraževalno delo ter ponuditi novo obliko ciljno usmerjene pomoči šolajočim na izbranih programih oziroma predmetih. Učitelji, sodelujoči v projektu, so zadolženi za oblikovanje baz podatkov za posamezno predmetno področje, ki vključuje povzetke tekoče učne snovi, preverjanje znanja, kriterije ocenjevanja in drugo delovno gradivo. Preko spletnega portala redno ažurirajo vse informacije, spremljajo vprašanja uporabnikov in izvajajo spremljavo projekta. Projekt vključuje sodobna IKT sredstva in je uporaben pri posameznih predmetih različnih strokovnih področij, v medpredmetnem povezovanju, pri interesnih in drugih izobraževalnih dejavnosti, v splošnem in poklicnem izobraževanju na vseh nivojih ter izobraževanju udeležencev s posebnimi potrebami. Projekt poteka po metodi akcijskega razvijanja in raziskovanja.

Ključne besede: baze podatkov, izobraževalne komunikacijske tehnologije, učenje na daljavo, učenci, učitelji

Look and Check

In this article we are introducing our school project which is partly sponsored by the Ministry of School and partly by the Faculty of Electrical Engineering and Computer Science Maribor. The project Look and Check, accompanied with the educational communication technology (IKT) is used to provide the most suitable access to the databases which are linked with the educational work to give all the help that is needed to the students who might want it or need it according to their own will or to the will of their parents. Teachers who work at this project have to moderate bases of data for each subject separately. These bases of data include the information about the summary of the lesson, knowledge control, criteria of marking and many others. All the information about Look and Check project are published regularly. Beside this we also try to answer all the user's questions. The project is run according to the method of active developing and exploring.

Key words: databases, knowledge control, criteria of marking, long-distance learning, student, teacher

Znanje in izobraževanje informatike v logistiki

Marko Urh, Anton Čižman

Univerza v Mariboru, Fakulteta za organizacijske vede, Kidričeva cesta 55a, 4000 Kranj

marko.urh@fov.uni-mb.si, anton.cizman@fov.uni-mb.si

Namen prispevka je prikazati pomen izobraževanja in znanja informatike z vidika njene uporabe v logistiki. Prikazani so osnovni elementi logistike in vpliv informatike na logistični management. V preteklosti se izobraževanju kadrov v logistiki ni posvečalo toliko pozornosti, kot danes. Ustrezno izobraženi kadri v logistiki, pa predstavljajo temelj za učinkovito poslovanje. Povečana uporaba informacijske tehnologije na področju logistike je povzročila dvig učinkovitosti, večjo zanesljivost in dvig hitrosti poslovanja. V nadaljevanju prispeveka so prikazani načini, področja in izobraževanje logistike na Fakulteti za organizacijske vede, ki ima temelje na nadgrajevanju osnov informatike in vodijo v celotno razumevanje sodobnega logističnega managementa.

Ključne besede: logistika, izobraževanje, informatika, mikrologistični procesi, logistični informacijski sistemi

Informatics Knowledge and Education in Logistics

The purpose of this paper is to demonstrate the importance of informatics education and knowledge from the logistics point of view. The basic elements of logistics and the influence of informatics on logistics management are shown. In the past years the education in the field of logistics was mostly ignored. The increased use of information technology in the field of logistics caused the rise of efficiency, reliability and pace of business. In this paper we present the methods, areas and the education of logistics at the Faculty of Organizational Sciences, which is based on the advancement of information science basics and leads to a wholesome understanding of contemporary logistical management.

Key words: logistics, education, informatics, micrologistics processes, logistics information systems

Določitev težavnostne skupine dijaku za izdelavo seminarske naloge pri predmetu Algoritmi in programski jeziki

Boštjan Vouk

Modrej 57, 5216 Most na Soči

bostjan.vouk@tscng.net

V pomoč dijakom drugega letnika je bila izdelana aplikacija, ki pomaga dijaku izbrati težavnost seminarske naloge pri predmetu Algoritmi in programski jeziki. Aplikacija je bila izdelana na podlagi odločitvenega modela. Odločitveni model pa je bil izdelan na podlagi rudarjenja podatkov na bazi podatkov »Ocene«, ki temeljijo na ocenah dijakov za posamezni predmet. Aplikacija je samo en okvir, ki lahko pomaga dijaku izbrati zahtevnost njegove seminarske naloge. Odločitev je v končni fazi prepuščena dijaku, ki lahko model oceni kot sugestijo ali pa se odloči po svoji lastni volji.

Ključne besede: učenec, DEXi, večparametrski odločitveni model, odločanje, WEKA, data mining, klasifikacija, aplikacija

Defining Difficulty of Group for Pupils' Seminar Work at Subject Algorithms and Program Languages

With the intention of helping pupil to accomplish seminar work at subject algorithms and program languages in secondary school we developed an application for choosing appropriate seminar work. First it has been developed decision model on the basis of data mining. For data source it was chosen database "Ocene" which is based on a pupils' marks for each subject in the school. After that it has been developed an application on the basis of decision model. This application is only a frame that helps a pupil to estimate pretentiousness of his seminar work. At the end the decision has to be accepted by a pupil who can estimate applications result as a suggestion or can accept a decision of his own will.

Key words: pupil, DEXi, multi-attribute decision model, decision support, WEKA, data mining, classification, application

Izbira sistema za upravljanje z vsebinami za vzgojno izobraževalne zavode

Alenka Zabukovec

Srednja ekonomska šola Ljubljana, Roška 2, 1000 Ljubljana

alenka.zabukovec@guest.arnes.si

V prispevku je opisana izgradnja večkriterijskega DEXi modela za izbiro sistema za upravljanje z vsebinami za potrebe vzgojno izobraževalnih zavodov v Sloveniji. Prikazan je postopek izbire in ocenjevanje s podporo tega modela šestih programskih rešitev za upravljanje z vsebinami (CMS: Content Management System): Drupal, XOOPS, Typo3, Mambo, CMSimple in eGroupware. Vključen je tudi opis in analiza najbolje ocenjenih sistemov ter utemeljitev končna izbire.

Ključne besede: CMS, sistemi za upravljanje z vsebinami, Typo3, Mambo, DEXi, večkriterijski odločitveni model, večkriterijsko odločanje

Choosing a Content Management System for the Needs of Educational Institutions

The paper gives a description of how to build a multiparameter decision-making DEXi model for the needs of Slovene educational institutions when choosing a content management system. Furthermore it presents a process of decision-making and evaluation based on the model consisting of six program solutions for content management (CMS: Content Management System): Drupal, XOOPS, Typo3, Mambo, CMSimple and eGroupware. Last but not least, the paper includes the description and analysis of highly rated systems and the argumentation of final choice.

Key words: CMS, content management system, Typo3, Mambo, DEXi, multiparameter decision-making model, multiparameter decision-making

Uporabnost in zanesljivost pri razvoju in uporabi odprte kode

Primož Zevnik

Gimnazija Kranj, Koroška cesta 13, 4000 Kranj

primoz.zevnik@guest.arnes.si

V okviru odprte kode je nastalo več vrst programske opreme. Večino te opreme uporabljajo izkušeni uporabniki. Čeprav uporaba prostega programja narašča, ima povprečen uporabnik računalnika stik le z lastniško zaščiteno programsko opremo. Razlogov za takšno stanje je več; eden izmed njih je prepričanje, da so programi odprte kode manj uporabni. V tej razpravi proučujem, kako razvojni proces odprte kode vpliva na uporabnost, in predlagam metode izboljšanja uporabnosti, ki so primerne za razvoj tovrstne programske opreme na Internetu.

Ključne besede: Odprta koda, zanesljivost, problem uporabnosti, razvoj, izboljšave, skupnost

Open Source Usability And Reliability In Developmenet And Usage

Open source communities have successfully developed many pieces of software. Most of this software is used by technically sophisticated users, in software development or as part of the larger computing infrastructure. Although the use of open source software is growing, the average user computer user only directly interacts with proprietary software. There are many reasons for this situation; one of which is the perception that open source software is less usable. This paper examines how the open source development process influences usability and suggests usability improvement methods that are appropriate for community-based software development on the Internet.

Key words: open source, reliabliy, usage problems, developement, improvements, community

Spodbude in blokade za študij

Neja Zupan, Janez Mayer

Univerza v Mariboru, Fakulteta za organizacijske vede, Kidričeva 55 A, 4000 Kranj

neja.zupan@fov.uni-mb.si, janez.mayer@fov.uni-mb.si

V prispevku so preverjene nekatere smernice razvoja Slovenije, iz katerih izhajajo načrti v izobraževanju. Z vidika nacionalnega programa je ključnega pomena spodbujanje in motiviranje za izobraževanje. Izvedena raziskava je usmerjena v proučitev spodbud in blokad pri študiju. Raziskava je bila izvedena med študenti prvega, drugega in tretjega letnika univerzitetnega programa na Fakulteti za organizacijske vede Univerze v Mariboru. Rezultati kažejo, da ni neke enotno izpostavljene spodbude oziroma blokade, ki bi jo potrdila večina študentov, medtem ko se kaže močan vpliv individualnosti posameznika na uspeh izobraževanja.

Ključne besede: izobraževalni proces, študent, informacijska družba, strateški načrt, študijska blokada, študijska spodbuda

Study Incentives and Blockades

This paper examines some development directives for Slovenia that are source for educational plans. National program placed on the first place motivation and stimulation for education as one of the main development key. This research investigates study incentives and blockades and compares results with national educational program directives. Observed populations were first, second and third year students at the Faculty of organizational sciences, University of Maribor. Results indicate that there is neither specific incentive nor specific blockade that is common for the whole observed population. Results show that educational process is individual process and can not be generalized. Motivation and success in education is personal dependant.

Key words: educational process, student, information society, strategical plan, study blockades, study incentives

Zbornik 8. mednarodne multikonference
Proceeding of the 8th International Multiconference

INFORMACIJSKA DRUŽBA IS 2005

INFORMATION SOCIETY IS 2005

Inteligentni sistemi

Intelligent Systems

Uredila / Edited by

Marko Bohanec, Matjaž Gams

http://is.ijs.si

11. do 17. oktober 2005 / 11th - 17th October 2005
Ljubljana, Slovenia

Predgovor

Čeprav konferenco *Inteligentni sistemi* izvajamo vsako leto, število referatov ne upada, hkrati pa se stalno povečuje kvaliteta prispevkov. 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 2005 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 2002* je predstavljenih 20 prispevkov. Vsi prispevki so bili recenzirani s strani dveh anonimnih recenzentov. Oblikovne pripombe sva prispevala tudi predsednika konference.

Poleg same konference so pomembne tudi spremljajoče dejavnosti. V sklopu celotnega dogodka Informacijske družbe imamo običajno tudi letno skupščino Slovenskega društva za umetno inteligenco, pa tudi letno skupščino ACM Slovenija.

Pomembna je tudi povezava z revijo Informatica, saj v tej osrednji mednarodni računalniški reviji, tiskani v Sloveniji, vsako leto izide specialna številka z najboljšimi prispevki s 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, their quality consistently improves each year. 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 2005 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 2002* includes 20 papers. All submitted papers have been reviewed by two reviewers. Some additional suggestions for improvements were also provided by the chairmen of the conference.

There are some other important activities related to this conference. Usually, there are held annual assemblies of the Slovenian Artificial Intelligence Society (SLAIS) and ACM Slovenia.

An important connection is also with the journal Informatica, which is a central international journal on computing sciences, printed in Slovenia. Each year, the best contributions presented at the conference are published in a special issue of Informatica.

Matjaž Gams and Marko Bohanec,
conference chairs

DEPARTMENT OF INTELLIGENT SYSTEMS E9

Matjaž Gams
Department of Intelligent Systems
Jozef Stefan Institute
Jamova 39, 1000 Ljubljana, Slovenia
Matjaz.gams@ijs.si

ABSTRACT

The intelligent systems department E9 is presented: mission, motivation, directions of research and applications, areas of activities and achievements. In cooperation with the Faculty for computer systems and informatics, the department stems to develop a computational theory of intelligence and to develop high-impact practical applications in areas such as intelligent information systems, data analysis, decision making, intelligent agents, medicine, ecology, language technologies, intelligent manufacturing, and economy.

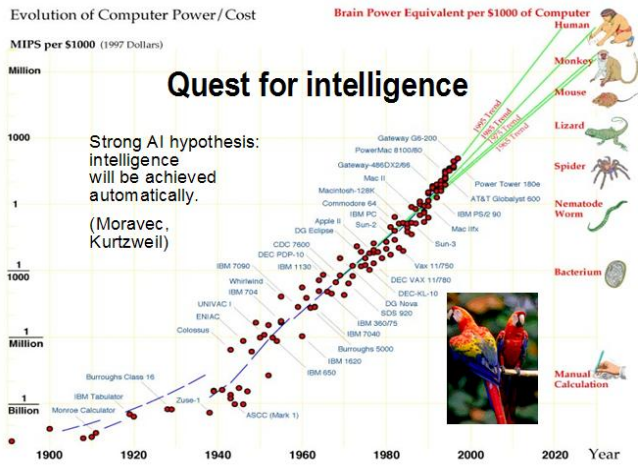
1 INTRODUCTION

The department with 23 members represents one of an important research groups in Slovenia and Europe.

The main research areas are presented in the next slide. Agent technologies introduce a new generation of intelligent computer systems, based on autonomy and social computing. Semantic Web is concerned with automatic understanding of computer text, mainly in HTML. Evolutionary computing is based on evolutionary principles and survival of best in a population. Machine learning and data mining rely on hundreds and thousands of learning examples, which enable automatic construction of properties of the problem domain. Decision support systems help humans creating and choosing best solutions. New solutions enable new communication services.

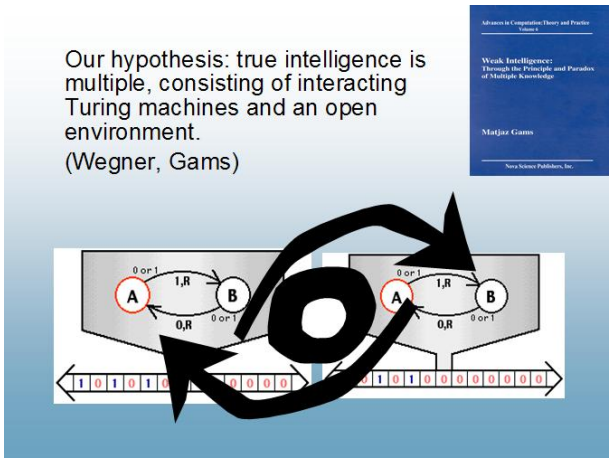
2 RESEARCH AREAS

The major quest in all our activities is for computer intelligence. It is well known that computer hardware increases capabilities exponentially. Moore's law determines the growth in chips, and the progress in memory capacities of disks and the network throughput is exponential as well.

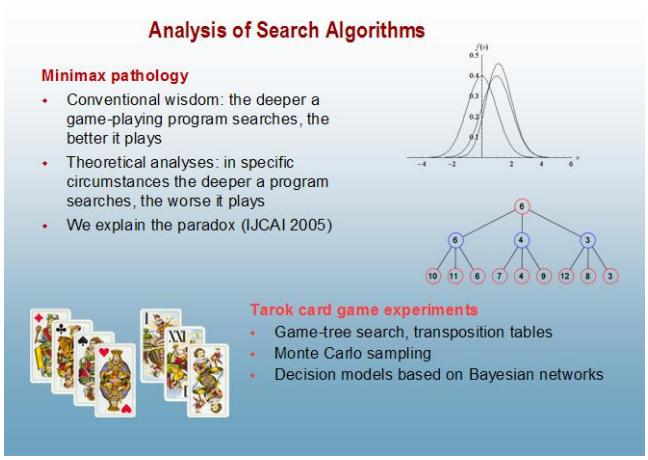


So some scientists say that sooner or later digital computers will become intelligent as anticipated in the previous picture.
But where is true intelligence in computers? No doubt that computers are very fast and humans very slow in comparison, but humans are much more

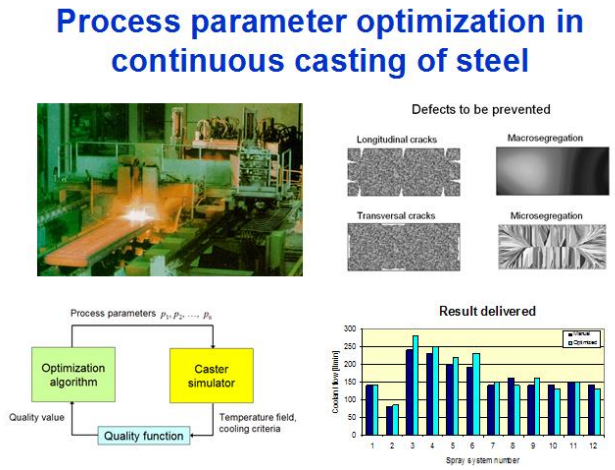
intelligent, they are conscious and have several abilities that are practically absent in current computers. One of the reasons why that is so is presented by the principle of multiple knowledge. Namely, the way that current computing is performed in humans and computers, clearly indicates that humans do it in a significantly more complex way. The schema of the principle in terms of Turing machines is presented in the next figure.



While the principle and paradox of multiple knowledge represents one research direction explaining major differences, the majority of research in the department is devoted to stientific solutions that can be tested and verified in real life.



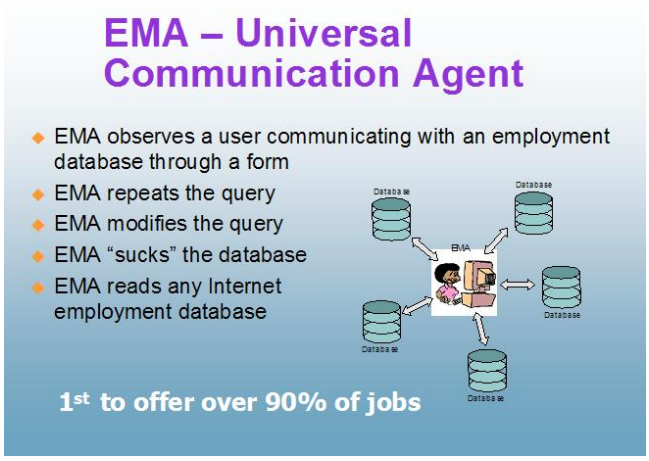
One of major research areas are search algorithms. We managed to explain the pathology in the minimax search algorithms: it is quite common in evaluation function with small number of possible evaluation values, but practically nonexistent with larger values, e.g. similar to the way estimating functions are used in real-life games such as chess or tarok. Search properties are indicated in the previous figure when analyzing a probabilistic card game tarok. Analysis of pathology was presented at IJCAI 2005.



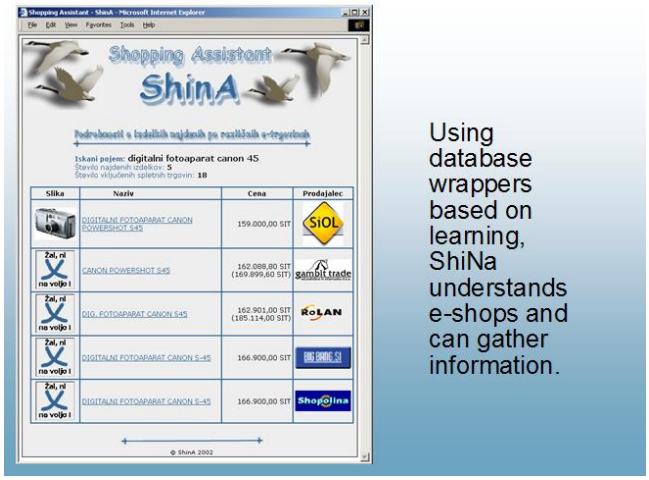
Another major research area is evolutionary computing, with specialization towards solving multiobjective optimization problems. The application for parameter optimization in continuous casting of steel is presented in the above figure. Evolutionary algorithms are first of all applicable for optimizing complex processes or tasks.

In the area of intelligent agents, currently one researcher is finishing his Ph.D. related to automatic construction of strategies by observing only movement of agents. For the benchmark domain, RoboSoccer games are tested. Currently, the system constructs strategies of good quality.

In the area of agent research and applications we have developed one of the major applications for not only agents but also intelligent systems in this part of Europe. Namely, the employment agent EMA was around 15 years ago visited by around 1/10th of population at best months. The system not only offered over 90% of all nationally available free jobs in Slovenia, it also incorporated several advanced agent functions like (at that time rather simple) database wrappers, translation between English and Slovene, browsing the Internet etc. EMA is semantically presented in the next figure.

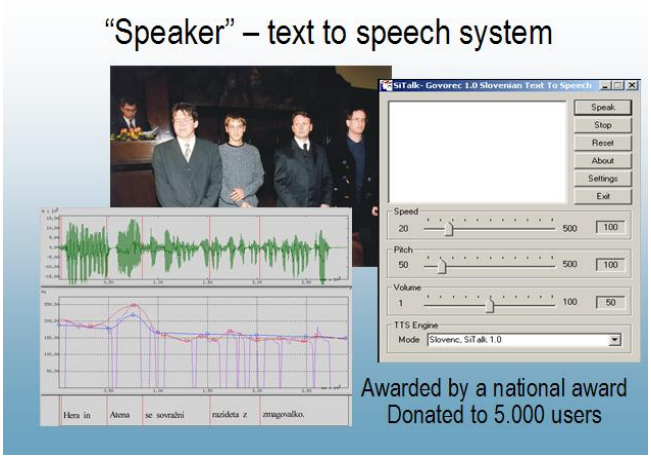


The EMA system was being further developed in scientific terms. The first successor was the ShiNa system, capable of understanding queries about market items and finding answers in internet shops using categories and automatic wrappers. ShiNa was actually gathering information from most Slovenian e-shops in a prototype version.



The research in database wrappers, agents and e-commerce resulted in a fully completed Ph.D. thesis, devoted to semantic Web. The developed system is capable of automatically gathering information from semi-structured tables, e.g. those in HTML. The input tables are gathered from the same, but arbitrary domain, thus it is possible to create formal semantic representation from them in the form of ontologies and frames in F-logic. This process of automatic transformation has achieved over 80% success rate in the performed thorough tests. After the semantic representation is created, queries either in natural language or formal query language achieved 100% accuracy.

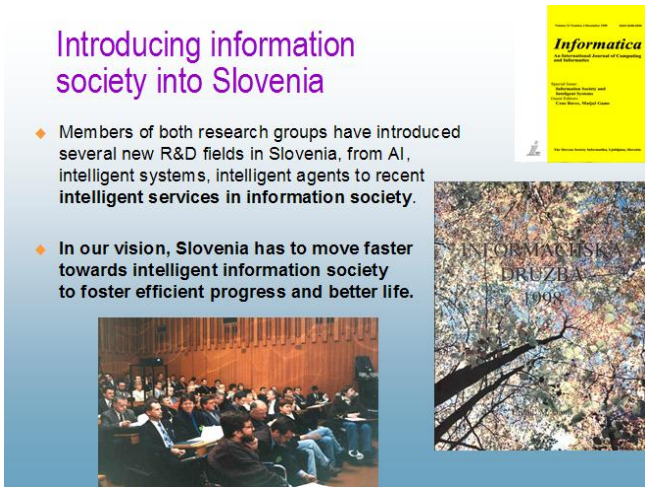
In the area of natural language the department developed an automatic text to speech system "Speaker", capable of fluently speaking Slovene computer texts from Windows Word or later also from the internet and other sources. The system was given to all visually handicapped in Slovenia free of charge. Although there are about 5000, it is estimated that the Speaker system is actually daily used more in hundreds than in thousands. But much to our surprise the system is lately used also in countries with similar language, first of all in countries from former Yugoslavia. The systems speak with Slovenian pronunciation, but still seems to work better than the competition. In the figure below there are two screens from the system and the four major developers receiving the first national reward for handicapped.



Currently, the natural language research is concerned with analyzing the meaning of words at least for the disambiguation purposes, e.g. which synonym should be used in the translation tasks. The two major approaches are based on ontology and machine learning. For comparison we often use human experts and statistical and pattern recognition methods. Typically, the computer system lags reasonably behind humans, but in practical tasks computers are able to reproduce most of the performances bofhumans since they use massive dictionaries, corpuses etc.

All research areas in the department are closely related to information society, which aims at optimizing life of citizens by introducing intelligent information services. There are enormous possibilities that are waiting to be exploited. The technology is growing constantly, and so is our knowledge how to implement intelligent user-friendly new functions that ease the burden on every human.

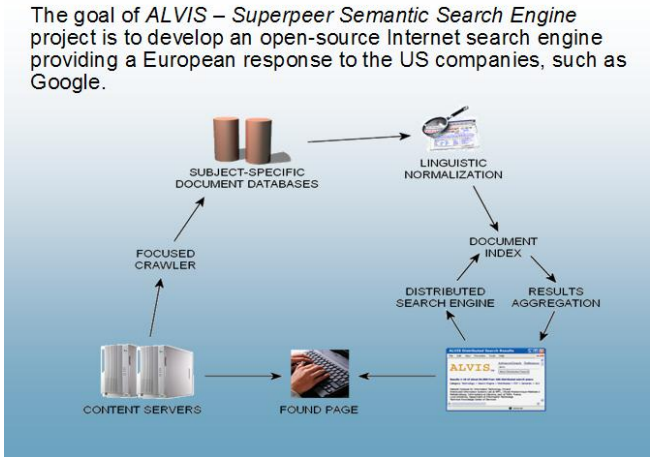
Our department introduced several new areas in Slovenia, e.g. agents or multiple learning. But we also organized several major events regarding information society such as a debate in our national parliament, we each year organize the national conference and in cooperation publish the major Slovenian international computer science and informatics journal Informatica.



3 PROJECTS, APPLICATIONS

The department is very active in research and application and cooperates in several innovative and international research projects.

As shown in the previous figure, there are several EU projects which indicate close ties with the world and in particular Europe. Two projects stand out: ALVIS, a semantic search engine, a kind of European reply to Google supremacy, and WINDECT, introducing new DECT internet communication services. Both systems should result in fully operational prototypes, e.g. ALVIS in an operational open-source peer-to-peer search engine that companies will be able to transform into commercial products.



Regarding industrial partners, the staff of the department cooperated in several hundred commercial applications and several ten new companies in two decades.

4 CONCLUSION

The Department of intelligent systems is one of the established European research departments with all attributes: interesting research areas, major research discoveries and applications in the area of intelligent systems.

We will continue the research and development excellence.

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ON STOCHASTIC OPTIMIZATION OF CONTINUOUS CASTING UNDER STEADY-STATE CONDITIONS

Bogdan Filipič
Department of Intelligent Systems, Jožef Stefan Institute
Jamova 39, SI-1000 Ljubljana, Slovenia
E-mail: bogdan.filipic@ijs.si

Erkki Laitinen
Department of Mathematical Sciences, University of Oulu
P.O. Box 3000, FIN-90014 Oulu, Finland
E-mail: erkki.laitinen@oulu.fi

ABSTRACT

This paper presents an empirical study of process parameter optimization in industrial continuous casting of steel under steady-state conditions. The optimization task is to tune 18 coolant flows in the caster secondary cooling system to achieve the target surface temperatures along the slab. Employing a numerical simulator of the casting process, a preliminary investigation of the search space properties was performed, and two stochastic optimization algorithms tested: an evolutionary algorithm and next-descent local optimization. The results indicate the difficulty of the optimization task arises not from a complicated fitness landscape but rather from high dimensionality and search space complexity.

1 INTRODUCTION

Manufacturing and processing of materials are nowadays largely based on numerical analysis and computer support. Availability of reliable process simulators and efficient optimization techniques allows for automated optimization of process parameters and improvement of material properties. They can be achieved by interconnecting a process simulator with an optimization algorithm through a cost function which allows for automatic assessment of the simulation results [4].

Continuous casting is a predominant technology of steel production in modern steel plants. It is a complex metallurgical process in which liquid steel is cooled and shaped into semi-manufactures of desired dimensions. To achieve proper quality of cast steel, it is essential to control the metal flow and heat transfer during the casting process. They depend on numerous parameters, such as the casting temperature, casting speed and coolant flows. Finding optimal values of process parameters is difficult since different, often conflicting criteria may be applied, the number of possible parameter settings is high, and parameter tuning through real-world experimentation is not feasible because of costs and safety risk. Over the last years, however, several computational techniques have been used to enhance the process performance and product characteristics, including knowledge-based heuristic search [3], genetic algorithms [6, 1], and evolutionary multiobjective optimization [2].

In this paper we report on preliminary numerical experiments in optimizing secondary coolant flows on a casting machine of the Rautaruukki steel plant in Finland. Calculations were done for a selected steel grade under the assumption of steady-state caster operation. Their objective was to get better insight into the properties of this optimization task and tune the coolant flows with respect to the given temperature distribution requirements. The paper describes the optimization problem, provides the results of numerical analysis, and discusses their implications for future work.

2 THE COOLANT FLOW OPTIMIZATION PROBLEM

The secondary cooling area of the considered casting device is divided into nine zones. In each zone, cooling water is dispersed to the slab at the center and corner positions. Target temperatures are specified for the slab center and corner in every zone. Water flows should be tuned in such a way that the resulting slab surface temperatures match the target temperatures. Formally, a cost function is introduced to measure the differences between the actual and target temperatures. It is defined as

$$\begin{aligned} c(T) &= \frac{1}{2}\Big(\sum_{i=1}^{N_Z} l_i (T_i^{\text{center}} - T_i^{\text{center}*})^2 + \\ &\quad + \sum_{i=1}^{N_Z} l_i (T_i^{\text{corner}} - T_i^{\text{corner}*})^2\Big) \end{aligned} \tag{1}$$

where N_z denotes the number of zones, l_i the length of the i-th zone, T_i^{center} and T_i^{corner} the slab center and corner temperatures, while $T_i^{\text{center}*}$ and $T_i^{\text{corner}*}$ the respective target temperatures in zone i. The optimization task is to minimize the cost function over possible cooling patterns (water flow

settings). Water flows cannot be set arbitrarily, but according to the technological constraints. For each water flow, minimum and maximum values are prescribed.

Table 1 shows an example of the prescribed target temperatures and water flow intervals for continuous casting of a selected steel grade analyzed in this study. The slab cross-section in this case was 1.70 m $\times$ 0.21 m and the casting speed 1.4 m/min.

Table 1: The target temperatures and water flow intervals for continuous casting of a selected steel grade

Position	Zone number	Target t. [°C]	Flow number	Min. [m^3/h]	Max. [m^3/h]
	1	1050	1	7.1	26.1
C	2	1040	2	22.8	57.5
e	3	980	3	13.3	39.9
n	4	970	4	1.5	7.9
t	5	960	5	2.7	10.0
e	6	950	6	0.8	6.5
r	7	940	7	0.7	5.9
	8	930	8	1.0	5.8
	9	920	9	1.2	6.2
	1	880	10	7.1	26.1
C	2	870	11	22.8	57.5
o	3	810	12	13.3	39.9
r	4	800	13	1.2	3.5
n	5	790	14	2.4	4.4
e	6	780	15	2.4	2.9
r	7	770	16	0.7	5.9
	8	760	17	1.0	5.8
	9	750	18	1.2	6.2

3 PRELIMINARY CONSIDERATIONS

Evaluation of cooling patterns and their assessment with respect to cost function (1) was done by means of a numerical simulator [8]. Its principal task is to dynamically track the temperature field in the slab as a function of process parameters. It involves a 3D model of the slab and finite element numerical approximation. In this study it was applied under the assumption of steady-state caster operation, and the search for optimal cooling patterns performed in the off-line manner. A single simulator run takes about 40 seconds on a 1.8 GHz Pentium IV computer.

Before the integration of the simulator with the optimization algorithms, a number of simulator runs were performed to get an initial insight into the properties of the fitness landscape associated with the optimization problem. Specifically, the cost was analyzed as a function of individual parameters and pairs of parameters, while keeping the remaining parameters fixed at their mid-interval values. The resulting plots show simple dependencies between the parameters and cost function in the form of monotonic or at most U-shaped curves and surfaces (see examples in Figures 1 and 2). They are much simpler than usual artificial test functions for numerical optimization, which is understandable because of the underlying physical process. However, one should bear in mind this offers a very limited view of the problem characteristics. The difficulty comes with the high dimensionality of the problem as there are 18 independent process parameters subject to optimization.

A question to be answered before the application of optimization procedures is whether to search for optimal solutions in continuous or discretized parameter space. In analogy to previous studies performed on similar task from the Acroni Steelworks at Jesenice, Slovenia [5, 9], the discrete version was considered. The rationale behind it is in the engineering approach to coolant flow tuning where it is meaningless to consider changes below certain amount as they do not reflect in changing the cost value. For the purpose of numerical experiments three discretizations were defined, a very rough one for initial tests of the optimization algorithms, another one with medium step sizes to refine the results, and the one with the uniform step size of 0.1 m^3/h which is the minimum practically considered change for all coolant flows (see Table 2).

Table 2: Parameter discretizations used in the optimization process

Flow no.	Discretization 1		Discretization 2		Discretization 3	
	Step [m^3/h]	Values	Step [m^3/h]	Values	Step [m^3/h]	Values
1	4.7	5	1.0	20	0.1	191
2	8.6	5	1.0	35	0.1	348
3	6.6	5	1.0	27	0.1	267
4	1.6	5	0.5	13	0.1	65
5	1.8	5	0.5	15	0.1	74
6	1.4	5	0.2	29	0.1	58
7	1.3	5	0.2	27	0.1	53
8	1.2	5	0.2	25	0.1	49
9	1.2	5	0.2	26	0.1	51
10	4.7	5	1.0	20	0.1	191
11	8.6	5	1.0	35	0.1	348
12	6.6	5	1.0	27	0.1	267
13	0.5	5	0.2	12	0.1	24
14	0.5	5	0.2	11	0.1	21
15	0.1	6	0.1	6	0.1	6
16	1.3	5	0.2	27	0.1	53
17	1.2	5	0.2	25	0.1	49
18	1.2	5	0.2	26	0.1	51

It is informative to calculate the number of possible parameter settings given each discretization. For a parameter from the interval $[p_i^{\min}, p_i^{\max}]$ with step size p_i^{step}, there are $v_i = \lfloor (p_i^{\max} - p_i^{\min})/p_i^{\text{step}} \rfloor + 1$ values possible, and the total number of settings is $v = \prod_{i=1}^{N_p} v_i$, where N_p is the number of parameters. This results in $4.6 \cdot 10^{12}$ possible setting for discretization 1, $4.9 \cdot 10^{23}$ for discretization 2, and $4.7 \cdot 10^{33}$ for discretization 3.

4 NUMERICAL EXPERIMENTS AND RESULTS

Two stochastic optimization techniques were applied to the coolant flow optimization problem, the steady-state evolutionary algorithm and the next-descent local optimization al-

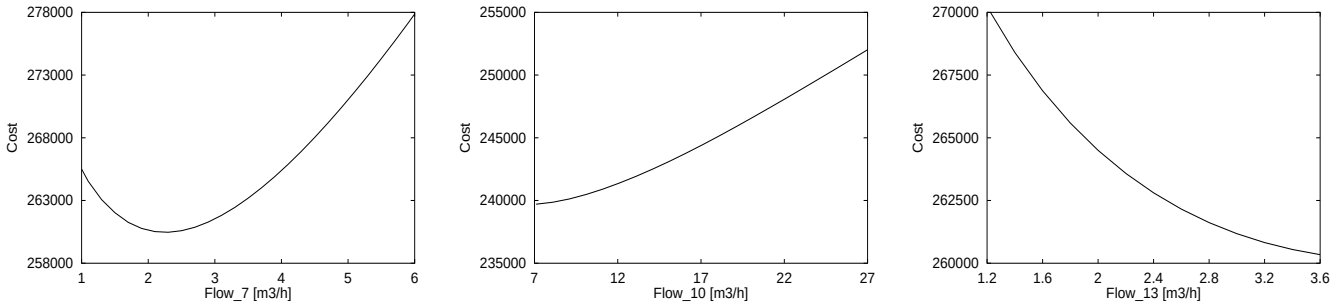

Figure 1: Examples of cost function dependencies on individual parameters

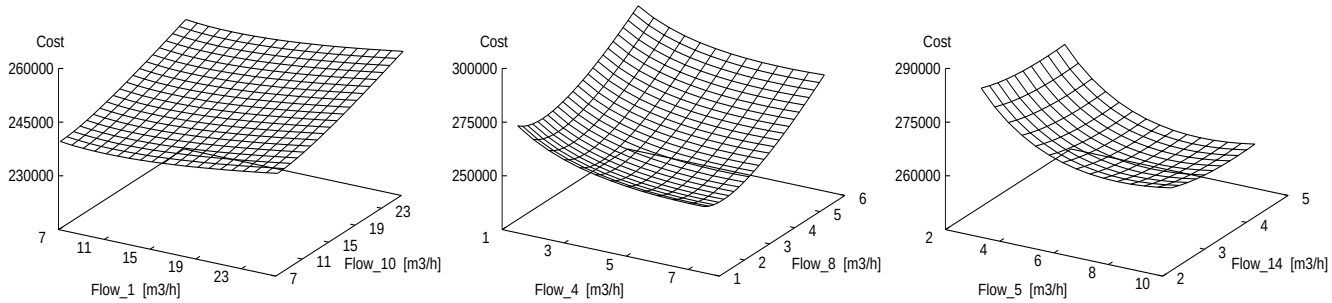

Figure 2: Examples of cost function dependencies on pairs of parameters

gorithm. They were selected as they performed well in solving similar optimization problems for the Acroni steel plant [5, 9]. Both methods iteratively improved candidate solutions represented as real vectors of coolant flow values.

The evolutionary algorithm was run with the population of 20 solutions, applying arithmetic crossover and Gaussian mutation adjusted to perform vector variation with prescribed discretization. The local optimization algorithm relied on the neigborhod relationship among candidate solutions. Two solutions were considered neighbors if differing in the i-th vector component for $\pm p_i^{\text{step}}$. In this way each solution, with the exception of those on the edge of the search space, had $2N_p = 36$ neighbors. The algorithm started from a randomly selected point and was restarted after reaching a local minimum.

For each of the three search space discretizations the algorithms were run five times and their results evaluated statistically. The number of solutions checked (parameter setting evaluated) in each algorithm run was 200 for discretization 1, 500 for discretization 2, and 2000 for discretization 3. No other parameter adjusting was done as this empirical study was a preliminary one.

The performance of the algorithms under different search space discretizations is illustrated in Figure 3 and the results in terms of cost summarized in Table 3. For discretization 1, the performance of random search is also shown to provide an empirical upper bound for the results. In this case, the local optimization algorithm clearly outperforms the evolutionary algorithm, but the cost values produced are still high which indicates the discretization is too rough to allow for detection of the near-optimal solution. With the refinement of discretization better results are found by both methods and their performance compares differently. The finer the discretization, the closer the final results, while in the initial stage of the search the evolutionary algorithm outperforms the local optimization algorithm. The solutions found with local optimization are however not dispersed as with the evolutionary algorithm. It turns out that the more complex the search space the more obvious the efficiency of the evolutionary algorithm in identifying the promising regions which suggests an appropriate hybrid of the two algorithms would reduce the number process simulations needed in the optimization procedure.

Table 3: Summary of the optimization results (EA denotes the steady-state evolutionary algorithm, and ND the next descent local optimization algorithm)

Discr.	Method	Best	Average	Worst	St. dev.
1	EA	24988.8	28965.9	32842.5	2800.8
	ND	13417.9	13794.9	15062.7	716.3
2	EA	10371.3	12466.6	14092.0	1790.4
	ND	9592.9	9592.9	9592.9	0.0
3	EA	9078.5	9194.0	9247.2	73.7
	ND	9070.4	9070.4	9070.4	0.0

5 CONCLUSION

Optimization of coolant flow settings in continuous casting of steel is a key to higher product quality. It is nowadays to a high degree performed through virtual experimentation involving numerical process simulators and advanced optimization techniques. In this preliminary study of optimizing 18 cooling water flows for a Rautaruukki casting machine

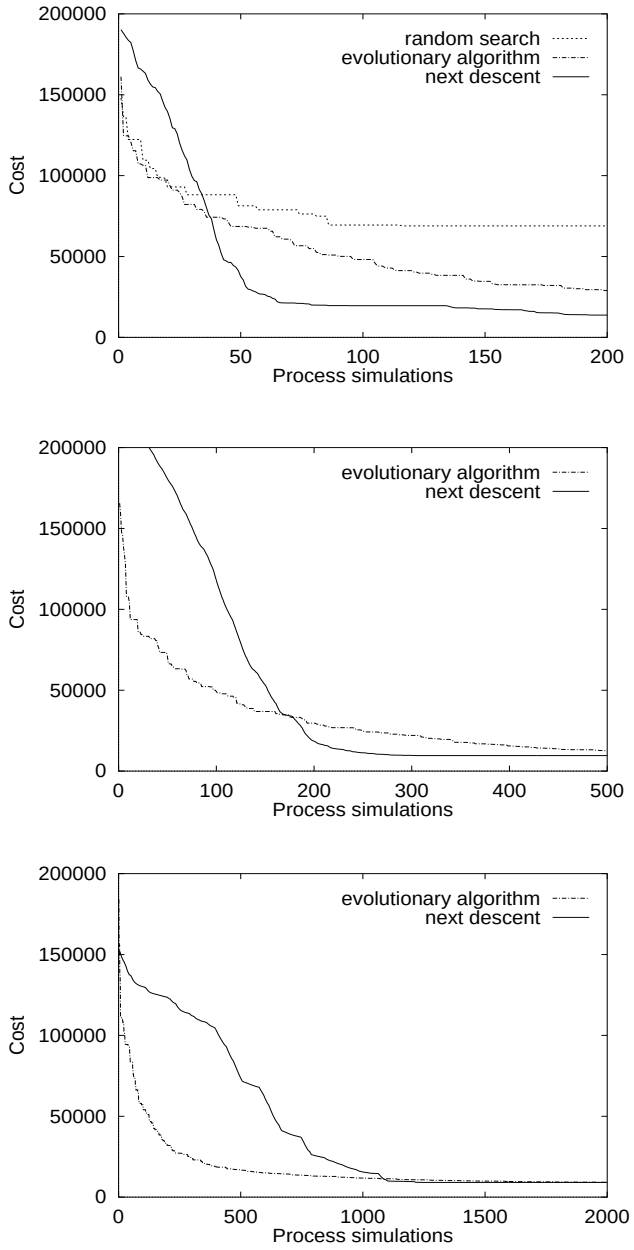

Figure 3: Best-so-far performance of the optimization algorithms averaged over five runs of each algorithm for parameter discretization 1 (top), 2 (center), and 3 (bottom)

under steady-state conditions, an empirical investigation of the problem properties was done, two stochastic algorithm applied and their performance compared. The results indicate the importance of the applied search space discretization and suggest the construction of a hybrid algorithm to find near-optimal solutions in smaller number of solution evaluations. With the same objective in mind the algorithms will be systematically tuned and enhanced with the mechanisms of gradual refinement of the search focus, such as the multilevel technique [7]. On the practical side, the optimized coolant flows will be evaluated with respect to the settings used on the caster machine and checked for potential further improvements of the casting process.

ACKNOWLEDGMENT

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Sistem GOVOREC za sintezo slovenskega govora

Tomaž Šef
Odsek za inteligentne sisteme
Institut "Jožef Stefan"
Jamova 39, 1000 Ljubljana, Slovenia
Tel: +386 1 4773419; fax: +386 1 4773131
e-mail: tomaz.sef@ijs.si

POVZETEK

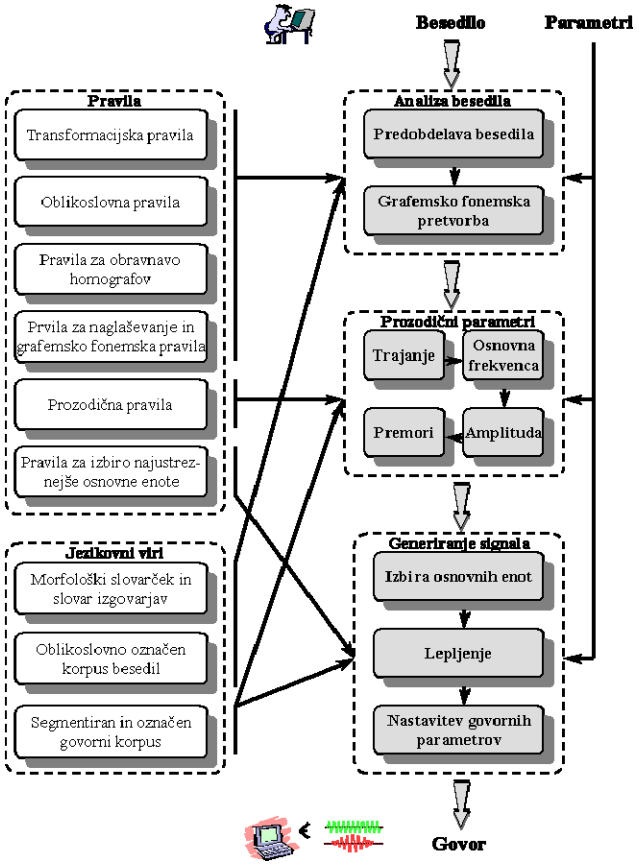
Sistem Govorec za sintezo neomejenega slovenskega govora sestavlja več med seboj povezanih in hierarhično urejenih modulov: to so analiza besedila, nastavljanje prozodičnih parametrov in generiranje govornega signala. V članku so podrobneje opisani zgradba posameznih modulov ter uporabljene tehnike in metode dela. Sistem je zasnovan na obsežnih označenih tekstovnih in govornih korpusih ter je rezultat dolgoletnega raziskovalnega in aplikativnega dela Odseka za inteligentne sisteme na Institutu "Jožef Stefan" in podjetja Amebis. Poudarek je na opisu opravljenih in tekočih raziskav ter izzivov za prihodnost.

1 UVOD

Frederik Hayes-Roth v članku "*AI - What Works and What Doesn't?*", objavljenem v reviji *AI Magazine* [1], uvršča današnje sisteme za generiranje umetnega govora med največje dosežke umetne inteligence. Projekcije predvidevajo občutno povečanje deleža govorne komunikacije človek-stroj v svetu. Razvoj na tem področju je za nekatere jezike dosegel že precej visoko raven [2, 3] in je rezultat načrtnih dolgoletnih raziskav in interaktivnega sodelovanja strokovnjakov različnih tehničnih in humanističnih ved. V Sloveniji je razvoj usmerjen predvsem v raziskave jezikovno odvisnih delov sistema. Pri tem delu gre za izvirne prispevke, saj je vsak govor popolnoma specifičen in s parametri težko primerljiv, vsekakor pa nenadomestljiv z drugimi jeziki oz. parametri govora.

2 ZGRADBA SISTEMA GOVOREC

Tako kot skoraj vsi podobni sistemi v svetu je tudi sistem GOVOREC za sintezo slovenskega govora zasnovan modularno (slika 1). V hierarhični zgradbi modulu za analizo besedila (predobdelava besedila in grafemsko fonemska pretvorba) sledi modul za nastavljanje prozodičnih parametrov (trajanje, osnovna frekvenca, amplituda, premori), temu sledi še modul za končno generiranje govornega signala (izbira osnovne enote, lepljenje, spre-memba govornih parametrov). Modularnost ni omejena le na zgornje tri kategorije, ampak se v veliki meri kaže tudi znotraj njih samih. To omogoča preprosto popravljanje in dopolnjevanje posameznih delov sistema.



Slika 1: *Zgradba sistema GOVOREC za sintezo slovenskega govora*

Vhod v sintetizator je poljubno slovensko besedilo v digitalni obliki, shranjeno v različnih formatih. Med samim besedilom lahko nastajajo različne kontrolne oznake, ki služijo krmiljenju sintetizatorja ali pa so mu v pomoč pri doseganju večje naravnosti umetnega govora. Slednjemu služi tudi vrsta nastavljivih parametrov. Tako lahko spreminjamo način predobdelave besedila, in sicer glede na vrsto besedila, ki ga sintetiziramo (splošna besedila, kratka sporočila, matematični zapisi, časopisni članki, internet, elektronska pošta, črkovanje itd.). Pri nastavljanju prozodičnih parametrov določamo hitrost govora (normalna, hitra, počasna ali katerakoli vmesna stopnja), osnovno frekvenco, pogostnost in trajanje premorov, način naglaševanja besed, izbiramo lahko med različnimi modeli nastavljanja. V modulu za generiranje govornega signala

lahko spreminjamo govorca, način določanja optimalnih enot lepljenja, izbiramo metode in algoritme, ki se bodo izvedli (TD-PSOLA, HNM+, linearna interpolacija, spektralno glajenje, normiranje amplitud na mestih lepljenja, kompresija, oblika izhodnega zapisa). Na izhodu dobimo sintetiziran govor, ki ga predvajamo prek zvočne kartice računalnika. Ker je sintetizator v celoti realiziran v obliki računalniškega programa, ni potreb po dodatni strojni opremi.

3 ANALIZA BESEDILA

Pojem *analiza besedila* uporabljamo za vse metode in postopke, ki jih izvajamo v prvem modulu sistema GOVOREC; to je pri predobdelavi besedila in grafemsko fonemski pretvorbi. Zaradi boljšega pregleda bomo celotni opis razdelili na dva dela, in sicer glede na to, v katerem delu se posamezni postopek izvaja.

3.1 Predobdelava besedila

Najprej različne vhodne formate besedil pretvorimo v standardni zapis in odstranimo vse odvečne simbole, ki ne vplivajo na izgovarjavo besedila. Temu sledijo:

- določitev mej med posameznimi stavki,
- detekcija okrajšav in posebnih zapisov,
- lematizacija (gesljenje): določanje besednih enot za gesla v slovarju,
- določanje oblikoslovnih podatkov posameznim besedam,
- zapis v začetku detektiranih okrajšav v polni obliki,
- razvoj posebnih zapisov v ustrezen grafemski zapis.

Vhodno besedilo obdelujemo poved za povedjo. Pri tem štejemo za poved vsako zaporedje grafemov, ki se konča s končnim ločilom (pika v skladenjski rabi, vprašaj, klicaj, tri pike, EOF - konec datoteke).

Posebne zapise določimo na podlagi seznama vzorcev, ki posamezni zapis opredeljujejo. Do njih smo prišli na podlagi analize obsežne zbirke primerov. Trenutno ločimo med naslednjimi posebnimi zapisi: deljenje besed, začetki in konci odstavkov, naslovi, poudarjene besede, kratice oz. akronimi (npr. SIT za slovenski_tolar), okrajšave besed (npr. g. za gospod), posebni simboli oz. ideogrami (npr. % za odstotek), merske in druge enote, datumi, ure, matematični zapisi, rimska števila, števniki, kolokacije. Posamezne sezname vzorcev lahko optimaliziramo tudi glede na področje uporabe sintetizatorja. Tako se npr. seznami vzorcev za sporočila, novice in podobno razlikujejo od tistih za branje matematičnih zapisov, e-pošte itd.

Rezultat normalizacije je besedilo, razdeljeno na posamezne manjše enote:

- posebni zapisi: določimo tip zapisa, pripišemo mu ustrezno oblikoslovno oznako in shranimo navodilo za njegovo nadaljnjo obravnavo;
- znane besede: iz slovarja prepišemo vse mogoče oblikoslovne oznake in ustrezne izgovarjave ter jih razvrstimo v ustrezne kategorije (npr. navadna beseda, lastno ime, del naslova, glavni števnik, morebiten pomen besede itd.);
- neznane besede (ne nahajajo se v morfološkem slovarčku in slovarju izgovarjav): glede na sosednje besede poiščemo vse potencialno mogoče oblikoslovne oznake;
- ločila v skladenjski funkciji.

V tem koraku obdelamo tudi posebna zaporedja znakov, ki služijo za krmiljenje samega sintetizatorja. Zapise najprej dekodiramo, da izluščimo njihovo informacijo (npr. hitrejša izgovarjava, višji ton, premor), ki jo nato posredujemo na ustrezna mesta znotraj posameznih enot.

Pri zapisu okrajšav v polni obliki in pri razvoju posebnih zapisov v ustrezen grafemski zapis, kakor tudi pri grafemsko fonemski pretvorbi, si v veliki meri pomagamo z oblikoslovnimi podatki besed, ki so v povedi. V pomoč so nam še razna pravila za obravnavo homografov. Pri tem ni pomembno, da je beseda le pravilno zapisana, ampak mora biti pravilna tudi v kontekstu.

Sestavni del našega algoritma je tako tudi *oblikoslovni označevalnik*. Za osnovo smo, podobno kot P. Jakopin [4], uporabili statistični pristop, ki se opira na slovar besednih oblik z vsemi mogočimi oznakami, slovar pogostejših besednih n-terčkov (n=2-5; frekvenca je vsaj 2) z oznakami in slovar n-terčkov oznak (n=2-5). N-terčki vsebujejo tudi frekvence, kar omogoča, da med postopkom spremljamo, kolikokrat se je vsaka izmed mogočih oznak pri opazovani besedi pojavila, in seštevamo vmesne frekvence te oznake. Tako lahko v preostalih dvoumnih primerih med preostalimi oznakami izberemo najpogostejšo. Vse skupaj temelji na obsežnih oblikoslovno označenih tekstovnih korpusih besedil, ki jih prispeva podjetje *AMEBIS*; poleg tega prispevajo tudi modul za stavčno analizo in morfološki slovar z okoli 70.000 lemami (700.000 različnih besednih oblik oz. 2.000.000 vnosov - ob upoštevanju vseh oblikoslovnih oznak posamezne besedne oblike).

3.2 Grafemsko fonemska pretvorba

Postopek poteka v več korakih in obsega:

- naglaševanje neznanih besed (tistih, ki jih ni v slovarju izgovarjav),
- detekcijo in analizo homografov (besed z enako pisno podobo in različnimi izovarjavami),
- določitev izgovarjave besed in imen.

V sistemu GOVOREC naglaševanje besed v osnovi temelji na slovarsko podprti analizi besedila. Pri tem uporabljamo prej omenjeni morfološki slovar s 70.000 lemami, ki smo ga s pomočjo v ta namen razvitega algoritma [5] dopolnili še s podatki o naglasu in posebnostih v izgovarjavi nekaterih besed. Agoritem (okoli 50.000 vrstic programske kode in pripadajoči slovar) omogoča pravilno izgovarjavo skoraj 300.000 lem, kar pomeni več milijonov različnih besednih oblik. To je več, kot jih zmore povprečen Slovenec. Tako najdemo več kot 99 odstotkov vseh iskanih besed (brez upoštevanja imen).

Za vse besede, ki so v slovarju, prepišemo mesto in vrsto tako dinamičnega kot tonemskega naglasa. Preostale besede

naglasimo v dveh korakih. Najprej za vsak samoglasnik in soglasnik 'r' v besedi preverimo, če je naglašen; za naglašene glasove določimo tudi tip naglasa. Sledi popravljanje tako dobljenih rezultatov glede na število naglasov v besedi in dolžino besede. Uporabimo avtomatsko generirana pravila, do katerih smo prišli z analizo fonetičnega slovarja. Pri učenju pravil smo upoštevali 67 atributov, na podlagi katerih učne vzorce razvrščamo v ustrezne razrede (vrsta naglasa, tip naglasa, prisotnost naglasa, širok ali ozek samoglasnik). Uporabljen je bil Quinlanov algoritem *See5/C5.0* [6]. Tako lahko pravilno naglasimo nepoznano slovensko besedo z več kot 83 odstotno natančnostjo. Podrobnejši opis uporabljenih postopkov in potek testiranja je podan v [7].

Odprto ostaja le še vprašanje naglaševanja raznih imen. Naš slovar do sedaj obsega nekaj tisoč takih lem (oziroma nekaj deset tisoč različnih besednih oblik), ki jih sproti dopolnjujemo, predvsem s pogostejšimi imeni iz dnevnega časopisja in preostale literature.

Več izboljšav je bilo narejenih tudi pri združevanju besed v daljše enote, kjer naletimo na problem homografije. Izkazalo se je, da lahko v povprečju vsako deseto besedo obravnavamo kot homograf. Na srečo je ponavadi ena izgovarjava veliko verjetnejša od preostalih, kar zmanjšuje verjetnost napake. S pomočjo slovarja izgovarjav smo določili nekaj tisoč homografov, ki smo jih nato razvrstili v skupine (glede na lemo in oblikoslovno oznako), iz obsežne zbirke primerov (2.000.000 besed) pa smo izluščili pravila za njihovo obravnavo. Ta upoštevajo tudi osnovni pomen nekaterih besed. Predstavljena pravila [5] dobro rešujejo predvsem najpogostejše primere in s tem precej zmanjšajo količino napak.

Pri določitvi izgovarjave besed in imen uporabljamo sezname kontekstno odvisnih grafemsko fonemskih pravil. Ta zajemajo tudi pojave, ki nastopajo pri glasovih zaradi soseščine drugih glasov. V primerih, ko poznamo oblikoslovne lastnosti besede, uporabimo specifična pravila, ki veljajo le za posamezno besedno vrsto [5]. Za druge besede pa so pravila bolj splošna.

4 NASTAVLJANJE PROZODIČNIH PARAMETROV

Nastavitev prozodičnih parametrov obsega določitev časa trajanja, osnovne frekvence, glasnosti in trajanja premorov. Večjo naravnost in razgibanost umetnega govora dosežemo predvsem z raznimi preslikavami (pri času trajanja) med označenim govornim korpusom in konkretnim besedilom, ki ga sintetiziramo.

Trajanje glasov nastavimo v dveh korakih: najprej za vsak glas določimo njegovo osnovno trajanje (na podlagi inherentnega trajanja glasu, njegovega glasovnega okolja, položaja glasu v besedi in strukture zloga, v katerem je glas), ki ga v nadaljevanju popravimo glede na želeno hitrost govora, število zlogov v besedi in položaj besede v frazi. Vrednosti trajanja glasov avtomatično izluščimo iz označenega govornega korpusa posameznega govorca. Če je ta premalo obsežen, uporabimo predhodno izmerjene vrednosti, ki jih ustrezno prilagodimo.

Osnovno frekvenco glasov nastavimo s "superpozicijskim" modelom, ki potek osnovne frekvence v intonacijskem segmentu definira kot vsoto globalne komponente in lokalnih komponent [8]. Globalna komponenta definira osnovno raven poteka v celem intonacijskem segmentu, lokalne komponente pa pomenijo lokalna naraščanja in padanja pri poudarjenih delih besedila.

Glasnost govora lahko v sintetizatorju poljubno nastavljamo. Poleg tega se glasnost govora spreminja še glede na stavčne poudarke v besedilu.

Glede na dolžino premorov in na položaj v besedilu *ločimo štiri skupine premorov* [8]: premori pri naslovih, premori na koncu povedi, premori v povedi na mestih ločil in premori v povedi na mestih ritmičnih delitev (pred vezniki in, pa, ter, ali ...) v daljših stavkih, ki jih premor razdeli na krajše intonacijske segmente.

5 GENERIRANJE GOVORNEGA SIGNALA

Sam postopek sinteze govornega signala temelji na korpusni sintezi govora. Govorna zbirka pri najbolj dodelanem moškem glasu (poklicni govorec s slovenskega nacionalnega radia) obsega 1509 difonov, 1568 besed in 139 skrbno izbranih in fonetično uravnoteženih stavkov. Velikost potrebnega pomnilnika je zmanjšana z različnimi postopki stiskanja govornega signala.

Predlagani algoritem za izbiro najustreznejših enot deluje na ravni povedi, pri čemer upošteva različne parametre, kot npr. spektralne karakteristike na mestih spajanja, dolžino predlagane osnovne enote, njene prozodične parametre ter vrsto in tip fonemov na mestih spajanja. Trajanje in osnovno frekvenco glasov po potrebi dodatno popravimo s pomočjo algoritma TD-PSOLA [9] ali HNM+ [10].

Trenutno lahko izbiramo med tremi moškimi glasovi, dodati pa nameravamo še ženski in otroški glas.

6 SKLEP

Sistem Govorec za sintezo slovenskega govora je bil uporabljen v številnih aplikacijah in ima več skupin uporabnikov (posredovanje informacij o prostih delovnih mestih; uporabljajo ga člani Zveze društev slepih in slabovidnih Slovenije - prva nagrada Sklada za nagrajevanje inovacij na področju usposabljanja, življenja in dela invalidov; testira ga več podjetij s področja računalništva ter telekomunikacij za gradnjo dinamičnih govornih portalov itd.). Stara verzija Govorca (v precej okrnjeni obliki; difonska sinteza, brez slovarjev, samo en glas) je dostopna tudi preko interneta na naslovu *http://ai.ijs.si/Govorec/* in se lahko uporablja v nekomercialne namene.

Cilj trenutnih in prihodnjih raziskav s področja govornih in jezikovnih tehnologij je ustvariti sintetizator slovenskega govora, ki bi bil primeren za čim širši krog uporabnikov. V prvi vrsti je potrebno poskrbeti za ustrezno velik in primerno označen govorni korpus, ki bo omogočil dokončen prehod na kvalitetno korpusno sintezo govora. Tu pa je potrebno predvsem veliko volje ter napornega in mukotrpnega dela. Šele potem bodo prišle do izraza vse do sedaj opravljene raziskave in razvoj s katerimi smo v veliki

meri rešili problem naglaševanja slovenskih besed. V prihodnje nameravamo več truda vložiti v raziskovanje problematike povezane s homografi. Poleg tega nam bo dovolj velik govorni korpus omogočil, da metode strojnega učenja preizkusimo še pri nastavljanju prozodičnih parametrov umetno generiranega govora.

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Construction of domain ontologies from tables

Aleksander Pivk, Matjaž Gams
Department of Intelligent Systems
Jožef Stefan Institute
Jamova 39, SI-1000 Ljubljana, Slovenia
aleksander.pivk@ijs.si, matjaz.gams@ijs.si

Abstract

Turning the current Web into a Semantic Web requires automatic approaches for document annotation, since manual approaches will not scale in general. The focus of the paper is on automatic transformation of arbitrary table-like structures into knowledge models, i.e. frames, and on the extension for merging of frames into domain ontologies. The presented work is based on Hurst's table model and consists of a methodology, an accompanying implementation named TARTAR, and a thorough evaluation. The evaluation showed over 80% success rate of automatic transformation of tables into semantic representations and 100% accuracy in the task of query answering over the table contents.

1 Introduction

Most information on the Web is presented in the form of semi-structured or unstructured documents, encoded as a mixture of loosely structured natural language text and template units. Tabular structures are one of the most popular and commonly used structures when it comes to presenting, visualizing or comparing data. The lack of metadata, which would precisely annotate the structure and semantics of documents, and ambiguity of natural language makes automatic computer processing very complex [1]. The Semantic Web aims to overcome this bottleneck. It relies on annotating resources such as documents by means of ontologies, enabling better and faster discovery of relevant information. Most efforts have been so far devoted to automatic generation of ontologies from arbitrary text, where quite poor results have been obtained. The research concentrates on analysis of tabular structures aiming to exploit their partial structure and cognitive modeling habits of humans. Understanding of table contents requires table-structure comprehension and semantic interpretation, which exceed the complexity of corresponding linguistic tasks.

The central contribution of the paper is twofold: (a) presents a novel method for automatic generation of knowledge models such as frames from arbitrary tabular structures, e.g. found on the Web and encoded in HTML; (b) presents a novel method for creation of more complex knowledge models such as ontologies, by merging generated frames. The outcome of applying these methods is threefold: a knowledge frame for each incoming table, a domain ontology created from all generated frames, and a knowledge base, all encoded in an F-Logic representation language. These structures are directly applicable for different scenarios, i.e. query answering (see Figure 1).

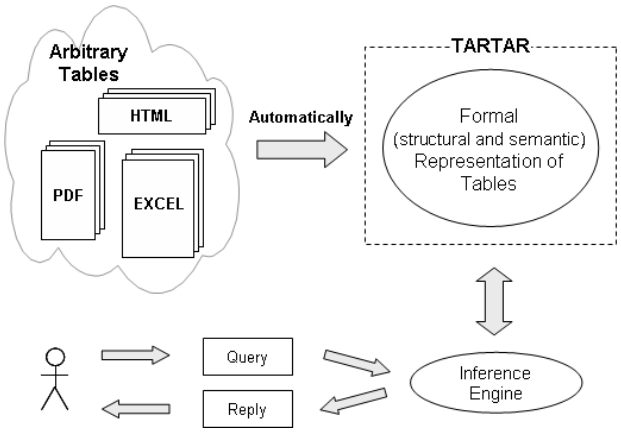

Figure 1: The general schema of the approach.

2 Methodological description of the approach

The most comprehensive and complete model for the analysis and transformation of tables, found in literature, is Hurst's [2], which was also adopted in the thesis. The model analyzes tables along graphical, physical, structural, functional, and semantic dimensions. Our approach stepwise instantiates the last four dimensions.

In the first step, corresponding to the physical dimension, a table is extracted, cleaned, canonicalized, and transformed into a regular matrix form.

In the second step, the goal is to detect the table structure. This is a very complex task, since there is a huge number of table layout variations. The three most important sub-tasks are: (a) determine table reading orientation(s), which is discovered by measuring the distance

among cells, and hence among rows and columns; (b) dismember a table into logical units and further into individual regions, in a way that regions consist of only attribute or instance cells; (c) resolve the table type, which must belong to the one of five pre-defined types. For these purposes several techniques, heuristics, and measures are used, i.e. token type hierarchy, value similarity (regression), value features (character/numeric ratio, mean, variance, standard deviation), data frames, and string patterns.

In the third step, the functional table model (FTM) is constructed. FTM is represented as a directed acyclic graph, which rearranges table regions in a way to exhibit a global path for each individual cell. After finalizing the FTM construction also its recapitulation is carried out, with a goal to minimize the model.

Finally, in the fourth step we deal with the discovery of semantic labels for table regions, where WordNet [7] lexical ontology and GoogleSets service are employed. These semantic labels serve as annotations of FTM nodes and are later also used within outgoing formal structures.

At the end of table analysis and transformation, a frame is generated out of an FTM. The frame makes explicit the meaning of cell contents, the functional dimension of the table, which is comparable to the relational schema, and the meaning of the table based on its structure. Figure 2 depicts a simple table-to-frame transformation, and a corresponding part of a knowledge base.

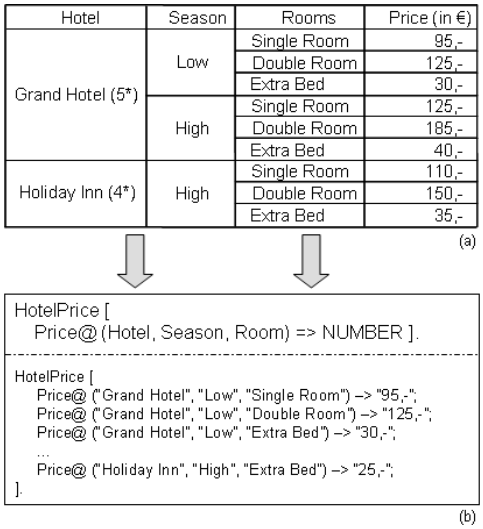

Figure 2: An example of a table-to-frame transformation.

In general, our method is not bound to a single document type nor domain, hence it can be applied to any table layout description (i.e. html, excel, pdf, text, etc.). This indicates that there are no domain-specific operations and no specific knowledge incorporated in the approach. A domain is chosen by a supervisor in order to ensure the semantic similarity of involved tables, making it possible to create ontologies. Note that only the first transformation step (physical dimension) must be specialized for the incoming document encoding, the remaining steps are independent. This makes the approach very flexible and easily extensible.

The transformation method is implemented within a system named TARTAR (Transforming ARbitrary TAbles into fRames), consisting of 15.000 lines of code written in Java programming language. Its sources are freely available at `http://dis.ijs.si/sandi/work/TARTAR/`. The system presents a component of a multi-agent system OntoGeMS (Ontology Generation Multi-agent System), which is applicable also for automatic construction of domain-dependent sets, consisting of proper Web tabular structures only.

3 Domain Ontology Construction

Tables with different structure that belong to the same domain, all transformed into frames, could be merged into a single domain ontology. In this way, a generalized representation that semantically and structurally describes captured tables would be created. This would most importantly provide an immediate way to generate annotated pages for the exploitation of Semantic Web aware computer agents, improve scalability, and reduce complexity. Figure 3 depicts an initial idea, where as an input serves a set of same-domain tables, that are transformed into frames, and finally merged into an ontology.

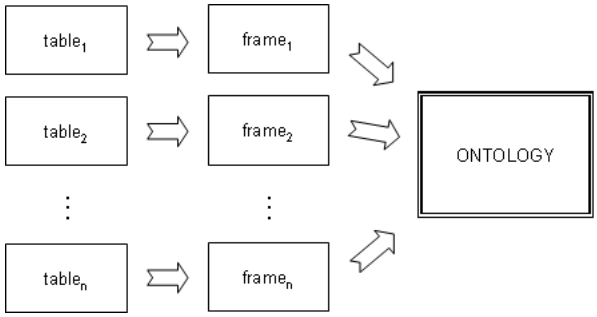

Figure 3: A process of ontology creation by merging different frames.

Our approach to frame matching is multifaceted, which means that we use all evidence at our disposal to determine how to match concepts. In using this evidence we look not only for direct matches as is common in most schema matching techniques, but also indirect matches. The most relevant matching techniques are the following:

- *Label Matching*: this technique depends on WordNet features such as synonyms, word senses, and hypernyms/hyponyms. Besides WordNet also string distance metrics, such as Levenshtein edit-distance,

fast heuristic string comparators, token-based metrics, and hybrid methods are used. These modified measures are particulary useful when name matching is obscured by shortened mnemonic names, abbreviations, and acronyms, which are often found in table headers.

- *Value Similarity*: matching of different object sets is based on value characteristics such as alphanumeric features including length, alpha/numeric ratio, space/nonspace ratio and numeric features such as mean and variance. Gaussian value matching and regression matching allow us to match imprecise but highly correlated value sets, such as price values, or insurance rates.

- *Expected Values*: using constant value recognizers in data frames ensure that finding and matching expected values in value sets provides significant leverage in schema matching. Being able to recognize values such as distances, dates, times, currencies, percentages, etc., helps us match object sets. Data frames recognizers also help distinguish labels from values in tables, decompose or compose value strings for matching, and determine whether value sets are unions or subsets of other value sets.

- *Constraints*: include keys in the table (as well as non-keys), functional relationships, one-to-one correspondences, subset/superset relationships, and optional and mandatory constraints involving unknown and null values. Constraints can be also derived from typed hierarchies and recurrent patterns.

- *Structure*: a matching algorithm was developed that is based on structural context, where features such as proximity, node importance measured by in/out-degree, and neighbor similarity help match object sets.

Once the mappings among frames have been discovered, the merging process begins. Sometimes the match is such that two frames are directly fused by simply merging corresponding nodes and edges. Often, however, merging induces conflicts that must be resolved, where several different approaches for conflict resolution are used. Conflict resolution will not be discussed in detail in this paper due to paper length limits.

Initially, we look for the frames that exhibit the largest possible overlap (as measured by the number inter-frame mappings) with respect to the size of considered frames to be merged. Thereafter frames that overlap the most with the growing ontology are selected individually for merging. Finally, after all frames are incorporated, the outcome is a domain ontology, where the concepts are arranged into a directed acyclic graph, with the arcs representing relations among concepts and also the types of relations. Eventually, a knowledge base is created by formalizing the table contents according to the newly generated formal structure.

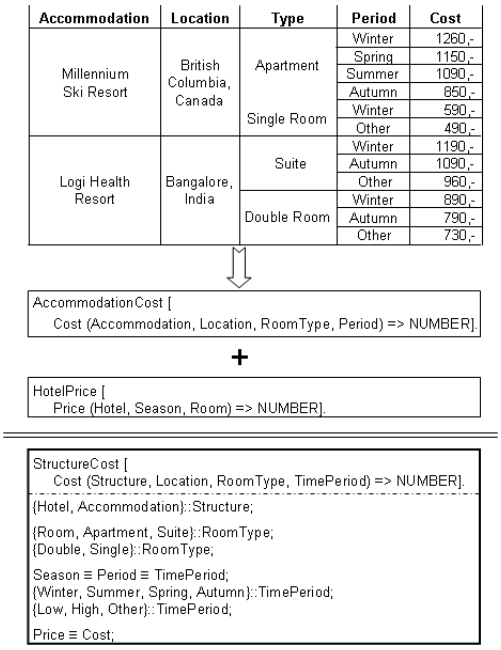

Figure 4: A simple example of the ontology creation process.

Figure 4 illustrates a simple example of the ontology creation process by merging two same-domain tables, where second table is shown in Figure 2. Both tables deal with hotel price information but the naming convention and contents are different. The matching of the frame concepts and object sets are based on several techniques, i.e. Label Matching and Structure help determine the concept matching, Value Similarity and Expected Values apply to price, room type, and period value matching. The domain ontology is presented as a frame, but its concepts are further classified, where for the representation purposes F-Logic notation is used. For example, concept 'Hotel' and 'Accommodation', according to the WordNet, share a common hypernym 'Structure'; values 'Double/Single Room', 'Apartment', and 'Suite' become concepts and are hierarchically organized under a 'RoomType' concept; the same thing happens to season periods. Also note that concepts 'Price' and 'Cost' share the same synset in WordNet, which is in the ontology described by an equivalent operator (≡) among them. In this way a common ontology covering both frames is generated, which enables ontology population, automatic query answering, and annotation.

In some cases, when there is no overlap among tables, or only few table are in the processing loop, a possible deficiency of the final domain ontology is that it could be too general or have only little (or none) common concepts and hence be useless for further exploitation. This is even more probable if we only depend on limited number of (semantic discovery) resources and tech-

niques. The lack of the specific ontology is possible from the following aspects: its size (could grow fast by adding new frames), poor connectedness (due to unsuccessful merging process), and hence sparse instance values. We suspect that using (a kind of) a domain specific ontology could enhance the resulting ontology, but this is yet to be verified.

4 Empirical results

The empirical evaluation is performed from the following perspectives: efficiency, usability, and applicability.

The efficiency E of the approach is measured according to the portion of correctly transformed tables belonging to two domains, tourist (E_t) and geopolitical (E_g), also enabling to prove the approach domain independency [5]. The efficiency reached 84.52% ($E = \frac{1}{2}(E_t + E_g) = \frac{1}{2}(\frac{289}{369} + \frac{313}{345})$).

The usability of the approach is shown in terms of the agreement among system-generated frames against manually annotated ones. The analysis showed that the system is getting appropriate formal representations from a structural and semantic point of view in almost 75% of cases and totally identical representations in more than 50% of cases [4].

Approach applicability is shown from two views. By querying the content of tables, formalized according to the domain ontology, and encoded in the knowledge base, it is shown that returned answers are true and complete in all cases [3]. The query execution is enabled by an inference engine OntoBroker [6].

The strict evaluation of the frame merging process is yet to be verified.

5 Conclusion

Most efforts in bridging the gap between the current Web and the Semantic Web are devoted to automatic generation of ontologies from unstructured text, where the results are still quite poor. By limiting the problem domain to tabular structures, we show that the automatic transformation into Semantic Web is feasible and gives much better results than from text, even though some operations exceed the complexity of corresponding linguistic tasks.

In the paper we present novel methods for automatic transformation of arbitrary table-like structures into frames and their merging into more complex, formalized, knowledge models, i.e. ontologies. The frame construction method is based on Hurst's cognitive table model, which covers five aspects of table analysis, where four of them are stepwise instantiated and implemented within TARTAR system. The approach is based on heuristic algorithms and methods since Hurst's model is inherently heuristic. The merging method incorporates several techniques for matching concepts and object sets. The evaluation of the approach shows that the method provides good results in term of efficiency and usability and is thus applicable in practice.

There is one interesting future research direction: use of several machine learning techniques in different levels of our approach, i.e. to eliminate (some) heuristics, or to enable better scalability in a merging process.

Acknowledgment

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Discovering Strategic Multi-Agent Behavior in a Robotic Soccer Domain

Andraž Bežek, Matjaž Gams
Department of Intelligent Systems
Jožef Stefan Institute
andraz.bezek@ijs.si, matjaz.gams@ijs.si

Abstract.
This paper presents an algorithm for multi-agent strategic modeling (MASM) applied in a robotic soccer domain. The method makes use of hierarchically ordered domain knowledge and transforms a multi-agent action sequence into a set of strategic action descriptions in the form of graph paths, agent actions, roles and corresponding rules. The method was evaluated on the RoboCup Soccer Server Internet League data.

1. Introduction

Multi-agent game modeling deals with the following task: How can external observation of multi-agent systems be used to analyze, model, and direct agent behavior? Analysis of such systems must thus capture complex world state representation and asynchronous agent activities. Instead of studying pure numerical data researchers often use knowledge-level structures, such as rules and decision trees. Although being extremely useful when characterizing state space, they lack the ability to clearly represent temporal state changes occurred by agent actions. Comprehending simultaneous agent actions and complex changes of state space is therefore not trivial. To capture such qualitative information, most often a graphical representation performs better in terms of human understanding.

This paper addresses the problem of qualitatively and quantitatively representing strategic activity of multi-agent systems (MAS). Our goal was to create an algorithm that would discover strategic agent behavior and enable humans to understand and study the underlying behavioral principles. The presented MASM algorithm translates multi-agent action sequence and observations of a dynamic, complex and multivariate world state into a graph-based and rule-based representation. By using hierarchically ordered domain knowledge the algorithm is able to generate strategic descriptions and corresponding rules at different levels of abstraction. The MASM scheme is presented in Figure 1.

Our approach is applied on a RoboCup Simulated League domain (RoboCup) [5.], a multi-agent domain where two teams of 11 agents play simulated soccer games. The domain accurately simulates a physical 2D soccer but introduces uncertainty by adding noise when calculating forces on objects. Continuous time is approximated with discrete cycles. All agents can move and act independently as long as they comply with soccer rules. Agents communicate with each other, but their visual and hearing perception is distance-limited. The domain is a complex MAS but its soccer-related content makes it easily understandable by humans. It is therefore a challenging multi-agent modeling domain.

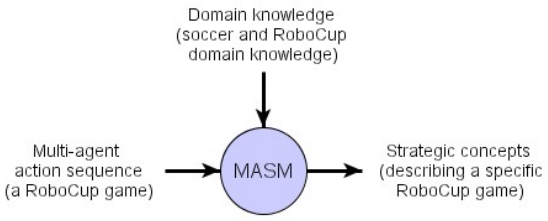


Figure 1: Scheme of the MASM.

This paper is organized as follows. Section 2 thoroughly presents the whole MASM algorithm as a 5 step process. In Section 3 an evaluation of the described method is given and discussion in Section 4.

2. Multi-Agent Strategic Modeling

Multi-agent strategic modeling (MASM) is a process that transforms raw multi-agent action sequence into a set of discovered strategic action descriptions with corresponding rules. A *strategic action description* is a description of an agent behavior that exhibits some strategic activity. A *strategic activity* is a time-limited multi-agent activity that exhibits some important or unique domain-dependant characteristics. We present a new MASM algorithm which consists of 5 steps. Each step is thoroughly described in a subsequent subsection.

2.1. Introduction of Domain Knowledge

MASM algorithm exploits domain knowledge through taxonomies of domain concepts. Taxonomy is a hierarchical representation of domain concepts. A concept x in a taxonomy is an ancestor of a concept y, $x \leftarrow y$, if it exhibits more general concept than the concept y. The rationale behind using hierarchically ordered domain knowledge is that this allows MASM algorithm to travel up and down in the hierarchy to produce more or less abstract descriptions. Specifically, MASM algorithm makes use of:

- a taxonomy of agent roles
- a taxonomy of agent actions
- taxonomies of binary domain features

As agents in MAS can change roles and thus change their behavior [4.], agent roles are assigned dynamically during

agent activity. Each agent action is assigned with its corresponding hierarchical representation. Domain features are used to identify the truth of some particular domain feature but only with an association with another agent. For example, in a RoboCup domain the feature *HasBall* is true only for agent which controls the ball, and is false for all other agents. Agent's roles and actions are used to describe the activity of agents, while domain features are used to describe the domain state space. An example assignment of soccer role and action concepts is presented in Figure 2.

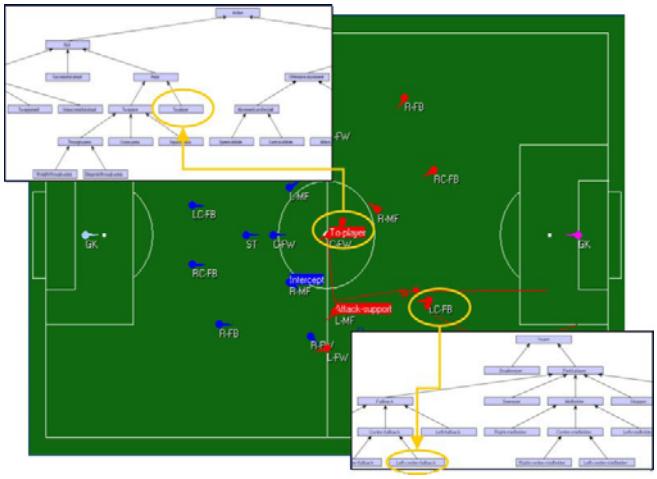


Figure 2: An example assignment of hierarchical role and action concepts

2.2. Action Graph Representation

An *action graph* (AG) is a directed graph, where nodes represent state space at the start of agent action and connections correspond to agent actions. Nodes *a* and *b* are connected, $a \rightarrow b$, if an action, represented by node *a*, is followed by an action, represented by node *b*. Terminal actions (i.e. the last action in an action sequence) are connected to a terminal node. For example, an action sequence {a,b,c} is represented as an AG: $a \rightarrow b \rightarrow c \rightarrow c_{end}$. Node positions are calculated from agent positions in a domain space. An appropriate hierarchical action and role concepts are assigned to each node. This enables the MASM algorithm to generate more abstract descriptions of agent role and actions. Each node also keeps an original action instance (i.e. time cycle of an action in a soccer game) of the represented action. A more detailed description of action graphs and the construction process is given in [1.]. An example action graph, obtained from actions in a RoboCup game, is presented in Figure 3.

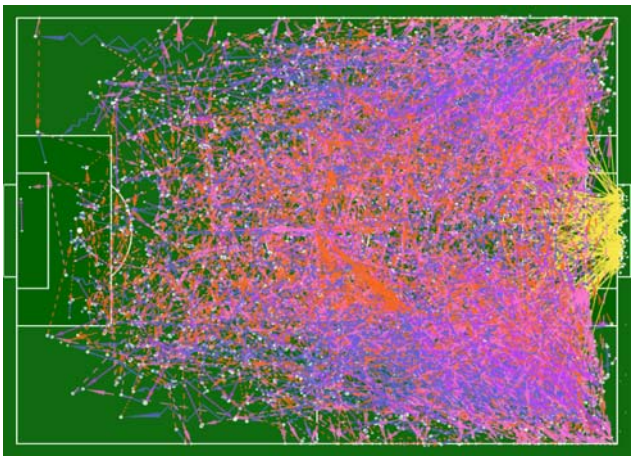


Figure 3: An example action graph

2.3. The Abstraction Process

Complex action graphs with many nodes are difficult to present in an acceptable manner and are thus difficult to comprehend by humans. A reasonable approach to overcome this problem is to reduce the number of nodes. However one would like to reduce action graph nodes in a manner to preserve captured action concepts.

This can be accomplished with hierarchical clustering of graph nodes. By merging the nearest two graph nodes, we generate a new node that represents common role and action concepts (i.e. first hierarchically common parent of both concepts). The rationale behind the merge process is that actions, frequently occurring near in domain space, define some important strategic concepts. The distance between graph nodes is defined as a weighted sum of distances between node positions and conceptual distances between role and action concepts. A more in depth description of the distance function and the whole abstraction process is described in [2.].

The clustering process results in an *abstract action graph* (AAG), which is an action graph where graph nodes represent more than one agent action. It is expected that abstract action graph describes agent behavior in a more abstract way than the original action graph. An abstract action graph, where minimal distance between nodes is greater than some value *dist*, is labeled AAG_{dist}. Such graph can be achieved with repeated merging of nearest nodes until the minimal distance between nodes is grater than *dist*. An *action description* of a node in AAG_{dist} is a combination of a node position, corresponding action and role concepts and a parameter *dist*. We claim that AAGs with greater value dist represent actions in a more abstract way that AAGs with a lower dist value. Therefore, the value of a dist parameter can be regarded as a value of abstraction of an AAG. An example abstract action graph A_{10} is presented in Figure 4.

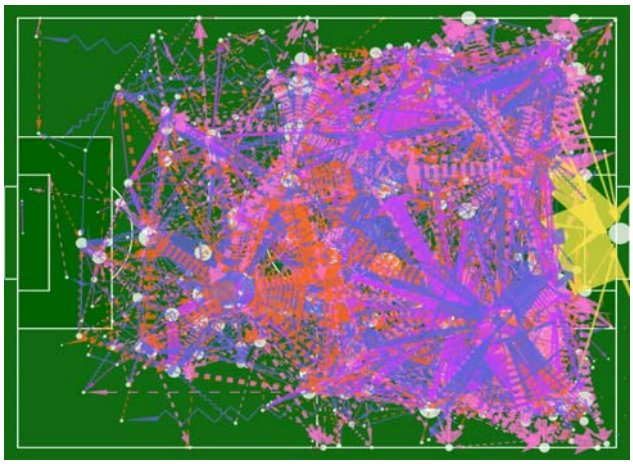


Figure 4: An abstract action graph (AAG_{10})

2.4. Detection of Strategies

A *strategy* is similar and frequent multi-agent activity that leads to a strategic situation. In abstract action graph it is represented as a path. Path nodes thus represent a sequence of strategic actions. For example, an obtained strategic action sequence presented in Table 1 corresponds to strategy shown in Figure 5. The sequence is strategic because it describes a strategic soccer situation - a successful shoot. Again, a strategy generated from AAG with a greater dist value is more abstract that the one generated from AAG with lower dist value.

LTeam.R-FW: Long-dribble	LTeam.R-FW: Square pass	LTeam.C-MF: Succesful-shoot	LTeam.C-MF: Succesful-shoot (End)

Table 1: A strategic action sequence

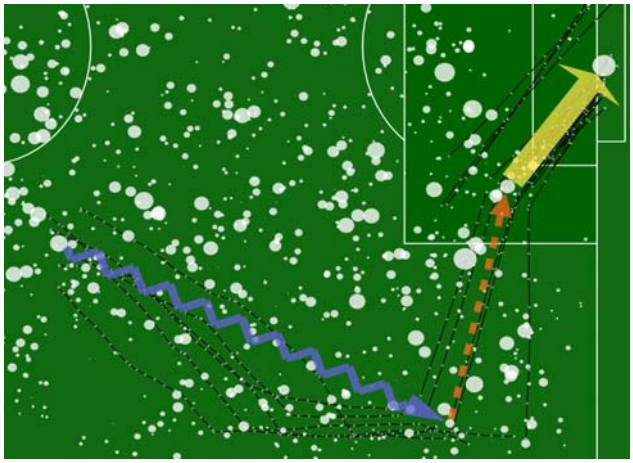


Figure 5: Strategy, a path in abstract action graph

2.5. Dataset Generation and Rule Induction

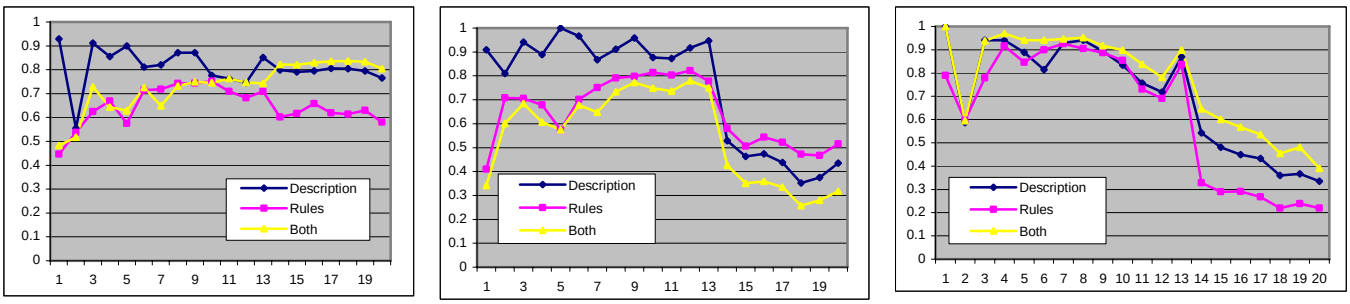
As each node defines unique action concept it can be used to generate rules that describe this specific agent action. We generate data suitable for rule inducing algorithms as follows. Positive examples are action instances in a target node and negative examples as instances in nearby nodes (i.e. near misses). For each instance we generate all pairs of agent role-domain feature and store the true ones. However, the standard feature-value approach is not suitable here. Namely, agents dynamically change roles and thus it is impossible to generate feature values for all roles. More appropriate approach is to define *set-valued attributes*, that is attributes which domain is a set instead of a value. Therefore, each feature corresponds to one set-valued attribute where the value is a set of agent roles, whose corresponding agent-feature pair is true. By using set-valued rule inducer, such as SLIPPER [3.], MASM algorithm is able to generate rules that describe actions in a strategy. For example, a rule describing a node, which represents an action concept *Successful-shoot* performed by an agent with a role *left team center midfielder*, is presented in Table 2.

ball:Penalty-box ∧ ball:Right-half ∧ ball:Fast ∧ LTeam.C-MF:Has-ball ∧ LTeam.R-FW:Moving-away ∧ LTeam.R-FW:Medium-dist ∧ RTeam.R-FB:Back ∧ RTeam.C-FB:Back ∧ RTeam.L-FB:Back.

Table 2: Rules that describe a successful shoot by a left team's center midfielder

3. Evaluation

We evaluated the MASM approach on 10 RoboCup games played during SSIL [6.]. A leave-one-out strategy was used to generate 10 learning tasks. A pre-determined strategy, shown in Table 1 and in Figure 5, was used as a reference and was generated on all 10 games, for AAG_1 to AAG_{20}. For each learning task, a strategy was generated on 9 games and tested on the remaining game, again for AAG_1 to AAG_{20}. Tests measured the difference between action descriptions, the quality of generated rules for all four action concepts and joint use of rules and together with action descriptions. The results presented in Table 3 are averaged results obtained during 10 tests where x-axis presents the value of a parameter *dist*. The results in Table 3 a) indicate that the accuracy of action descriptions is approximately constant with the abstraction. However, the accuracy of rules increases until it peaks at dist=10 and then slowly decreases. This is expected because for lower abstractions, nodes represent only a few action instances consequently prohibiting rule inducer to generate good rules. This is different with high dist values where nodes represent quite different action concepts, thus producing more abstract and less accurate rules. But using rules and action descriptions together gives the best results with higher dist values. When measuring tp rate, that is the rate of correctly classifying true cases, all test scenarios give similar results as shown in Table 3 b). That is, that the quality of classifying true cases increases until about dist=12 but then quickly drops. The similar phenomenon is observed when measuring precision, that is the rate of correctly classifying the true classified cases, shown in Table 3 c). This can be explained by generating too abstract strategies that represent the agent behavior in a too abstract way.



a) Accuracy b) TP rate c) Precision

Table 3: Results

The last test was devoted to test if the abstraction process really generates more abstract descriptions. For this test we measured the abstraction of generated rules. The abstraction of a rule is defined as an average feature depth in a feature taxonomy for features used in rules. The lower the depth is, the more abstract it is. The results, presented in Table 4, clearly show that average feature depth is negatively correlated with the parameter dist. This proves that as dist value increases the rules contain more abstract features. Since rules were generated from node data we can safely conclude, that generated strategies and AAGs exhibit the same principle: that the AAG with higher dist value presents more abstract action activity than the one with lower dist value.

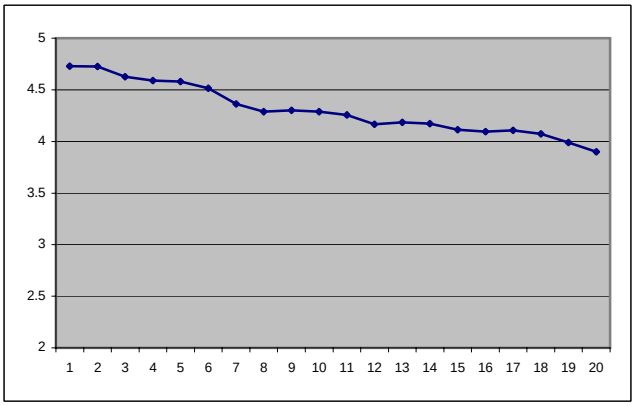


Table 4: The abstraction of generate rules

4. Discussion

We have designed and implemented the MASM algorithm as a general domain-independent framework for discovering strategic behavior of multi-agent systems. Domain-specific knowledge was introduces in the form of role, action and domain feature taxonomies. We assume that changing a domain is a straightforward task that would require changing specific domain-knowledge of a similar form. We believe that there is a wide range of possible domains that can be exploited by the MASM since it's essence is stepwise abstraction in the domain-space.

The tests show that the approach is practically useful in terms of accuracy, tp rate and precision. Our tests also confirm that the abstraction process in fact generates more abstract descriptions of agent activity.

However, there are some open questions that need to be addressed. First, MASM was evaluated only on the RoboCup domain. Although authors believe that no major problem should emerge when introducing another domain, this should be verified in practice. Second, the output of the MASM system seemed promising to the soccer coach performing preliminary evaluation. On the other hand, this should be systematically verified by a number of soccer experts. Third open question is how to specify relevant strategic situations. These situations are domain-dependant and have to be provided by a domain expert. But, a relevant situation can be defined as a kind of system parameter thus making MASM a tool for mining strategic concepts.

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PATHOLOGY IN SINGLE-AGENT SEARCH

Mitja Luštrek
Department of Intelligent Systems
Jožef Stefan Institute
Jamova 39, 1000 Ljubljana, Slovenia
Phone: +386 1 4773380; fax: +386 1 4773131
E-mail: mitja.lustrek@ijs.si

ABSTRACT

In incomplete single-agent search, it is generally accepted that deeper searches produces better results. It has recently been discovered, though, that this is not always the case – such behavior has been termed pathological. This paper identifies two properties of search trees that cause pathological behavior and explains how they produce the pathology. A number of different heuristic functions were also investigated, focusing on admissibility and consistency. Consistency was most effective at preventing the pathology, while admissibility helped only in some cases.

1 INTRODUCTION

Search pathology occurs when the quality of a shallower heuristic search exceeds the quality of a deeper one. It is called pathology [9] because it is the opposite of what 'should' happen, namely that the more effort one puts into searching, the better results he gets. This phenomenon has been known in minimax search since 1979 [1, 9], but it has only been discovered in single-agent (or minimin) search in 2003 [5]. It does not occur in complete search methods such as A* [6], because these, given appropriate heuristics, compute the optimal path to the goal, leaving no room for the pathology. Where it has been observed is in incomplete search methods such as real-time A* [7]. Incomplete search methods perform minimin searches to a chosen depth, heuristically evaluate the search tree nodes at that depth and back their values up to a level below the root. These backed-up values are then used to choose the action leading from the root to its descendant with the optimal (typically minimal) value (typically representing the cost of reaching a goal node). We speak of the pathology when the choice of the action is more likely to be erroneous after a deeper search than after a shallower one.

There are two possible reasons for pathological behavior of single-agent search: the domain (or the nature of the problem) and the heuristic evaluation function directing the search. The domain is reflected in the distribution of true values in search trees. We identify two properties of search trees that lead to pathological behavior. The more interesting reason for the pathology, however, is the heuristic function, because unlike the domain, which is given, it can be controlled. The properties of heuristic functions that usually concern their designers are admissibility and consistency. The pathology turned out to be affected by both, by consistency more than by admissibility.

The paper is organized as follows. Section 2 briefly touches on the minimax pathology and then reviews the existing work on the pathology in single-agent search. Section 3 describes the properties of the domain that cause the pathology. Section 4 deals with heuristic functions. Section 5 concludes the paper and points out where further research is needed.

2 RELATED WORK

The minimax pathology was discovered independently by Nau [9] and Beal [1]. They set out to determine why minimaxing reduces the error of the heuristic evaluation function used to evaluate the leaves of the search tree, only to find out that on their seemingly reasonable models, it did exactly the opposite, i.e. amplify the error. Different explanations of this paradox were proposed, the most common [2, 3, 10] being that the pathological models ignored the similarity of positions close to each other, a characteristic of real games. More recent explanations [8, 11] featured reduced error at lower levels of search trees, which was previously dismissed.

It seems that the pathology in single-agent search was investigated only by Bulitko et al. They first demonstrated it [5] on a two-level search tree shown in Figure 1; the numbers in the figure are the nodes' true values and the letters the nodes' names. The tree was designed specifically to be pathological, but the heuristic function was 'fair'.

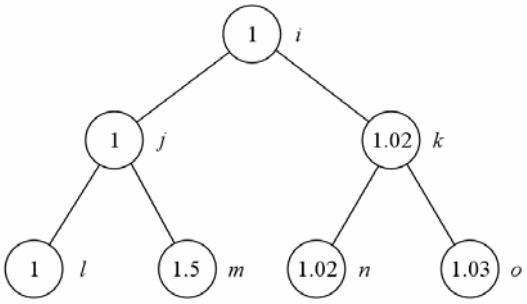

Figure 1. *Pathological search tree by Bulitko et al.*

The heuristic value or cost of a node is usually presented as $f = g + h$, where g is the known part and h the heuristic part. We will only discuss the cost as a whole: the heuristic cost of a node x will be denoted $c(x)$ and the true cost $c^*(x)$. In

the example in Figure 1, c (x) is distributed uniformly between c (y) and c^* (x), where y is the parent of x. This makes is both monotonically non-decreasing (which is equivalent to its heuristic part being consistent) and admissible. Let Err (x, d) be the probability that among the descendants of a node x, one that does not have the lowest true value has the lowest heuristic value as returned by a search to depth d. In the example in Figure 1, Err (i, 1) = 0.461 < 0.486 = Err (i, 2). This shows that the pathology is possible even with a heuristic function having both desirable properties, consistency and admissibility.

Bulitko later [4] discovered that the pathology can also occur outside synthetic search trees. He observed pathological behavior when solving the eight-puzzle using a heuristic function represented by an artificial neural network.

An issue Bulitko et al. did not address, though, is why the pathology occurs. This is what this paper focuses on.

3 DOMAIN AS A REASON FOR THE PATHOLOGY

The reasons for the pathology were mostly investigated on synthetic search trees with depth 2 and branching factor 2. Monte Carlo experiments were used to confirm that the conclusions also apply to larger branching factors and depths.

3.1 The First Reason

The first property of search trees that affects the pathology, *property 1*, is the difference in true value between the level-1 node with the lowest value and its descendants, compared to the difference in true value between other level-1 nodes and their descendants. It can be observed in the example from Figure 1, using Bulitko et al.'s heuristic function. To do that, we will treat heuristic values as random variables. We will write static c (x) as X_0, backed-up c (x) when searching d levels below x as X_d and c^* (x) as X^*. $f_{X\,d}$ (y) is the probability density function of X_d. Figure 2 shows the probability density functions of J and K from the example in Figure 1: on the left side for search to d = 1 and on the right side for search to d = 2. The functions are integrated over all the possible values of I.

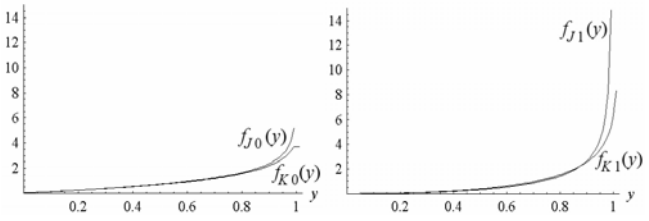

Figure 2. *Explanation of property 1.*

Since $J^* < K^*$, an error occurs when $J > K$, so we must determine why P ($J_1 > K_1$) > P ($J_0 > K_0$); the left side of the inequality is shown in the right side of Figure 2 and the right side of the inequality in the left side of Figure 2. A node's backed-up heuristic value is higher than its static heuristic value because the static heuristic values of the node's descendants must be higher than the node's static value (due to consistency of the heuristic function) and the node's backed-up value is made up of the descendants' values. This can be seen in Figure 2, where the probability density functions on the right have on average a higher value than those on the left. If this increase were equal for both J and K, there would be no pathology. However, the increase is larger for J, which means that J_1 is closer to K_1 than J_0 to K_0, resulting in the pathological P ($J_1 > K_1$) > P ($J_0 > K_0$). To see why J_1 is closer to K_1 than J_0 to K_0, we must consider that J_1 = min (L_0, M_0) and K_1 = min (N_0, O_0). Let us take two random variables X and Y. If Z = min (X, Y), Z tends to be lower than both X and Y, because for some values of $X = x$, there is a non-zero probability that Y (and therefore Z) is lower than x, and vice versa, for some values of $Y = y$, there is a non-zero probability that X (and therefore again Z) is lower than y. If Y is much higher than X, than Z will be very similar to X, because Y will have little effect on Z. The closer X and Y get, the more effect Y will have; its effect can only be to make Z lower, so the closer X and Y get, the lower Z will be. Since N_0 and O_0 are much closer to each other than L_0 and M_0 and since K_0 puts an upper limit on N_0 and O_0 in the same fashion as J_0 on L_0 and N_0, K_1 = min (N_0, O_0) is lower relatively to K_0 than J_1 = min (L_0, M_0) relatively to J_0. This explains why J_1 and K_1, the descendants of the lower level-1 node, are closer to each other than J_0 and K_0 and hence how property 1 produces the pathology in the example in Figure 1.

To further demonstrate the effect of property 1, let us strengthen it (cause it to produce a stronger pathology) by increasing M^* to 3. Err (i, 1) = 0.461 remains unchanged, while Err (i, 2) increases from 0.486 to 0.507. If O^* is reduced to 1.02, Err (i, 2) increases as well, this time to 0.492. Property 1 can also be weakened, for example by reducing M^* to 1 or by increasing O^* to 3. This eliminates the pathology by reducing Err (i, 2) to 0.426 and 0.391 respectively.

3.2 The Second Reason

The second property of search trees that affects the pathology, *property 2*, is the difference in true value between the level-1 node with the lowest value and other level-1 nodes relative to the true value of the root. It can be explained on the search tree shown in Figure 3, which is somewhat related to the tree in Figure 1, but is not pathological. Bulitko et al.'s heuristic function is used again.

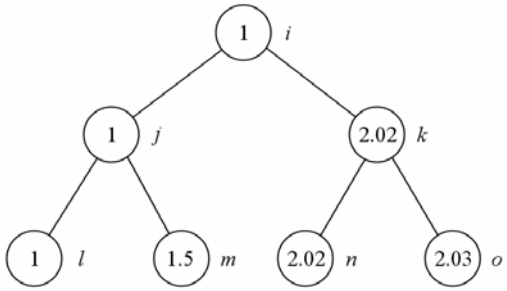

Figure 3. *Search tree to explain property 2.*

Figure 4 shows the probability density functions of J and K from the example in Figure 3: on the left side for search to $d = 1$ and on the right side for search to $d = 2$. The functions are integrated over all the possible values of I.

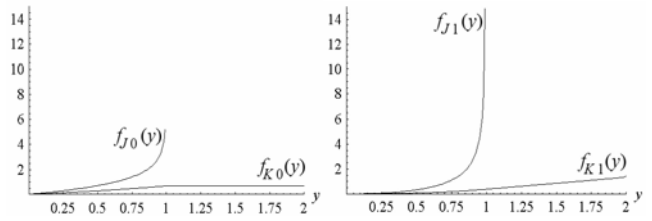

Figure 4. *Explanation of property 2.*

As can be seen in Figure 4, $f_{J1}(y)$ has larger values for y close to $J^* = 1$ than $f_{J0}(y)$; $f_{K1}(y)$ also has larger values for y close to $K^* = 2.02$ than $f_{K0}(y)$. This phenomenon was already explained in subsection 3.1 when discussing property 1. However, the example in Figure 3 has a much larger difference between $I^* = J^*$ and K^* than the example described in subsection 3.1. This gives f_{K1} much more room to distance itself from f_{J1} and thus eliminates the pathology. Property 2 does not only require level-1 nodes to be far away from each other to eliminate the pathology, it requires them to be far away from each other relatively to the value of one of them (or the root). Why this is necessary can easily be seen by proportionately increasing the values of all the nodes: this certainly increases the distance among level-1 nodes, but does not affect the error, so it cannot affect the pathology.

To further demonstrate the effect of property 2, let us strengthen it (cause it to produce a stronger pathology) on the tree from Figure 1. This can be done by reducing K^* and N^* to 1.01 and O^* to 1.02. On the unmodified tree, the increase in error when increasing the depth of search from 1 to 2 is 5.4 %. On the modified tree, it is 8.4 %, which is more pathological. Property 2 can also be weakened, for example by increasing K^* and N^* to 1.03 and O^* to 1.04. This reduces the increase in error to 2.9 %, which is less pathological.

4 HEURISTIC FUNCTION AS A REASON FOR THE PATHOLOGY

The two properties of the heuristic function that will be considered in this section are admissibility and consistency. If a heuristic function is admissible, the corresponding cost function will be called optimistic, because admissibility of c means $c(x) \leq c^*(x)$, i.e. that the true value of x is always underestimated. If a heuristic function is consistent, the cost function is monotonically non-decreasing, which means $c(x) \geq c(y)$, where y is the parent of x. In complete search, the former implies the latter, but we are investigating incomplete search, where this is not the case, so we can deal with each property separately.

We will investigate uniformly and normally distributed cost functions. The cost function can be plain (the heuristic value of a node is simply distributed around its true value), optimistic, pessimistic (the opposite of optimistic, i.e. $c(x) \leq c(y)$, where y is the parent of x), monotonic (monotonically non-decreasing), Bulitko (distributed as described in section 2) or a combination thereof.

The cost functions were compared in Monte Carlo experiments. 100,000 search trees with depth 2 and branching factor 2 were built and 100 sets of heuristic values were generated for each tree. Some experiments with larger depths and branching factors were also performed, yielding similar results. The percentage of pathological search trees is denoted *Pat*. However, different cost functions cause errors with different probabilities, so *Pat* might not be best suited to comparing them. For example, if one function causes very few errors, it will also be pathological on very few trees, even though it might be pathological on every tree where it causes an error. Therefore another measure is needed: relative pathology *RPat*. *RPat* is defined as *Pat* divided by the probability of a deeper search being beneficial compared to a shallower one. Both *Pat* and *RPat* for different cost functions are shown in Figure 5 and Figure 6.

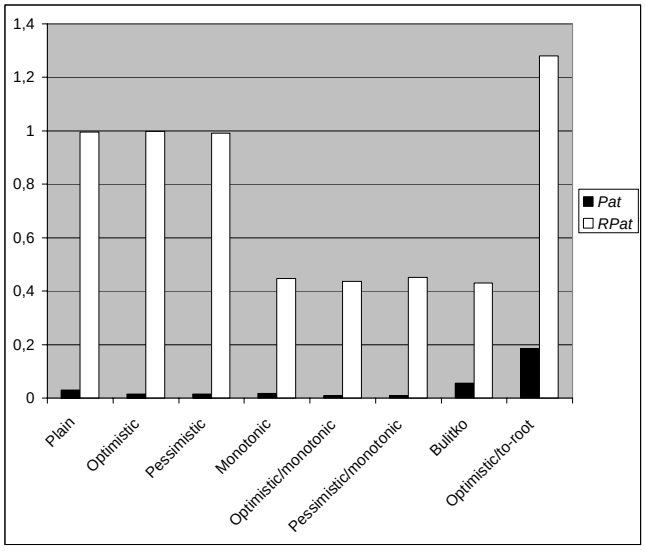

Figure 5. *Pathology of cost functions with uniform probability distributions.*

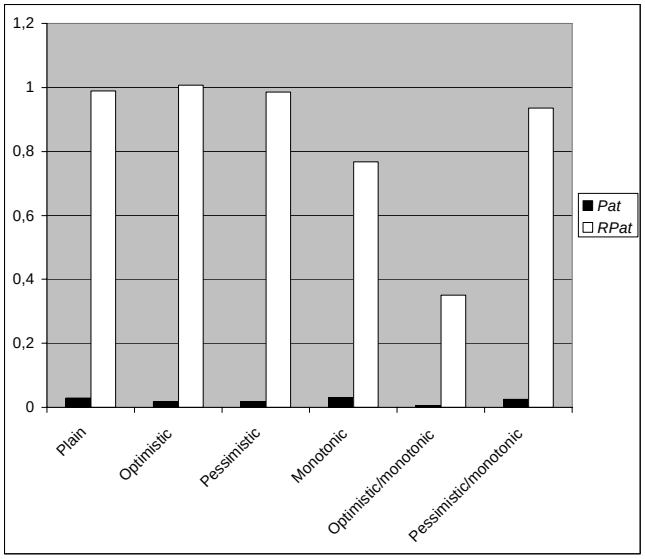

Figure 6. *Pathology of cost functions with normal-based probability distributions.*

Figure 5 and Figure 6 lead to the following conclusions:

- if the cost function is monotonic, the pathology is less likely;
- if the cost function is non-monotonic, the pathology is hardly affected by whether the function is optimistic or pessimistic;
- if the cost function is monotonic and distributed uniformly, the pathology is also hardly affected by whether the function is optimistic or pessimistic;
- if the cost function is monotonic and its distribution is based on normal, the pathology is less severe if the function is optimistic.

These conclusions do not appear to be very exciting: it is accepted that a cost function should be optimistic and monotonically non-decreasing. However, it should be noted that if a cost function is effective at leading an agent to desirable actions, that does not prevent it from being pathological. A good cost function can still be more effective when used in shallower searches than when used in deeper ones. So it is reassuring to *know* that the two properties already considered desirable also help with the pathology. Perhaps somewhat surprising is the discovery that it is more important that the function is monotonically non-decreasing than that it is optimistic, since usually more attention is paid to the latter. This is probably the legacy of complete search, where an optimistic cost function guarantees an optimal solution.

5 CONCLUSION

Unlike the minimax pathology, the pathology in single-agent is not very well understood. This paper sheds some light on why it occurs by identifying two properties of search trees that cause pathological behavior and explaining how they cause it. The effect of these two properties is undeniable on synthetic search trees, but it also needs to be verified on a practical example. This is one area where we will direct our future research.

The distribution of true values in the search tree is only one reason for the pathology – the other is the heuristic function. We showed that to avoid the pathology, the heuristic function should first be consistent and then admissible. However, since pathological behavior has been observed even with consistent and admissible heuristic functions, there are probably other characteristics of heuristic function that cause the pathology. They also need to be verified on a practical example. This is the other area where additional research is required.

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ODVISNOSTNA DREVESA IN AVTOMATSKO RAZČLENJEVANJE

Domen Marinčič
Odsek za inteligentne sisteme (E9)
Institut "Jožef Stefan"
Jamova 39, 1000, Ljubljana, Slovenija
domen.marincic@ijs.si

POVZETEK

V pričujočem delu predstavljamo uporabo odvisnostnih struktur v jezikovnih tehnologijah. Opisujemo njihovo teoretično ozadje, dostopnost jezikovnih virov, ki so označeni z odvisnostnimi strukturam in obstoječa orodja za avtomatsko označevanje (razčlenjevalniki). Opisujemo tudi poskus razkosavanja povedi na stavke s pomočjo strojnega učenja, kar bi lahko uporabili kot predobdelavo besedila pred razčlenjevanjem.

1. UVOD

Sintaktične strukture v jezikoslovju ponavadi predstavljamo z drevesi. V širši uporabi sta dve vrsti strukturnih opisov:

- dekompozicijske strukture (constituency structures)
- odvisnostne strukture (dependency structures),

Dekompozicijske strukture temeljijo na kontekstno neodvisnih gramatikah in so bile v preteklosti največkrat uporabljane predvsem za angleški jezik. Za jezike z visoko stopnjo pregibnosti in v pretežni meri prostim besednim vrstnim redom so bolj primerne odvisnostne strukture.

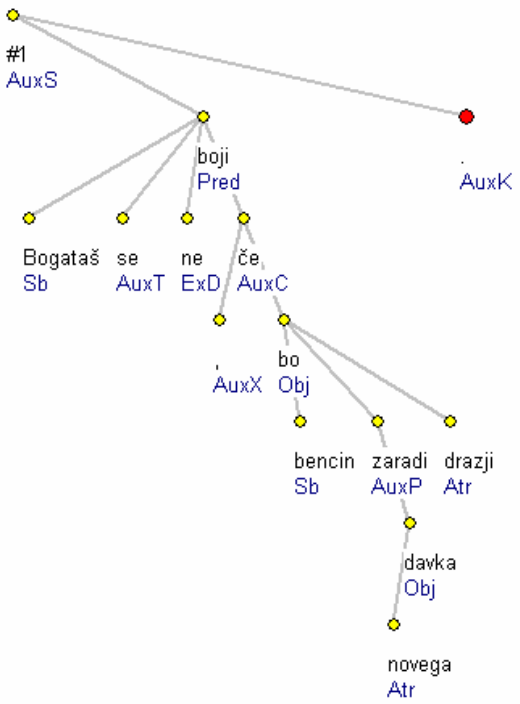
V tem prispevku bomo opisali osnovna dejstva o odvisnostnih drevesih. Predstavili bomo Prague Dependency Treebank (PDT) ter Slovene Dependency Treebank (SDT), korpusa češkega in slovenskega jezika, ki sta označena z odvisnostnimi drevesi. Opisali bomo nekatere razčlenjevalnike, tj. programe, ki avtomatsko izdelujejo odvisnostna drevesa nad besedili. Predstavili bomo, kje na področju jezikovnih tehnologij lahko uporabimo odvisnostne strukture. Na koncu bomo opisali še poskus razkosavanja povedi na stavke s pomočjo strojnega učenja, kar bi lahko uporabili kot predobdelavo besedila pred razčlenjevanjem.

2. ODVISNOSTNA DREVESA

En izmed načinov strukturnega opisa so odvisnostna drevesa, ki jih zgradimo nad posameznimi povedmi besedila. Enote, ki sovpadajo z vozlišči drevesa, so elementarni segmenti opisanega besedila, torej besede in ločila. Povezave med vozlišči določajo odvisnosti med enim elementarnim segmentom in njegovimi komplementi (Tesnière, 1959).

Kot primer si poglejmo razčlenitev sledeče povedi.

Bogataš se ne boji, če bo bencin zaradi novega davka dražji.



Slika 1: Primer odvisnostnega drevesa

Na sliki 1 je odvisnostno drevo, ki ga zgradimo nad to povedjo. Vsaka beseda je predstavljena z enim vozliščem. Poleg tega smo dodali še pomožno vozlišče *"#1"*, ki prestavlja celotno poved.

Vodilna beseda v povedi je glagol *"boji"*. Čeprav vozlišča v drevesu predstavljajo besede in ločila, povezave ne

predstavljajo samo odvisnosti med posameznimi besedami, ampak odvisnost med vodilno besedo in celotno frazo, ki sovpada z vodilno besedo. V drevesu v zgornjem primeru je to razvidno iz povezave med besedama *"če"* in *"boji"*. Ta povezava opisuje odvisnost celotnega odvisnika od besede *"boji"* v glavnem stavku.

Poleg določanja odvisnosti med besedami lahko vsaki besedi določimo še njeno funkcijo v povedi. Beseda *"Bogataš"* ima funkcijo *"Sb"*, kar v danem primeru pomeni osebek. Beseda *"boji"* ima funkcijo *"Pred"*, tj. predikat. V zvezi s funkcijami besed velja podoben razmislek, kot za povezave. Vsaka beseda ima vodilno vlogo v določeni frazi. Npr. fraza katere vodilna beseda je glagol *"boji"* je njeno celotno poddrevo. Funkcija te besede velja za celotno frazo.

3. PRAGUE DEPENDENCY TREEBANK (PDT)

PDT je korpus čeških besedil, ki vsebuje 1,8 mio. besed (Bohmova et al., 2002). Označen je na treh nivojih:

- morfološki,
- analitični (označitev z odvisnostnimi drevesi),
- tektogramatični (označitev z drevesi, ki opisujejo pomenske povezave)

Osnovna enota morfološkega nivoja je posamezna beseda, ki je označena z ustrezno besedno vrsto (npr. samostalnik, glagol), s svojo lemo ("boji" - "bati") in s slovničnimi atributi (npr. število, spol, sklon, čas, itd.).

Z analitičnim nivojem PDT predstavlja enega večjih korpusov besedil, ki vsebujejo označitve z odvisnostnimi drevesi. Poleg odvisnostnih dreves, ki so zgrajena nad povedmi korpusa je vsaka beseda označena z analitičnimi funkcijami (Glej primer na sliki 1).

Tretji, tektogramatični nivo, predstavlja pomenski opis povedi. Prav tako je predstavljen z drevesom, ki temelji na odvisnostnem drevesu iz analitičnega nivoja. Novo drevo ne vsebuje vseh vozlišč (npr. opustimo pomožne glagole in ločila ter nekatera druga vozlišča). Preostalim besedam priredimo nove oznake, ki nakazujejo pomen besede v povedi.

Analitični nivo

Opišimo natančneje analitični nivo, predvsem postopek označevanja, torej izdelave odvisnostnih dreves. Na začetku je označevanje v celoti potekalo ročno. Označevalci so s pomočjo navodil za vsako poved zgradili drevo in vsaki besedi določili funkcijo. Ko so imeli že imeli na voljo nekaj označenega besedila (približno 19000 stavkov), so razčlenjevalnik (Collins, 1997) priredili za uporabo v češčini. Prav tako so izdelali programe za avtomatsko določanje funkcij posameznih besed.

Razčlenjevalniki

Vzporedno z označevanjem korpusa je potekal razvoj novih razčlenjevalnikov, tj. programov za avtomatsko izdelavo odvisnostnih dreves. Postopek učenja iz podatkov je bistveni del pri izdelavi razčlenjevalnika.

PDT za razčlenjevalnike predstavlja učno množico. Do leta 2000 je bilo na voljo nekaj manj kot 100.000 stavkov označenih z odvisnostnimi drevesi (približno 1.3 mio besed). Kljub precejšnji količini podatkov v postopku učenja ne moremo operirati z besedami. Večina besed se pojavi v korpusu premalokrat, zato jih predstavimo z njihovimi besednimi vrstami in z vrednostmi nekaterih slovničnih atributov. Če to ponazorimo na primeru s slike 1, bi vozlišču za prvo besedo v stavku ne pripadala beseda "Bogataš", ampak podatek, da gre za samostalnik v prvem sklonu. Podatki o večini ostalih atributov, ne doprinesejo k boljši kakovosti učenja, ampak le povečujejo problem redkosti podatkov (konkretno pri samostalnikih je najbolj pomenljiv atribut sklon). Le nekatere besede se v korpusu se pojavljajo zadosti pogosto in jih je smiselno v odvisnostnih drevesih ohraniti kot besede in ne kot besedne vrste, primer za to je glagol "biti".

Razčlenjevalnik (Zeman, 2004) je bil naučen tako, da so na podatkih iz PDT najprej naredili statistično analizo verjetnosti pojavljanja povezav med določenimi vozlišči. Ko razčlenjevalnik gradi drevo za določeno poved, postavlja povezave med vozlišča glede na pogostost pojavitve take povezave v PDT.

Drug pristop, ki so ga uporabili pri razčlenjevanju češkega besedila je z uporabo razčlenjevalnikov za dekompozicijiske strukture. Pri tem je potrebno narediti še pretvorbo med dekompozicijskimi drevesi in odvisnostnimi (Collins et al., 1999).

Tretji pristop je kombinacija večih razčlenjevalnikov. Vsak od razčlenjevalnikov poda svojo razčlenitev, kot končni rezultat izberemo tisto, ki jo je izdelala večina razčlenjevalnikov. (Zeman, 2004).

4. PRIMERI UPORABE

Eno izmed področij jezikovnih tehnologij, kjer lahko uporabljamo odvisnostna drevesa, je strojno prevajanje. Prvi korak pri strojnem prevajanju je praviloma morfološka in nato še sintaktična analiza besedila v izvornem jeziku. Ravno tako v določenih primerih potrebujemo sintaktično analizo tudi za ciljni jezik

Drug primer uporabe je recimo napredno iskanje informacij po besedilih. Besedila najprej označimo z odvisnostnimi drevesi. Če iščemo dokumente z več ključnimi besedami, je pomembno ugotoviti, kdaj so ključne besede v dokumentih povezane, kajti le v takih primerih bodo kazalec na relevantne dokumente.

5. SLOVENE DEPENDENCY TREEBANK (SDT)

Kot visoko pregiben jezik z relativno prostim besednim vrstnim redom je slovenščina primerna za uporabo odvisnostnih dreves. Slovene Dependency Treebank (SDT) trenutno obsega 394 povedi, označenih na morfološkem in analitičnem nivoju. V načrtu imamo v naslednjih nekaj mesecih označiti nekoliko večjo količino besedila, približno 3000 povedi.

Razčlenjevalniki

Za slovenščino še ne obstaja noben razčlenjevalnik za analitično nivo. Pred leti je Zdeněk Žabokrtsky s svojim razčlenjevalnikom, ki je bil razvit za češki jezik, opravil poskus na slovenskem besedilu. Dosežena točnost je bila približno 65%. Točnost je definirana kot delež pravilno določenih povezav v drevesu. Opis razčlenjevalnika in poskusa žal ni nikjer objavljen.

6. RAZKOSAVANJE (CHUNKING) POVEDI NA STAVKE

V splošnem za razčlenjevalnike velja, da njihova točnost pada glede na dolžino povedi oziroma glede na število glagolov. Najboljše rezultate razčlenjevalniki ponavadi dosegajo na enostavčnih povedih dolžine manj kot 10 besed.

Preden razčlenjevalnik začne določati povezave med posameznimi besedami bi bilo torej smiselno razdeliti poved na manjše kose. Elementi posameznega kosa morajo biti izbrani tako, da jih lahko povežemo v poddrevo celotnega drevesa. Razčlenjevalnik bi nato najprej besede znotraj vsakega kosa povezal v poddrevesa ter poddrevesa združil v drevo celotne povedi.

En način razkosanja je razdelitev na stavke. Na sliki 1 imamo dvostavčno poved (podredje) pri čemer je odvisni stavek predstavljen s poddrevesom, katere koren je beseda *"če"*.

Razkosavanje povedi s pomočjo strojnega učenja

Opravili smo poskus razkosavanja povedi na stavke s pomočjo strojnega učenja. Problem smo definirali kot iskanje stavčnih mej. Odločitveno drevo pove, ali se z določeno besedo začne nov stavek ali ne. Učno množico smo izdelali na osnovi besedila iz SDT v katerem smo dodatno označili mesta, kjer se pojavljajo stavčne meje.

Učni primeri so zgrajeni iz *n* zaporednih besed, *n* lahko zavzame vrednosti 2, 4 ali 6. V učnih primerih so besede predstavljene z oblikoslovnimi oznakami (MULTEXT-East, 2004), upoštevani so samo nekateri slovnični atributi. V tabeli 1 je prikazan stavek s slike 1 pri čemer je za vsako besedo je v 2. stolpcu navedena oblikoslovna oznaka. Za besedo *"Bogataš"* oznaka *"Nm"* pomeni, da gre za samostalnik v 1. sklonu. Podatek v 3. stolpcu pove, ali se pred besedo nahaja stavčna meja.

Bogataš	*Nn*	*0*
se	*Px*	*0*
ne	*Q*	*0*
boji	*Vmi*	*0*
,	*Z*	*0*
če	*Cs*	*1*
bo	*Vci*	*0*
Bencin	*Nn*	*0*
Zaradi	*S*	*0*
novega	*Ag*	*0*
davka	*Ng*	*0*
dražji	*An*	*0*
.	*Z*	*0*

Tabela 1: Besede in oblikoslovne oznake

Atr1	***Atr2***	***Atr3***	***Atr4***	***Razdred***
NDEF	*NDEF*	*Nn*	*Px*	-
NDEF	*Nn*	*Px*	*Q*	-
Nn	*Px*	*Q*	*Vmi*	-
Px	*Q*	*Vmi*	*Zv*	-
Q	*Vmi*	*Zv*	*Cs*	-
Vmi	*Zv*	*Cs*	*Vci*	+
Zv	*Cs*	*Vci*	*Nn*	-
Cs	*Vci*	*Nn*	*S*	-
Vci	*Nn*	*S*	*Ag*	-
Nn	*S*	*Ag*	*Ng*	-
S	*Ag*	*Ng*	*An*	-
Ag	*Ng*	*An*	*Zp*	-
Ng	*An*	*Zp*	*NDEF*	-
An	*Zp*	*NDEF*	*NDEF*	-

Tabela 2: Učni primeri

V tabeli 2 so učni primeri, sestavljeni na podlagi štirih zaporednih besed, ki jih dobimo iz stavka na sliki 1. V prvih štirih stolpcih so oblikoslovne oznake besed. Vrednost "NDEF" pomeni začetek oziroma konec stavka. Pozitivni primeri, označeni s "+", so tisti, kjer stavčna meja med 2. in in 3. primera besedo obstaja. Nasprotno velja za negativne primere, ki so označeni z "-".

Uporabili smo program WEKA, algoritem J48 za izgradnjo odločitvenih dreves, s parametroma C=0.25 in M=2. Prvi parameter določa stopnjo rezanja. Drugi parameter določi, da naj se postopek gradnje odločitvenega drevesa konča, ko v enem vozlišču ostaneta samo še dva učna primera, ki ne pripadata večinskemu razredu.

Tabela 3 prikazuje rezultate poskusa. Izveden je bil na devetih različnih učnih množicah. Poskus smo naredili z učnimi primeri iz 2, 4 in 6 zaporednimi besedami. Učne

množice so bile različnih velikosti: 850, 1700 in 3400 primerov. Prvi stolpec opisuje tip učne množice. Drugi stolpec prikazuje klasifikacijsko točnost. Tretji stolpec prikazuje delež pravilno klasificiranih pozitivnih primerov. Četrti stolpec prikazuje delež pravilno klasificiranih negativnih primerov.

Tip učne množice	***Klas. točnost***	***Pravilni "+"***	***Pravilni "-"***
2 besedi, 850 primerov	92,35	0/65	785/785
2 besedi, 1700 primerov	94,47	88/130	1518/1570
2 besedi, 3400 primerov	95,67	169/279	3084/3141
4 besede, 850 primerov	92,35	0/65	785/785
4 besede, 1700 primerov	94,47	88/130	1518/1570
4 besede, 3400 primerov	95,64	172/279	3081/3141
6 besed, 850 primerov	92,35	0/65	785/785
6 besed, 1700 primerov	94,47	88/130	1518/1570
6 besed, 3400 primerov	95,70	169/279	3085/3141

Tabela 3: Rezultati

Rezultati prikazujejo, da število zaporednih besed v primeru nepomembno vpliva na klasifikacijsko točnost. Večina pomembnih informacij se skriva v besedi oziroma ločilu tik pred in tik za stavčno mejo. Pač pa je pomembna velikost učne množice, saj smo najboljše rezultate dosegli z največjo količino učnih primerov. V splošnem rezultati niso zadovoljivi. Predvsem je problematičen delež napačno klasificiranih pozitivnih primerov. Ker je razkosavanje povedi na stavke šele prvi korak v procesu izdelave celotnega odvisnostnega drevesa, bi morali tu doseči bistveno večjo točnost.

7. ZAKLJUČEK

Odvisnostne strukture so primeren način za sintaktično razčlenjevanje besedil v jezikih z veliko stopnjo pregibnosti in pretežno prostim vrstnim redom. Največ na tem področju je bilo do sedaj narejeno za češčino. Na voljo je korpus velikosti več kot mililjon besed, ki je označen z odvisnostnimi drevesi. Prav tako so tudi razviti razčlenjevalniki, pri čemer kombinacija rezultatov večih razčlenjevalnikov daje najboljše rezultate. Zaradi podobnosti jezikov bi lahko precej algoritmov, razvitih za češčino, uporabili tudi za slovenščino.

Naš poskus razkosavanja povedi na stavke je pokazal, da tak pristop verjetno ni perspektiven, če bi radi postopek uporabljali kot prvi korak pri razčlenjevanju povedi. Informacije, ki jih upošteva odločitveno drevo, so očitno preveč lokalnega značaja, da bi zadostovale za dobre rezultate. Pristop bi verjetno lahko izboljšali tako, da bi za bi pri razmejevanju stavkov kot izhodišče vzeli spregane glagole. Druga verjetno težja možnost je, da bi poved razkosali na enote, ki niso nujno stavki, vendar predstavljajo kose enakomernih velikosti.

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COMPARISON BETWEEN HUMANS AND MACHINES ON THE TASK OF ACCENTUATION OF SLOVENE WORDS

Tea Tušar, Andrej Bratko, Matjaž Gams, Tomaž Šef
Department of Intelligent Systems
Jožef Stefan Institute
Jamova 39, SI-1000 Ljubljana, Slovenia
tea.tusar@ijs.si, andrej.bratko@ijs.si, matjaz.gams@ijs.si, tomaz.sef@ijs.si

ABSTRACT

The accentuation of Slovene words represents a challenging task for automated solvers since in Slovenian, stress can be located on arbitrary syllables. This paper compares the performance of humans, expert-defined rules and computer methods, such as machine learning methods and n-gram Markov models, on this task. We find that humans tend to accentuate the words correctly, even when they have never heard or seen them before. On the other hand, expert-defined rules for accentuation perform quite poorly, achieving worse results than machines. This indicates that humans are good at accentuating, but very limited when their knowledge has to be formalized. Therefore, machine methods have to be employed for automatic accentuation of Slovene words.

1 INTRODUCTION

The grapheme-to-phoneme conversion can be described as a function mapping the spelling form of words to a string of phonetic symbols, representing the pronunciation of the word. Most work on data-oriented grapheme-to-phoneme conversion has been performed on a few worldwide languages, especially on English [2]. Several highly inflected languages lack large databases that give the correspondence between the spelling and the pronunciation of all word-forms. For example, no database for orthography/phonology mappings for Russian-inflected words is known [6].

While most other languages have difficulties with grapheme-to-phoneme conversion, in the Slovene language this is rather straightforward if the accentuated form of words (i.e. stress assignment) is known. The conversion can be done on the basis of less than 100 context-dependent letter-to-sound rules with over 99% accuracy [5]. However, no good rules exist for stress assignment of Slovene words. This is somehow in contradiction to the general observation that humans can often pronounce words reasonably well, even though they have never seen or heard them before.

Accentuation of Slovene words is a hard problem, since the lexical stress can be located almost arbitrary on any syllable of the word [7]. Most words have only one stressed syllable, but there exist also words with no stress and words with more than one stress. Furthermore, different forms of the same word can be stressed differently (see Table 1).

In this paper, we inspect the performance of humans (human volunteers, human experts and expert-defined rules) and machines (machine learning methods and n-gram Markov models) on the task of stress assignment of Slovene words. We analyze the relation between human knowledge and their rules and compare the results of expert-defined rules and machines to find the best method for automatic accentuation of Slovene words.

Slovenian	English translation
Danes moraš *peljáti* ti.	Today, you have *to drive*.
Rada se *péljeva* po deželi.	We like *to drive* across the country.
Pêlji, prosim.	*Drive*, please.

Table 1: Stress assignment for the verb *peljati* (to drive) in different forms (infinitive, first person in present tense and imperative). The stressed vowels are marked with the phonetic signs ‘´’ and ‘ˆ’, which are usually not written in the normal text.

2 PROBLEM DESCRIPTION AND RESOURCES

We decompose the problem of stress assignment into two subproblems – determining the stress position and, once stressed vowels have been identified, determining the type of stress. In the Slovene language, the stressed vowels differ according to *duration* (short and long vowels – all vowels) and *quality* (narrow and wide vowels – only the vowels e and o). In this paper we distinguish only the quality of stress. Besides the vowels a, e, i, o and u in Slovenian there exists also the reduced vowel, which can appear instead of the vowel e and is always present before the consonant r, provided there are no other vowels around it.

The stress assignment task thus consists of classifying all vowels (and reduced vowels) of a word in one of the following classes: *unstressed vowel* (all vowels and reduced vowels), *stressed vowel* (vowels *a*, *i* and *u*), *wide stressed vowel* (vowels *e* and *o*), *narrow stressed vowel* (vowels *e* and *o*), or *stressed reduced vowel*.

Unlike in other languages, in the Slovene language the stress assignment depends on the morphological category of the word. Therefore, we use a Slovene pronunciation dictionary (created in previous work [8]), where for every word we have the following information (see Table 2): the word (without stress), the word's lemma, the stressed word and the word's morphological information. The dictionary contains almost 600.000 words with more than 2.000.000 syllables.

The dictionary holds only the most common words. To find words, which are unknown to an average Slovene-speaking person, we use the word-stock of Slovene language. It contains almost 180.000 rare words (mostly technical terms and foreign words) together with their morphological information. Beside these two resources, we provide several lists of parts of words that bear some information on the stress of the word, for example, prefixes and suffixes that are usually not stressed. These lists were derived from expert-defined rules and together contain 230 entries.

word	lemma	stressed word	morphological information
peljati	*peljati*	*peljáti*	verb, infinitive
peljeva	*peljati*	*péljeva*	verb, present tense, first person, dual
pelji	*peljati*	*pêlji*	verb, imperative, present tense, second person, singular

Table 2: Information, contained in the dictionary for the words *peljati*, *peljeva* and *pelji*.

3 METHODS FOR AUTOMATIC ACCENTUATION

3.1 Expert-defined Rules

The rules for accentuation of Slovene words were created by the best human experts more than 20 years ago [7]. They were written to help foreigners who are studying Slovenian and Slovene people who speak local dialects to learn the correct formal pronunciation of Slovene words. In this paper, a slightly modernized machine-readable version of expert-defined rules [3] is implemented in 68 IF-THEN rules.

The expert-defined rules that predict the position of stress rely mostly on common word prefixes and suffixes mentioned in the previous section. These lists are scanned in a predefined order. If a word's prefix or suffix matches an entry in the current list, the word is stressed accordingly. If the word does not match any of the list's entries, the stress position is set to be the most frequent stress position in other words with the same number of syllables. This happens with approximately 25% of all words.

The stress type has to be defined only for stressed syllables containing the vowels *e* or *o*. For this task, the expert-defined rules make use of the context of the observed vowel in the word as well as the word's morphological information. For example, the following expert-defined rule predicts a wide stressed *o* [7]:

All nouns that contain a stressed o *in the endings* -oba, -oča *or* -ota, *have a wide stressed* o.

3.2 Machine Learning Methods

Machine Learning (ML) methods build a model from a given data set and use this model to classify new instances. We applied many ML methods on this task (decision trees, decision rules, one variety of naive Bayes classifier and meta methods boosting and bagging), all from the WEKA ML toolkit [9].

In the task of stress assignment of Slovene words with ML, we classify the stress on every vowel individually. We first use a ML method to predict whether the vowels are stressed, after which we apply the same method to predict the stress type. The predictions made on the vowels are combined to produce the final stress assignment of the whole word.

To evaluate prediction of stress position and type for every vowel, we divide all vowels from the dictionary into six groups: *a*, *e*, *i*, *o*, *u* and *r*. Machine learning is performed on each group separately. Each vowel is thus treated as an instance, described with a set of attributes. These attributes contain information on the word in which the vowel appears and the context of the vowel in the word, as well as characteristic prefixes and suffixes contained in the word. When predicting stress position, each vowel is described with 75 attributes (see Figure 1). The class attribute can take on one of the values *stressed* and *unstressed*. The same attributes are employed for predicting stress type, with the exception of the class attribute, which can have one of the following values: *narrow stressed vowel*, *wide stressed vowel* or *stressed reduced vowel*.

3.3 n-gram Markov Model

We also employ a character-level Markov model, called *Prediction by Partial Matching* (PPM), which was originally designed for lossless text compression [1]. The PPM algorithm predicts the next character in a sequence based on preceding text. The text is approximated with a finite-length n-gram Markov model, so that the current symbol is considered independent of all but the previous $n-1$ characters. These characters are called the current *context*, its length $n-1$ is the *order* of the PPM

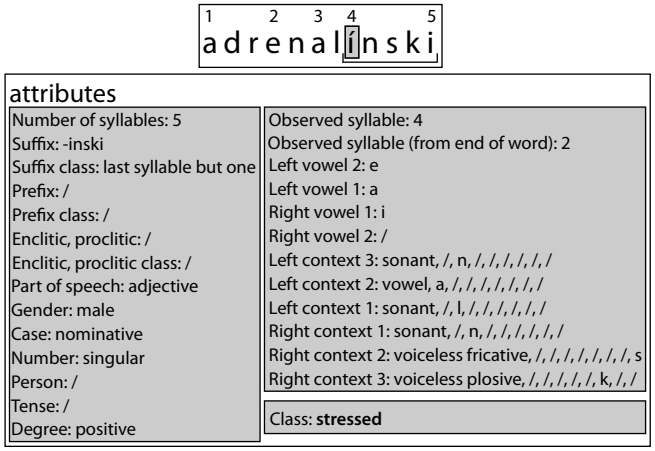

Figure 1: Attributes for the fourth vowel of the adjective *adrenalinski* (adrenaline). The attributes on the left are bound on the word, while the attributes on the right depend on the observed syllable.

model. Many variants of the PPM algorithm exist. We use escape method D in combination with the exclusion principle.

In predicting stress position (and type), the PPM model is built on the training portion of the pronunciation dictionary. To predict the accentuation of words in the test set, we generate all plausible stress assignments for each word. We then compute the probability of each such solution using the trained model and predict the solution that is deemed most probable. When predicting the position of stressed vowels, only combinations that contain up to three stressed vowels are considered. An example for predicting stress position for the word *relief* is given in Figure 2.

The probability of a word is computed as the product of character probabilities, as predicted by the PPM

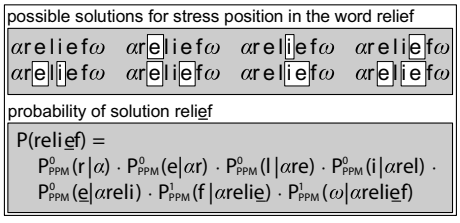

Figure 2: Predicting stress position for the word *relief* (same word in English and Slovenian). All solutions considered by the method are listed in the top part of the figure. The special characters α and ω mark the beginning and the end of a word. The evaluation of the correct solution *reliéf* is depicted in the bottom part of the figure. P^0_{PPM} denotes the character probability of the first PPM model. After encountering the stressed vowel *e*, PPM switches to the second model P^1_{PPM}.

model. For every word, we trained two models, one for prediction from left to right and a second model for prediction from right to left. The final probability assigned to a stressed word is simply the average of both models.

4 EXPERIMENTS AND RESULTS

4.1 Experimental Setup

We perform three different experiments. In the first, we compare the expert-defined rules to machine methods. To this end we use the dictionary, described in Section 2. The words from the dictionary are divided into three corpora of similar size in such way that words with the same lemma are always placed in the same corpus. All applied methods are thus evaluated with 3-fold cross validation, where two corpora are used for training and the remaining corpus for testing.

In the second experiment, the whole dictionary is used as the training set and 100 random words from the same dictionary are selected to represent the test set. These words are common Slovene words and are "known" to machine methods as well as to humans. For the third experiment, we use the dictionary as the training set and 100 unknown words as the test set. The "unknown" words were obtained from the word-stock (see Section 2) in the following manner. First, we randomly selected 200 words from the word-stock. Words, which might have been known to an average Slovene-speaking person, were manually eliminated. This yielded 100 unknown words that are used in the third experiment.

For space limitations, among all ML methods we report only the results of the best ML method – boosting [4] (called *AdaBoostM1* in WEKA). Boosting is run using ten C4.5 decision trees as basic classifiers. All other parameter settings are the same as the default settings in WEKA [9]. The PPM method accepts a single parameter – the order of the PPM model. An order-4 model was found to perform best or near-best in all tasks and is used as the default setting in all comparisons.

In experiments with 100 known/unknown words we asked ten Slovene-speaking people and a human expert to accentuate these words. All volunteers have at least a university degree in technical sciences. The results of volunteers are averaged. Humans first stressed the known/unknown words by marking the stress on words written on paper, and second, by reading the known/unknown words aloud. The sound records were later analyzed by the human expert, which annotated the spoken stress assignment. In this way, mistakes made due to difficulties with phonetic signs were avoided.

4.2 Results

The results of all three experiments are presented in Figure 3. On the words from the dictionary, boosting

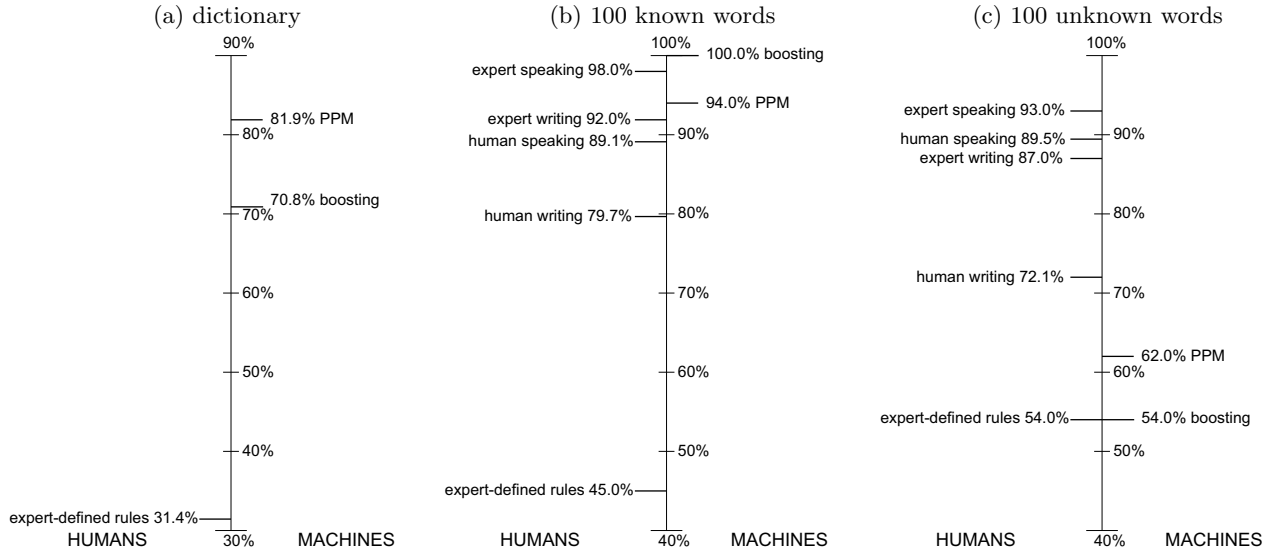

Figure 3: Comparison of accuracy achieved by humans and "machines" on the problem of stress assignment of (a) words from the dictionary, (b) 100 known words and (c) 100 unknown words.

outperformed the expert-defined rules by a 40% improvement in accuracy. Even better results were achieved by PPM. Similar relation between machine methods and expert-defined rules can be observed also on known words, while on unknown words, expert-defined rules equal boosting.

The human expert always achieves better results than the average volunteer and people accentuate more accurately when speaking than writing. On known words, boosting and PPM achieve better accuracy than humans because the test words were also used for training. On unknown words, this changes and humans are better than all artificial methods.

5 CONCLUSION

While humans accentuate Slovene words correctly, they have only a limited ability to formulate their knowledge. This has been shown in two ways. Firstly, they achieve better results when speaking than when writing down the stressed words. And secondly, the expert-defined rules, which should incorporate the human ability for correct accentuation, achieve very bad results.

Machine methods obtained good results on the words from the dictionary and are therefore more suitable for automatic accentuation of Slovene words than the expert-defined rules.

Acknowledgment

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Sistem za avtomatsko razpoznavanje obnašanja z metodami računalniškega vida

Mitja Kolbe, Matjaž Gams
Odsek za inteligentne sisteme
Institut Jožef Stefan
Jamova 39, 1000 Ljubljana, Slovenija
mitja.kolbe@ijs.si, matjaž.gams@ijs.si,

Stanislav Kovačič, Janez Perš
Fakulteta za elektrotehniko
Univerza v Ljubljani
Tržaška 25, 1000 Ljubljana, Slovenija
(stanislav.kovacic), (janez.pers) @fe.uni-lj.si

System for automatic behaviour recognition using computer vision methods

Computer vision has gained much popularity recently and it is being used quite often for smart video surveillance purposes. The growing performance efficiency of computer hardware and software enabled the implementation of simple methods for real time video analysis in smart video surveillance systems. However the applications in this field are still limited to predictable situations that can be expected in controlled environment. Moreover the costly development and efficiency that is difficult to carry out bring additional uncertainty to deployment of such systems.

This paper analyses the feasibility and sense of developing a video surveillance system for early drowning detection using computer vision methods and overhead cameras in swimming pools. Swimmers safety is nowadays ensured with a rescuer, who faces a difficult and responsible task – saving people's life. The advantage of an early drowning detection system would be to shorten the average time needed for detection of potential distress. The paper also compares the use of overhead cameras, which in contrast to underwater cameras require a more complex software application.

The development of smart surveillance system is a complex project, which needs a thorough study about the possibilities and expediency of deployment. The paper examines a smart video surveillance system for early drowning detection and gives conclusions for further investments in this systems

1. Uvod

Varnost posameznika in varnosti civilne družbe je v zadnjih štirih letih pridobila precej na pomenu, zlasti po terorističnih napadih 11. septembra 2001. Ukrepe za zagotavljanje varnosti je mogoče zaslediti na različnih nivojih; tako povečanje skupnih sredstev za zagotavljanje varnosti na državnem nivoju, kot tudi različni ukrepi na nivoju organizacij ali posameznikov. Zaradi težko predvidljive napovedi nevarnosti, ki lahko preti skupini posameznikov, je bilo v zadnjem času veliko narejenega na področju analize in razpoznavanja obnašanja ljudi s pomočjo računalniškega vida.

Računalniški vid izpostavlja vidno zaznavno sposobnost naprav in poskuša avtomatično tolmačiti zajete prizore [1]. Od zaznavanja do razpoznavanja obnašanja pa je precej dolga pot, ki zavisi od področja uporabe in namena razpoznavanja. Od tega pa je odvisna tudi izbira pristopa in primerne tehnologije za najučinkovitejšo[1] izvedbo.

Članek obravnava izvedljivost in smisel razvoja video nadzornega sistema za zgodnje odkrivanje nevarnosti utopitve z metodami računalniškega vida[2] in uporabo nadvodnih kamer. Po današnjih predpisih zagotavlja varnost kopalcev reševalec iz vode, ki je postavljen pred težko in odgovorno nalogo – reševati človeška življenja. Prednost uporabe sistema za zgodnje odkrivanje nevarnosti utopitve je predvsem skrajšanje časa, ki ga reševalec v povprečju potrebuje, da odkrije potencialno žrtev v nevarnosti.

Izvedena je primerjava pristopa z uporabo nadvodnih in podvodnih kamer na podlagi testnih posnetkov in izkušenj sorodnih sistemov. Razvoj pametnega video nadzornega sistema je kompleksen projekt, ki zahteva temeljito študijo o možnostih in koristih uvedbe takega sistema.

2. Pametni videonadzorni sistem v bazenu

Koncept *pametnega videonadzornega sistema* je sestavljen iz klasičnega videonadzornega sistema, nekaterih metod računalniškega vida in razpoznavanja vzorcev. Napredni videonadzorni sistemi ne omogočajo zgolj sledenja premikajočim se objektom, temveč tudi razpoznavajo in interpretirajo posamezne prizore. Ravno avtomatično razumevanje dogodkov v realnem času zajetih prizorov predstavlja končni cilj pametnih videonadzornih sistemov [1].

Zamisel o uporabi pametnega videonadzornega sistema z avtomatičnim razpoznavanjem neobičajnega obnašanja je zanimiva tudi v bazenih. Idejno zasnovo sistema sestavlja mreža video nadzornih kamer, ki snemajo dogajanje na vodni površini bazena. Posnetek vsake kamere se najprej vzorči in procesira v modulu za detekcijo (in sledenje ljudi). Na ta način se iz dogajanja izloči ozadje in izpostavi

[1] Učinkovitost kot razmerje vložkov in učinkov iz tehničnega in ekonomskega vidika.

[2] Računalniški vid z avtomatičnim tolmačenjem obnašanja nekateri imenujejo tudi umetni spoznavni vid.

območje zanimanja (t.j. plavalci), ki ga dalje procesira modul za razpoznavanje obnašanja[3]. Glede na rezultate razpoznavanja, sproži modul za alarmiranje različne alarme in dodeli posameznim plavalcem statuse glede na trenutno nevarnost utopitve. Zaradi zahtevnosti razpoznavanja nevarnosti utopitve na podlagi video posnetkov, je potrebno hraniti določeno zgodovino določenih izhodnih parametrov vključenih modulov (pozicija, hitrost, aktivnost, statusi in alarmi ...), ki pripomorejo k lažjemu kasnejšemu razpoznavanju.

2.1. Izvedba z nadvodnimi kamerami

Pametni videonadzorni sistem za zgodnje odkrivanje nevarnosti utopitve je možno realizirati z uporabo nadvodnih video kamer [2]. Video kamere so nameščene nad vodno gladino in zajemajo prizore iz celotne vodne površine. Zaradi znane problematike obdelave prizorov pri katerih nastopa interakcija svetlobe in vodne površine ter problemov perspektive, je potrebno video kamere postaviti dovolj vertikalno [1]. Omejenost vidnega polja narekuje dovolj visoko postavitev kamer, kar je pogojeno tudi z prostorskimi omejitvami (predvsem pri pokritih bazenih).

Poleg omenjenih infrastrukturnih omejitev, je razpoznavanje nevarnosti utopitve v prizorih posnetih z nadvodno kamero precej kompleksno. Učinkovito računalniško obdelavo prizorov preprečuje več dejavnikov:

- spreminjanje pogojev osvetlitve,
- bleščanje in škropljenje,
- dinamično ozadje,
- prekrivanje kopalcev in problem trkov.

Ločen problem predstavlja računalniško razpoznavanje nevarnosti utopitve na podlagi posnetih prizorov. Učinkovitosti razpoznavanja ni mogoče objektivno preizkusiti zaradi pomanjkanja posnetkov resničnih utopitev. Zato tudi določanje značilk za uspešno razvrščanje vzorcev ni enostavno; potrebno je sodelovanje s strokovnjaki na področju reševanja iz vode.

2.2. Izvedba s podvodnimi kamerami

Bolj inženirski pristop pri ugotavljanju nevarnosti utopitve predstavlja uporaba podvodnih kamer. Človeško telo se namreč po prvi fazi aktivnega ali pasivnega utapljanja začne potapljati pod vodo [6]. Podvodne kamere tako spremljajo samo tiste objekte (plavalce), ki se potopijo pod določeno gladino kar bistveno olajša nadaljnje delo že zaradi manjše populacije objektov.

Izvedba s podvodnimi kamerami zahteva robustnejšo strojno opremo, poseg v obratovanje pri implementaciji in dražje vzdrževanje. Sama logika razpoznavanja nevarnosti utopitve pa je precej bolj preprosta kot pri izvedbi z nadvodnimi kamerami.

[3] Obnašanje, ki nakazuje na nevarnost utopitve.

2.3. Primeri pametnih videonadzornih sistemov v bazenih

V dostopni literaturi je mogoče najti dva sistema, ki naj bi omogočala zgodnje odkrivanje nevarnosti utopitve z metodami računalniškega vida. Sistem *Poseidon* so razvili v podjetju Vision IQ in je tržno dostopen produkt, ki za odkrivanje nevarnosti utopitve uporablja podvodne kamere in preproste metode računalniškega vida. Sistem je inštaliran v več kot 100 bazenih, vendar je njegovo delovanje preizkušeno le v pokritih bazenih. Proizvajalci trdijo, da je Poseidon doslej večkrat pripomogel k reševanju človeških življenj [7]. Draga implementacijo podvodnih kamer kompenzirajo z relativno enostavno programsko opremo, ki zanesljivo deluje.

Drugi primer sistema za zgodnje odkrivanje nevarnosti utopitve so razvili v Singapurskem inštitutu Institute for Infocom. Sistem uporablja mrežo nadvodnih video kamer in kompleksne metode računalniškega vida za analizo človeškega gibanja v realnem času [8]. Ker je sistem v testni fazi, je težko izmeriti njegovo učinkovitost.

3. Izvedba analize človeškega gibanja v vodi z metodami računalniškega vida in nadvodnimi video kamerami

Za namene izvedbe analize gibanja smo pridobili posnetke iz bazenskega okolja. Posnetki so bili razdeljeni v učno in testno množico (skupaj 60 posnetkov po približno 15 sekund), da bi lahko čim bolj objektivno presodili delovanje algoritmov.

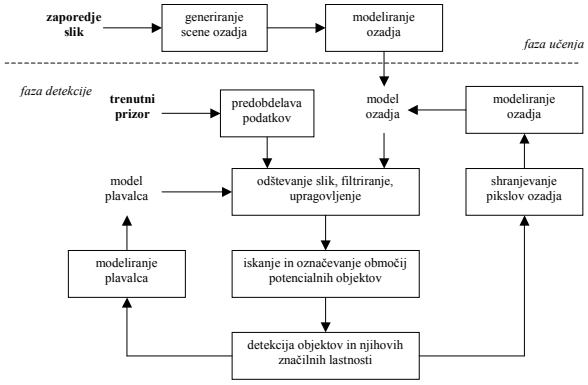
3.1. Predobdelava podatkov

Ugotovljeno je bilo, da slike v RGB barvni lestvici ne omogočajo najbolj učinkovite segmentacije kopalcev iz bazenskega ozadja. Preizkusili smo še barvna prostora HSV in CIE Lab, med katerimi se je za najbolj ustreznega izkazal HSV. Pri ročni segmentaciji, se je namreč človek od vode relativno najbolj razlikoval po barvnem odtenku (*hue*). Glede na pričakovane hitrosti gibanja plavalcev in priporočila drugih avtorjev [2], smo uporabili frekvenco vzorčenja f_s 3 slike na sekundo oz. čas vzorčenja T_s 1/3 sekunde.

3.2. Modeliranje ozadja in segmentacija slike

S segmnentacijo slike smo želeli iz zaporednih slik ločiti objekte (v danem primeru plavalce) od ozadja (v danem primeru vode v bazenu). Zaradi že opisanih problematik obdelave videoposnetkov se v primeru bazena ne moremo uporabiti klasičnih metod segmentacije [1], [2]. Segmentacija zgolj na podlagi videza ne pride v poštev, ker je težko iz bazena izločiti človeka na podlagi statičnih značilk. Na drugi strani tudi segmentacija zgolj na podlagi gibanja ne pride v poštev, saj ni nujno da se človek v vodi premika oz. zaradi valovanja, ki povzroča občutek premikanja ozadja. Zaradi časovne spremenljivosti ozadja odpade segmentacija na podlagi časovnih razlik [5], segmentacija na podlagi optičnega toka pa ni primerna zaradi računske zahtevnosti metode [5]. Avtorji navajajo,

da se je za najprimernejšo metodo segmentacije človeka v vodi izkazala metoda odštevanja ozadja [1], [2], pri čemer je zelo pomembno, da zgradimo dober model ozadja.



Slika 1: Shema postopka detekcije kopalcev

Da bi se izognili generiranju scene ozadja, na kateri bi bili prisotni tudi plavalci, poskušamo v fazi učenja nepremične plavalce izločiti s filtriranjem slike po barvnih vrednostih modela človeške kože. Premični plavalci pa predstavljajo v seriji naključno izbranih slik preteklih prizorov zgolj kratke, impulzne šume, ki jih lahko izločimo s medianinim filtrom po časovni osi. Prednost uporabe medianinega filtra (1) je v tem, da za razliko od npr. filtra na podlagi povprečenja vzame kot reprezentativni slikovni element (piksel) ozadja realni vzorec in ne matematične sredine ali kakšnega drugega izračuna.

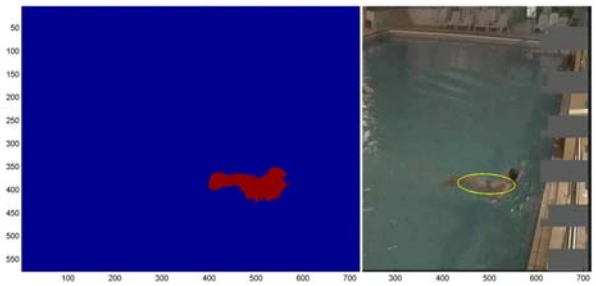
$$\mathbf{Y}(i,j) = \mathbf{V}_q(i,j) \in \mathbf{V}(i,j) \mid \min_{\mathbf{V}_q(i,j)} \sum_{p=1}^{T} \left| \mathbf{V}_p(i,j) - \mathbf{V}_q(i,j) \right| \qquad (1)$$

Za modeliranje dinamičnega ozadja so nekateri avtorji [1], [2], uporabili rojenje in tako prišli do predstavitve ozadja s središči homogenih barv. Na ta način se izognemo modeliranju vsake posamezne točke ozadja ter izkoristimo močno prostorsko korelacijo med posameznimi točkami.

Segmentacijo slike smo izvedli z metodo odštevanja ozadja. Zaradi dinamičnosti ozadja potrebno vgraditi adaptivnost modela ozadja. S posodabljanjem modela vsakih 2,67 sekunde smo zajeli začasne značilnosti bazena in hkrati uspešno preprečili vgraditev objektov v ozadje. Pri tem smo ob vsakem prizoru napovedali prihodnjo pozicijo plavalca in to tudi ustrezno obtežili v naslednji iteraciji (model plavalca).

Za segmentacijo slike predlagajo avtorji [1], [2] modificirano metodo odštevanja ozadja, ki temelji na razlikah barvnih komponent posamezne točke trenutne slike in središčnih vrednosti rojev vzorcev pripadajočega okvira (bloka) ozadja in razlik s povezanimi (sosednjimi) bloki. Na ta način se minimizirajo možnosti napačnega razvrščanja zaradi premikov ozadja na trenutni sliki, ki niso bili zajeti v modelu ozadja.

Za dokončno segmentacijo smo uporabili metodo dvonivojskega upragovljenja slike [4], pri čemer gre za uporabo principa histereze, ki jo določata spodnji T_l in zgornji prag T_h. Za bolj učinkovito odkrivanje kopalcev je smiselno uporabiti tudi druge, empirično pridobljene podatke o značilnostih kopalca. S poskusi smo prišli do zaključka, da imajo vsi slikovni elementi (piksli), ki predstavljajo penjenje vode (zaradi škropljenja, čofotanja, naglih premikov plavalca ...), naslednje normirane vrednosti komponent v prostoru HSV: barvni odtenek je večji od 0,35 (H > 0,35), nasičenje je manjše od 0,15 (S < 0,15), intenziteta je večja od 0,85 (V > 0,85).



Slika 2: Segmentirana slika objekta - plavalca

Na testnih posnetkih se je, da je predstavljena metoda segmentacije dobro deluje za detekcijo in sledenje kopalcev.

3.3. Predstavitev človeka

V primeru analize gibanja človeka v vodi za namene zgodnjega odkrivanja potencialne utopitve nas zanimajo sledenje, ocenjevanje drže in razpoznavanje gibanja. Zato je potrebno določiti več značilk, ki opisujejo človekovo pozicijo, orientacijo in položaj v vodi na različnih nivojih podrobnosti ter z različnimi semantičnimi pomeni. Izbrali smo naslednje značilke na nižjem nivoju podrobnosti *težišče plavalca P_i, orientacija plavalca P_i, parametri območju R_i najbolje prilagajoče se elipse (os a in b), površina območja R_i - N_i, povprečne vrednosti barvnih komponent območja R_i.* Iz nizkonivojskih značilk je možno izpeljati višjenivojske značilke, s katerimi lahko v fazi razvrščanja vzorcev določimo nevarnost utopitve [2].

3.4. Rezultati

Opisani algoritem za detekcijo in sledenje smo preizkusili na testni množici posnetkov. Izkazalo se je, da algoritem uspešno odkriva, segmentira in sledi plavalcu v vodi pri različnih aktivnostih (plavanje, mirovanje, potapljanje, agitacija). Dodatno bi ga bilo potrebno nadgraditi še za sledenje več plavalcev hkrati, kar lahko pri večjem številu kopalcev postane problem (procesorska moč) [1]. Potrebno pa se je zavedati, da je sledenje vsakemu posamezniku v zelo obljudenem bazenu praktično nemogoče. Problemsko ločeno področje predstavlja ugotavljanje nevarnosti utopitve. Nekateri avtorji [2], [3] so predlagali nabor značilk na različnih nivojih podrobnosti, s katerimi naj bi v večini primerov pravilno razpoznali utopitev. Dejstvo je, da posnetki resničnih utopitev niso dostopni in je algoritem možno preizkusiti le na bolj ali manj dobrih simulacijah zbuja dodatno nezaupanje v delovanje.

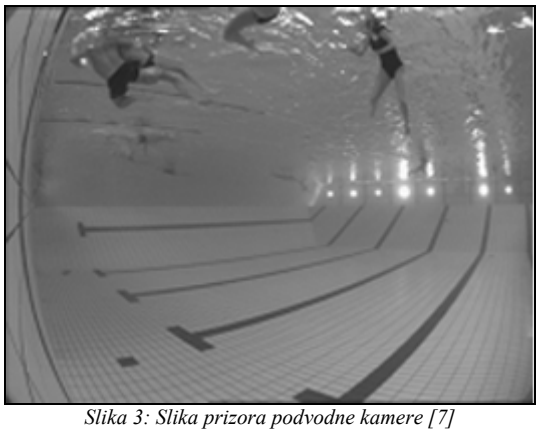
Druga možen pristop, je analiza skupine plavalcev kot množice. V tem primeru se številko objektov v bazenu lahko zmanjša, vendar je razpoznavanje obnašanja veliko bolj zamegljeno. Pri sledenju in analizi gibanja

posameznika, lahko za namene razpoznavanja utopitve uporabimo znane opis faz utopitve [6]. Pri analizi množice pa je razvrščanje vzorcev veliko bolj kompleksno in zato podvrženo manjši učinkovitosti.

Razvoj inteligentnega agenta za avtomatično razpoznavanje obnašanja utopitve zahteva največ dela in prinaša negotove rezultate. Za izvedbo dovolj dobrega[4] algoritma je potrebnega veliko znanja na področju reševanja iz vode in sodelovanja s strokovnjaki na področju umetnega spoznavnega vida. V praksi tak sistem še ni pomagal rešiti nobenega življenja.

4. Detekcija nevarnosti utopitve z uporabo podvodnih video kamer

Uporaba pristopa s podvodnimi kamerami narekuje precej enostavnejšo razpoznavo nevarnosti utopitve. Povodne kamere so postavljene pod vodno gladino tako, da lahko v zajetih prizorih v vsakem trenutku vidimo vse kopalce.



Slika 3: Slika prizora podvodne kamere [7]

V zgornjem delu slike lahko sledimo gibanju posameznih objektov, kjer mirujoča navpična drža plavalca predstavlja potencialno nevarnost pasivne utopitve. Aktivno gibanje plavalca na istem mestu predstavlja potencialno nevarnost aktivne utopitve, ostali objekti pa nas ne zanimajo. Na ta način se osredotočimo na nekaj plavalcev, ki so kandidati za utopitev. Ugotavljanje postopnega potapljanje izbranega objekta je relativno enostavno s kombinirano segmentacijo slike na podlagi videza in na podlagi gibanja. Zato je delovanje takega sistema lahko veliko bolj učinkovito, neglede na to, da ne razpolagamo s posnetki resničnih utopitev.

Sistem s podvodnimi kamerami s komercialnim imenom *Poseidon* je uspešno instaliran v več kot 100 bazenih. Njegov reakcijski čas je v povprečju med 20 in 30 sekund po nastopu utopitve, kar ohranja relativno visoke možnosti uspešnega reševanja žrtve. V času obratovanja naj bi sistem *Poseidon* večkrat pripomogel k hitrejšemu ukrepanju reševalca.

[4] Dovolj dober je takšen algoritem, ki razpozna vse resnične utopitve (false negative = 0), sicer bi, zaradi redkosti nastopa utopitve v določenem bazenu, sistem bil izrazito neučinkovit. Hkrati pa se od algoritma pričakuje zgornjo mejo napačno zaznanih utopitev (false positive < n_s) v časovnem nekem obdobju.

Zaključek

V prispevku je podan opis postopka detekcije in sledenja gibanja plavalca v vodi z nadvodnimi kamerami. Nakazane so bile smernice nadaljnjega razvoja algoritmov za razpoznavanje nevarnosti utopitve. Predstavljen je bil tudi princip delovanja sistema za zgodnje odkrivanje nevarnosti utopitve z uporabo podvodnih kamer. Izpostavljene so bile bistvene prednosti in dileme vsake izmed metod.

Iz navedenega lahko sklepamo, da je razvoj sistema za razpoznavanje utopitve s kompleksnimi metodami spoznavnega vida in zgolj nadvodnimi kamerami neutemeljen. Uporaba podvodnih kamer namreč prinaša tehnično precej enostavnejšo rešitev za razpoznavanje nevarnosti utopitve, kar dokazuje tudi primer iz prakse. Iz ekonomskega vidika je razlika v ceni strojne opreme in implementaciji relativno nizka v primerjavi z dodatnimi stroški razvoja. Poleg tega je postopek razpoznavanja obnašanja z nadvodnimi kamerami še precej negotov in občutljiv na število opazovanih objektov (plavalcev). Sistem s podvodnimi kamerami je smiselno dopolniti z inteligentnim sistemom za detekcijo in sledenje plavalcev na prizorih nadvodnih kamer in tako uporabniku zagotoviti popolnejšo informacjo o dogajanju v bazenu.

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USING AGENT APPROCH IN DEVELOPING A COURSE SHARING SYSTEM

Yaroslav Tsaruk[1], *Kimmo Salmenjoki*[1], *Helmut Dispert*[2]

[1] Department of Computer Science
University of Vaasa
Box 700, 65101 Vaasa, Finland

[2]University of Applied Sciences Kiel,
Faculty of Computer Science and Electrical Engineering
Grenzstr. 5, 24149 Kiel, Germany

e-mail: {yats, ksa}@uwasa.fi, helmut.dispert@fh-kiel.de

ABSTRACT

This paper presents the description of system for observing and presentation of information about a course. This system is going to improve the way of presenting up to date information about the courses and educational organization, which provide these courses. The information for user is presented irrespective of device type, used for the access of this information. The paper describes technologies and approaches used for building the system. Also paper proposes information about data structure and describes the system architecture.
The system operates on semantically full data. RDF format is used for presentation of data in semantic web appearance.

1 INTRODUCTION

The educational process becomes globalized. All over the world people start to collaborate and share experiences and knowledge with other nations. There are lot of international exchange programs and agreement between universities all over the world. According to these agreements students can easily attend courses in other universities all over the world. This kind of interaction between universities helps to extend and internationalize the options of education for their students. Thanks to this interaction, lot of professors and students could share their experience and knowledge among each other. Also this type of educational process allows cultural exchange. Implementation modern technologies allow making this interaction more efficient and more productive. The MODE is a project, in which researching into the process of searching and interaction between partners in collaborative environment. One of the collaborative an environments could be educational domain. In the University of Vaasa, we are running the project MODE, which stands for Management Of Distributed Expertise. In this project we have analyzed different cases, where several networked organizations share interest and knowledge on common projects. Although educational units collaborate continuously, there are many problems to establish common terminologies among the universities or while working in specific projects as all things are heavily language, culture and practical operational habits. To simplify the handling, we next introduce the Baltic Sea Network BSN as a case project of MODE and discuss its information architecture in detail. The main purpose of BSN is to combine efforts in sharing education and research operations and interests among the partner universities. The network promotes international cooperation focusing on the following areas: Welfare, Business Skills and Management, Tourism, and Information and Communication Technology always taking into account the sustainable development. about 40 educational organizations belong to the BSN network. The partners of BSN network are base for creation Baltic Sea Open University. The purpose of BSOU is providing the joint degree, based on the courses provided by BSN partners. The large part of BSN partners has a list of courses, which could be available to any of student of BSOU. In paper [1,2] has been discussed how important and useful are modern technologies and solutions in educational domain. In papers above, have been discussed projects going to improve quality of education.

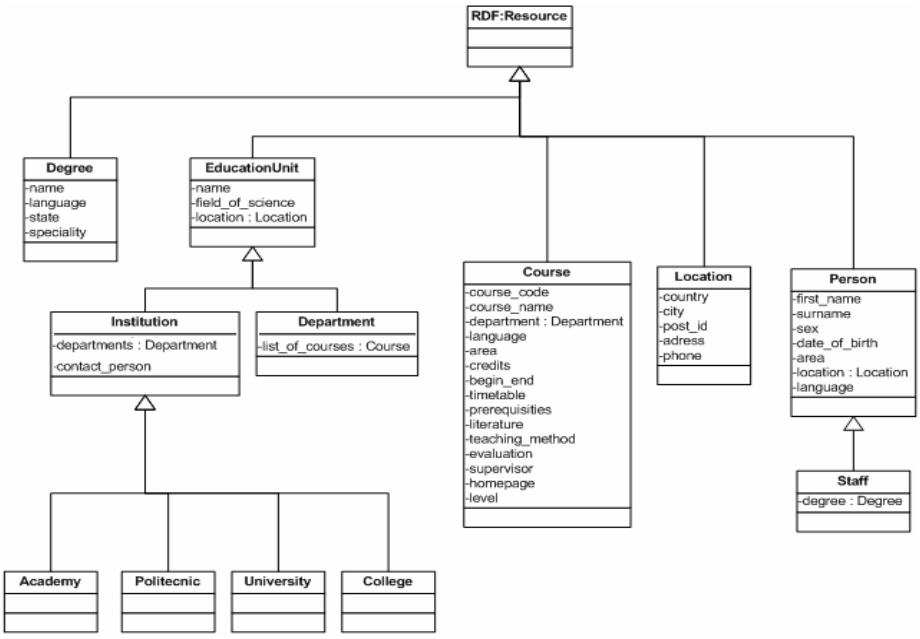

Figure 1: *The structure of presented information*

2 INFORMATION STRUCTURE

According to Bologna [3], all educational organizations should follow the same degree structure. The educational institution should use the same level of degree, the same measure for evaluation of the course (credit transfer). The unifying mechanism of credit transferring makes studying in the all other universities. More than 25 educational organizations from 9 countries come to BSOU (Baltic Sea Open University). All of these countries are Baltic Sea countries. In our work we have tried to find the unified structure. Should be proposed the structure, which is suitable for all educational institution from Baltic Sea region. The structure of information presented on the Figure 1. One of the modern technologies, which are using in this project, is Semantic Web. According to [4], the Semantic web is a mesh of information linked up in such a way as to be easily processable by machines (intelligent agent software), on a global scale. You can think of it as being an efficient way of representing data on the World Wide Web, or as a globally linked database. One of such format, which is used for presentation of information, is RDF[5].

RDF is XML-based format for representing of information in the web. As a XML based format RDF assumes available schema and document created according to structure defined in the schema file (RDFS). Figure 1 presents the structure of data according to RDF format. RDF imbibes object-oriented paradigm. The root element in RDF elements tree is Resource. All RDF objects are inherited from Recourse element. Figure 1 illustrates the classes, which define the structure of educational institution and the list of courses, proposing by this institution. Information about educational institution is presented by classes Instruction and Department. Both of these classes derive from EducationUnit class. The class EducationUnit defines generic properties for educational unit, such as:

- name;
- domain in which this unit works(field_of Science);
- Location of this unit (physical address).

The property location has a type Location, defined in this schema. All of these properties are inherited by its subclasses of EducationUnit class: Institution and Department. In addition each of these classes has its own set of properties. Institution class has four childs. Each of these childs specifies their type of educational organization:

- Academy;
- Polytechnic;
- University;
- College.

The information about courses is structured according to Course class.

Such classes as Person, Staff and Degree are needed for specifying supervisor for the course and their degree.

3 ARCHITECTURE OF COURSE SHARING SYSTEM

Architecture of the system is presented by four parts. The input data for the system is web resources educational institution. The processing of information is organized by Server-side component. Data storage component uses as storage for all data.

More detailed description about each of this component is provided below.

3.1 Data storage

Each component of the system operates with data. Data storage is a component, which takes care about saving of data.

The format of presenting data in system is RDF. Each component of the system uses it. The system use RDF storage mechanism in addition to common relational database for storing data. Before data become stored in MySQL database it is processed by Joseki server [6]. The Joseki server present RDF data in internal format and store it in MySQL. The key features of Joseki RDF storage are able to operate with server via HTTP protocol and execute query in RDQL (Resource Description Query Language) [7]. The union on traditional relational database and RDF storage allows to get productive data storage.

3.2 Server-side component

Processing, storing information and extracting data from the storage are responsibilities of the server-side components. Server-side components consist from:

- metadata engine
- content provider
- information extractor engine.

Each of these parts operates with RDF data and interacts with Data storage. Jena is a framework, which allows to work with RDF data and easily interact with Joseki storage [7, 8].

The responsibilities of Information extractor engine is to extract information from specified web resource. The Information extractor engine extracts information from the web resource and passes it to the metadata engine. Then metadata engine got the data, process it and store in the storage. By request from Content provider, Meta data engine extracts appropriate data and pass it to Content provider. Then content provider got the data, presents this data in appropriate form for the user view, according to the type of device, which the user uses. The information about user's device type is provided by the Agent discovering type of device.

3.3 Sources and consumers of information

The information from BSOU partners is an input information for the system. All information provided by partners could be specified according to the same structure, according to the same RDF schema. It means that all educational organization should have the same RDF document on their web site. The RDF documents of all organization should be designed according to one schema. Optionally we will use some harvesting of web based information to our semantic portal with semiautomated RDF annotataions.

The consumer (user) of information is a person, who needs to get information about the courses or detail information about organization that provides this course. The responsibilities of system are detection of the type of approporiate device used by the user and response, providing data in adequate format.

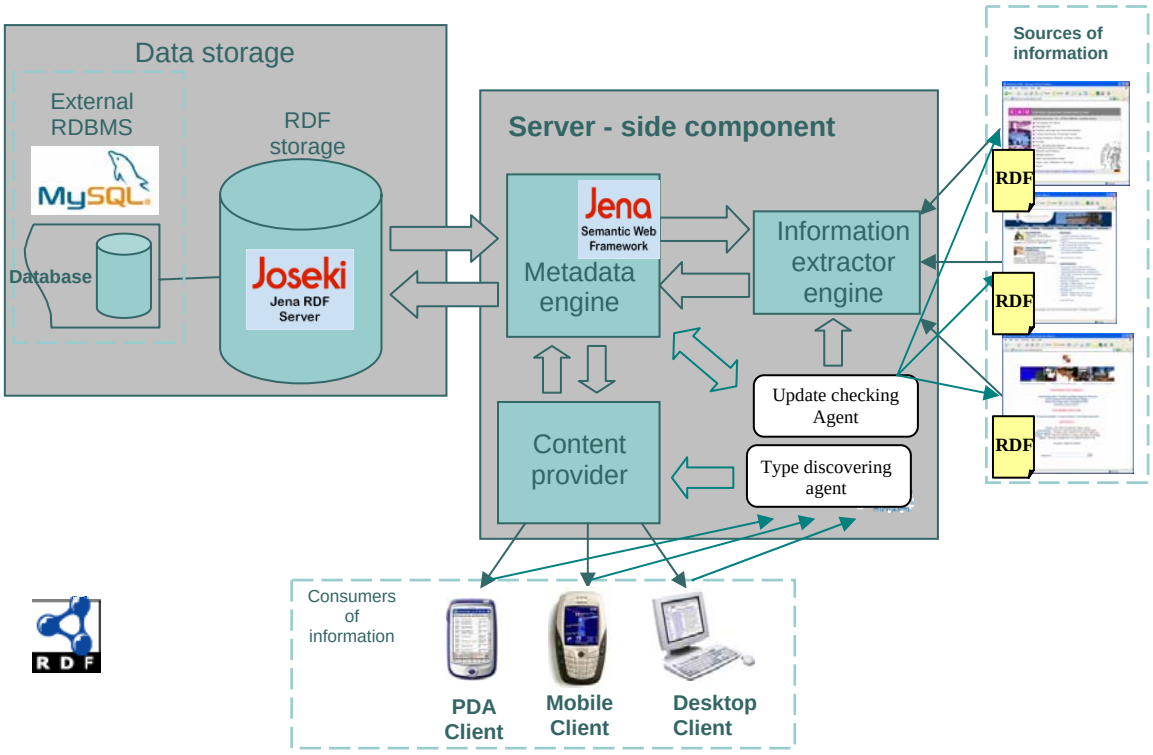

Figure 2: *The architecture of system.*

4 AGENT TECHNOLOGIES SOLUTION

The information provided by the system should be presented in human readable format. The system should keep track of the changes and react to these by updating the content of system storage. To meet these requirements, we have decided to use agent technology.

There are a lot of discussions regarding definition of intelligent agent, but all of them come to specifying the set of behaviors, which intelligent agent should have [8, 9].

The intelligent agent should have such behaviors:

- reactivity;
- proactivity;
- collaboration.

The main advantage of computer systems is the simplification of tasks, executed by user and delegation of the rights for performing the hundred tasks. The intelligent agent could do more than follow predefined rules. The agent should react for the changes in environment and react on it. As well as react, agent should be able foresee the changes in environment and make appropriate changes. In process of operation agent should be able to communicate with other agents or software components. It could provide its resources for someone else, who need it or get some resources from other agents.

In our system we are using two agents. In order to meet requirements of tracking the changes in partner's web resources the Update checking agent has been proposed. The responsibility of Update checking agent is examination of partner's web resources. The period and frequency of check is specified by agent according to situation. For example, there is a low probability that during Christmas or summer holiday some changes would be made. There is no need to check changes often in these periods of time, but it should be checked quite often in the beginning of each semester, when the most part of courses are setting up. Then the system detects the changes at one of the partner's portal it calls for execution Information Extractor Engine.

One more agent used in this system is agent, which discover the type of client which user use. The agent assumes that it could be: PDA browser, Wap browser (mobile phone) or computer browser (desktop). According to the browser request agent detects the type of device and provide this information to Content provider component. The Content provider component sends data in appropriate format to the user's browser.

5 CONCLUSIONS

The developed system is used for improving the performance of educational organization and provision of up-to-date information about educational organization and provided courses in useful human form. The user of this system should get up-to-date information irrespective of type of device, which he or she uses to access this information.

In process of design and developing this system modern technologies, such as Semantic Web have been used. Using of semantically full format allows intelligent organization of web based data. This data could be efficiently used further by the different software components.

Another technology used in this project is agent. Using of agents allowed to improve the performance of the system.

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MULTIAGENT LEARNING ORGANIZATION

Viljem Tisnikar, Jadran Prodan
Jozef Stefan International Postgraduate School
Jozef Stefan Institute
Jamova 39, 1000 Ljubljana, Slovenia
Tel: +386 41 690619; fax: +386 5 6400525
e-mail: vili@inka.si, jadran.prodan@mtt-solutions.si

ABSTRACT

Attempts were made to formalize the concept of Learning Organization. We see the equation of people with their organizational roles as obsolete if we introduced modern technologies. The paradigm shift in Computer science and the modern agent technology give raise to opportunities to build new kind of ICT infrastructure for organizations. We propose a new definition for Multiagent Leaning Organization where ICT technology supports multichannel intra and inter organizational communication and another special protocol is used for dynamical organizational tree building. Our protocols are FIPA compliant and can serve as a universal solution for any kind of organization to enhance its capability for timely reactions to dynamical, discontinuous changes in their environment.

1 INTRODUCTION

The Learning organization is the concept tightly connected to Senge [14]. He defined a learning organization as dynamical systems (as defined in Systemics) that are in a state of continuous adaptation and improvement. That is, organizations that are adapted for maximum organizational learning and that build feedback loops deliberately to maximize their own learning. An attempt was made [13] to formalize the Senge's definition of Learning Organization and related five disciplines by using Multiagent approach. Agent technology [8] is young and promising field for development new software solutions, reflecting the progress and the paradigm shift in Computer science [3]. With agent technology we can do the software that works in the way people solve problems – not how computers process data (www.magenta-technology.com).

The unforeseen progress in (electronic) communication abilities and computation power calls for the paradigm shift also in the management science. Traditional (business) processes and organization types could be redefined using new information and communication technology (ICT). To many fine scientists and software developers work on solutions which merely automate processes that existed before the new technology is introduced. We have to search in the new space of organizational solutions instead, considering both the technological advances and simultaneous organizational changes.

A decision maker in an organization today could have available in any moment all the observations from all people involved in organization but unless these observations were compressed in some way she would be overloaded with them. Many authors write about "information overload" today. This is because new communication technologies increased enormously the availability of information but less was done to efficiently compress and organize them. We try to organize knowledge in organizations by using cybernetic principles [1,5,6,9].

This paper presents a novel model of organization, based on possibilities that agent software technologies bring. The new model is content independent and could deal with same old organizational goals but it adapts in real time to the changes in its environment. The rest of the paper is organized as follows: in the next section we provide for Learning Organization Definition; in section 3 we present the basic elements and some mechanisms within our Multiagent organization model; section 4 is about partial prototype solutions and in section 5 conclusions and future work are treated.

2 LEARNING ORGANIZATION DEFINITION

Organizational learning is an area of knowledge within organizational theory that studies models and theories about the way an organization learns and adapts. In Organizational development (OD), learning is a characteristic of an adaptive organization, i.e., an organization that is able to sense changes in signals from its environment (both internal and external) and adapt accordingly. But what exactly does learning mean?

One of possible interpretations of learning from computer science point of view is the Minimum Description Lenght (MDL) principle [4], which is based on the following insight: any regularity in the data can be used to compress the data, i.e. to describe it using fewer symbols than the number of symbols needed to describe the data literally. The more regularities there are, the more the data can be compressed. Equating learning with finding regularity, we can therefore say that the more we are able to compress the data, the more we have learned about the data. Because data compression is formally equivalent to a form of probabilistic prediction, MDL methods can be interpreted as searching for a model with good predictive performance on unseen data. It turns out

that any data can be described with one more or less complex mathematical function, which reflects the regularities in it. Many times it is better to treat some specific data examples as noise and to represent them separately in order to become less complex functions.

We can break down mathematical functions into less complex ones [17] and become a hierarchy of so called features. It is possible also to build features bottom up [16]. In an organizational setting we can build a hierarchy of goals [15]. On the top is the mission goal, from which derive strategic goals, then tactical goals (business plan) and finally operational goals on leaves of the tree of goals. If we see the goals as some positions in the time-space we need some functions to become them from current positions in time-space. We equate these functions with activities and we name the activities with short description of the goal to which they lead.

The dynamic of changes in organizational environment and their impact on organization can be very different. We define the Learning Organization (LO) as such that have real-time mechanisms to detect, evaluate and react on changes in its environment. Changes in LO's environment are defined as observations different from its predictions. The LO can set some policies in terms of different thresholds for differences evaluation and (not) react on that basis. The reaction of the LO is defined as change of its "big function", possibly broken down into tree of features.
Presented mechanisms, "big function" and features can be the knowledge in heads of people, some business rules and LO's culture. We claim that we become more robust and efficient LO if we introduced appropriate structure in these processes with help from ITC infrastructure. Before we present basic characteristics of our proposal solution in sections 3.1-3.3 we have to introduce an "organizational paradigm shift" in the next section.

3 THE ACTIVITY AGENT

Usually we think of the agent in an organizational setting either as a human agent [13] or "pure" software agent. We introduce an abstract concept of ACTIVITY as the most important "agent" in the LO. This way we become several advantages and eliminate disadvantages of both human and software agents. The autonomy of an agent is based upon its knowledge (intelligence) and computer scientists have many difficulties with creating intelligent software so we require that human knowledge (intelligence) is one of crucial parts for our new kind of agent (ACTIVITY).
The second basic characteristic of agents is their social ability and communication goes along with it. We know that with emergence of e-mail (and the internet) and GSM technology the communication among people increased. But it is also more difficult to keep track of communication with same partners through different communication channels. We propose that software is responsible for communication (social) abilities of our ACTIVITY agent.
The Foundation for Intelligent Physical Agents – FIPA (www.fipa.org) in its Abstract Architecture Specification among other things focus on Agent interoperability, which includes 1. managing multiple message transport schemes, 2. managing message encoding schemes, and 3. locating agents and services via directory services. The FIPA Abstract Architecture explicitly avoids issues internal to the structure of an agent.
Any our ACTIVITY can be viewed as (mathematical) function that maps from state A to state B in the space-time. We already claimed that any function could be broken down into less complex ones [17]. When we do that we need some special communication protocol among higher level activity and its lower level features. The protocol's basic duty is to provide for consistency among higher level ACTIVITY (function) and it's subactivities (features). This is the first of our two basic types of communication protocol.
The second type of communication protocol among our ACTIVITIES is classical message passing. It is important that this protocol is the same regardless which organization the activity belongs. So the ideal solution is standardized, such as FIPA, which define three fundamental aspects of message communication between agents: message structure, message representation and message transport. This way our activities can communicate (send and receive messages through various channels) inter and intra organization the same way.

3.1 The new way of communication

We defined our activity agent (AA) as the hybrid between human agent, which provide intelligence (knowledge) and software agent, which provide for enhanced communication abilities. We further define a human that provide for knowledge of the generic AA as the owner of that AA. We defined also that activities form a hierarchical tree. Subactivities (features) are entailed in their higher level activity (function).
When the communication between two AA occurs in the same time occurs also the communication between their owners – humans. The main difference is that the change of states (internal model) due to communication in the AA is explicit meanwhile changes in human brain are tacit. Many authors from Knowledge management field claim the importance of transformation of tacit knowledge into the explicit one in organizations. In our model this transformation occurs naturally due to the design of the model. Namely humans interact between themselves through AA. In order to do this, they have to transform their tacit knowledge into explicit one.
We introduce now another type of agent, a Personal Agent (PA), which serves as human-computer interface. Its main task is to keep track of all AA that a specific human is involved in and of the role that she (the specific human) plays in a generic AA. She can be the owner of that generic AA or the owner of other AAs connected to it (Markov blanket) or the sender (receiver) of the message relevant for that AA. The communication schema between humans is presented in Fig. 1.

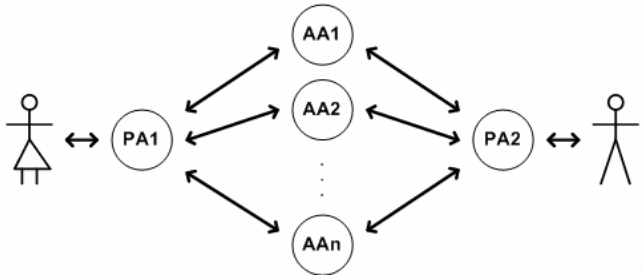

Fig. 1: The communication schema between humans in our model of Multiagent Learning Organization

3.2 The AAs life cycle

The AA life cycle has tree stages: first it is the idea (IAA) than it transforms into AA and finally it becomes the Document about concluded activity (DAA).
The owner of the generic IAA has to transform his tacit knowledge to an explicit one and define the goal of the activity and the scenario for reaching that goal as well as some additional constrains (timing, budget). Then she sends this explicit representation to some generic AAs or to a service, which provide a "market place for IAAs". The owners of existing AAs have to evaluate the fitness of that IAA to their AAs. When the generic IAA fits to a generic AA the latter "approves" the transformation of IAA to a new generic AA.
Our first communication protocol (see section 2) provide the constrain that one and only one generic AA can approve the transformation from IAA to AA. This way we ensure consistency for tree building and we also eliminate circular references.
The presented constrain doesn't apply to our second communication protocol. All AA and IAA can communicate between themselves and they distinguish only between incoming messages (documents) and outgoing messages (documents).
When the generic AA is concluded it have to communicate to its higher level AA which has to decide whether to approve the transformation of the AA to DAA or not. If it approves the concluded AA doesn't communicate with its higher level AA using our first communication protocol but transforms itself to an incoming document for higher level AA. This way every generic AA becomes the documented history of concluded lower level AAs i.e. an explicit internal model of the world. It becomes the database consisting of records from real-world experiences and can serve as an input for learning. We could examine such a database with various data-mining tools and find hidden regularities in it.

3.3 Dynamic tree building

We know plenty of organizational types but all of them suppose a kind of equation between humans and their roles (positions) within the organization. Every role (position) is defined with a bundle of tasks (activities) and responsibilities for a person. It is usually the task of some organizational expert to design the appropriate bundles of tasks and relations (responsibilities) between them. But every designer has only partial knowledge and any centralized function has difficulties with timeliness of its reactions to changes in the environment.
With our approach we dynamically build the tree of activities within an organization and we do that in highly distributed manner. Namely every person in the organization has to put explicit the goals she would like to reach for the organization and "sell" her IAAs to existing AAs. If she didn't succeed to sell a generic IAA she has to change it and this way the system encourages the entrepreneurship within an organization. Every person can experiment with different generic IAAs and in the worst case she has to abandon a particular IAA if it doesn't fit at that moment to any AA in the organization.
On the other hand the first AA of the organization is its root. The owner of the root AA is the managing director, which also represents the organization formally. When we register the organization with authorities we have to define basic attributes, such as: legal type, type of its activities, the official address and the person responsible... Now the root AA and its owner have to find appropriate lower level activities and their owners. The (root) AA has to publish its expected features in form of "Request for IAAs" with some selected group of person or in the "market place for IAAs".
The problem that (root) AA has is the high redundancy of (theoretical) possibilities for breaking down the AA to simpler features (lower level AAs). On the other hand it is constrained with the availability of appropriate IAAs. If it managed to find the appropriate bundle of IAAs and if it transformed them to AAs within the organization it created new branches for the organizational tree of activities.
Some (lower level) types of AAs are reused many times in the specific organization. In that case it is convenient to secure their availability within the organization. The others are used only occasionally and it is better to outsource them. The FIPA compliant architecture ensures high compatibility of both possibilities. Features selection or dynamical organizational tree (of activities) building can be viewed as a Multiagent e-procurement process. Some relevant solutions were developed for traditional (business) enterprises [2,7,12], which include modern Decision support tools for winner determination problem and co-adaptive matchmaking with mutual relevance feedback.

4 PROTOTYPE SOLUTIONS

In the company Inka, Slovenija we built some prototypes which represent partial solutions for the overall model of Multiagent Learning Organization. We defined very well the first type of communication between AAs (see section 2). This type of communication is specific for AAs within the organization and is crucial for dynamic tree building. We equate the organization's high ability for restructuring its tree of activities with our definition of Learning Organization, presented in section 2.
So far our prototype solutions were built on Python/ZOPE platform, which performs very well with Internet standards. It is important because the second type of communication

in our overall model is the same, no matter whether inside organization or with its environment.

5 CONCLUSION

We developed a new model for Multiagent Learning Organization. Until now it was Multiagent only by theoretical design so the aim for further work is to rewrite the model on the real Multiagent platform in any case FIPA compliant.

We will also refine our model in terms of more formal representation and integrate in it the tools from relevant scientific fields such as Decision support systems and Data mining. The tool for simulations using Genetic algorithm for IAAs is still somehow remote.

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VEGA: LUPINA EKSPERTNEGA SISTEMA

Štefan Furlan, Rok Rupnik, Marjan Krisper

Laboratorij za informatiko
Fakulteta za računalništvo in informatiko
Tržaška cesta 25, 1001 Ljubljana, Slovenija

stefan.furlan@gmail.com

ABSTRACT

Vega: Expert System Shell

The paper introduces research project of developing expert system shell Vega. First part of the article forms theoretical background. Second part introduces Vega system through development goals, formalism for modeling decision-making process, inference function concept and system architecture.

POVZETEK

Članek predstavlja raziskovalni projekt razvoja lupine ekspertnega sistema imenovane Vega. Prvi del članka predstavlja teoretično ozadje problema. Drugi del pa predstavlja sistem Vega in sicer: prvotne cilje razvoja sistema, način modeliranja procesa odločanja, koncept funkcije sklepanja in arhitekturo sistema

1. UVOD

Cilj razvijalcev ekspertnih sistemov je zapisati znanje o določeni problemski domeni v formalni obliki, ki bo omogočala avtomatsko sklepanje. Pri tem si pomagajo z množico formalizmov in nad njimi tehnik sklepanja. Uspešnost posameznega primera je v veliki meri odvisna od ustreznosti izbranega formalizma za modeliranje znanja o konkretni problemski domeni.

Članek predstavlja projekt razvoja lupine ekspertnega sistema imenovane Vega. Sistem omogoča razbitje problema na podprobleme po načelu 'deli in vladaj'. Na nivoju podproblemov omogoča izbiro poljubnega formalizma za zapis znanja, potrebnega za reševanje le tega. Nad tem znanjem pa omogoča izbiro poljubne tehnike sklepanja. Tak pristop omogoča kombinacijo pristopov v eni problemski domeni.

Zasnova sistema omogoča dostop do poljubnih podatkovnih virov in uporabo pridobljenih podatkov v procesu odločanja. Jedro sistema je zasnovano kot spletna storitev. To omogoča praktično neomejeno število načinov uporabe od spletnih, namiznih in vdelanih (*embedded*) aplikacij do aplikacij na mobilnih napravah, ki so uporabniku na voljo ne glede na njegovo trenutno lokacijo.

Članek je sestavljen iz dveh delov. V prvem delu je podano teoretično ozadje – pojmi, ključni za razumevanje problematike. Drugi del pa ima naslednjo strukturo: cilji razvoja sistema Vega (poglavje 3) ter logični in arhitekturni vidik sistema (poglavje 4). Sledi povzetek in predstavitev načrtov za nadaljnje delo.

2. TEORETIČNO OZADJE

V tem poglavju so predstavljeni osnovni koncepti sistemov za podporo odločanju, ekspertnih sistemov in lupin ekspertnih sistemov.

2.1 Sistem za podporo odločanju

Sistemi za podporo odločanju so računalniški sistemi, ki nudijo računalniško podporo sprejemanju odločitev [2]. Številni avtorji koncept natančneje opredeljujejo z gradniki takih sistemov ali postopki izgradnje [Bonczek v 14, Keen v 14].

Namesto natančnejše definicije podajamo splošne lastnosti takih sistemov [2, 4, 14]:

- uporabljajo se za reševanje polstrukturiranih ali nestrukturiranih problemov;
- njihov cilj ni avtomatizirati, temveč izboljšati odločitev;
- imajo uporabniku prijazen vmesnik, ki se hitro odziva na njegove potrebe.

2.2 Ekspertni sistem

Ekspertni sistemi predstavljajo posebno vrsto sistemov za podporo odločanju. Njihova specična lastnost je baza znanja in nivo znanja (ekspertize), zajetega v njej.

Osnovni komponenti ekspertnega sistema sta baza znanja (*knowledge base*) in mehanizem sklepanja (*inference engine*). Baza znanja zajema formalizirano znanje o neki problemski domeni, mehanizem znanja pa omogoča sklepanje na podlagi tega znanja. Ostale komponente, ki se še lahko pojavijo v ekspertnem sistemu so: uporabniški vmesnik, razlagalni podsistem (*explanation subsystem*) itd [2, 5, 14].

Najpogostejša oblika ekspertnega sistema je interaktivni pomočnik (asistent, učitelj) oziroma orodje, ki na podlagi vhodov avtomatsko generira (predloge) odločitve [2].

Navadno je razlog za razvoj ekspertnega sistema ohranitev znanja eksperta oz. izboljšanje dostopnosti znanja, izboljšanje učinka manj izkušenih kadrov, uveljavitev višjega nivoja konsistentnosti pri opravljanju določenih nalog itd [2].

2.3 Lupina ekspertnega sistema

Problem izdelave ekspertnega sistema na novo (npr. s pomočjo programov LISP ali Prolog) je zahtevnost in posledično cena. Kot odgovor na to problematiko so se v

osemdesetih pojavile t.i. lupine ekspertnih sistemov. S pojavom le teh je tehnologija ekspertnih sistemov postala finančno dostopna večini organizacij. Lupina ekspertnega sistema navadno ponuja realizacijo splošnih komponent ekspertnega sistema in s tem narekuje način oz. formalizem za persistenco znanja [12, 13, 14].

Lupine se zelo razlikujejo po kompleksnosti in ceni, lahko pa jih v grobem razdelimo na splošne in specifične določeni domeni. Pri izbiri lupine je pomembno, da omogoča tak način zajema znanja, pri katerem se bo izgubilo čim manj informacij o problemski domeni, ki jo modeliramo. V praksi se zaradi specifičnosti večine lupin pri izgradnji ekspertnih sistemov za nestandardne probleme poslužujejo združevanja več lupin. Tak pristop otežuje nadgrajevanje in vzdrževanje sistema ter izobraževanje kadrov [14].

Čeprav lupine olajšajo programiranje, ne pomagajo pri pridobivanju znanja (*knowledge acquisition*). Zbiranje kvalitetnega znanja pa je po menju nekaterih avtorjev pomembnejše od izbire lupine [5].

Stylianou v okviru izgradnje empiričnega modela za evalvacijo lupin ekspertnih sistemov [12, 13] med drugim podaja rezultate ankete uporabnikov lupin ekspertnih sistemov. Glede na anketo so kvalitete, ki jih uporabniki lupin najbolj cenijo, naslednje: možnost dostopa do podatkovnih virov, možnost vdelave v druge aplikacije (embeddability), možnost prototipnega razvoja, obstoj enote za razlaganje, možnost prilagajanja razlage in kvaliteta razlage.

3. CILJI PROJEKTA

Cilj projekta je izdelati lupino ekspertnega sistema, ki bo v čim večji meri ugodila pričakovanjem uporabnikov in bo v skladu s trendi IT.

Zahteve uporabnikov so pomemben vidik razvoja vsakega informacijskega sistema. Temelj za identifikacijo zahtev nam je predstavljala raziskava Stylianoua [12, 13] (glej tudi poglavje 2.3).

Trendi na področju IT zahtevajo vse bolj inovativne pristope k razvoju informacijskih sistemov. Dostopnost postaja ključnega pomena, mobilne aplikacije že postajajo standardna platforma za dostop do časovno kritičnih podatkov [10]. Ena od pomembnejših smeri razvoja sistemov za podporo odločanju bo razbijanje meja dostopnosti orodij. Le ta naj bi v prihodnosti nudila podporo nosilcem odločanja ne glede na njihovo trenutno lokacijo [11]. V skladu z omenjenimi trendi sta cilja projekta tudi razvoj odjemalcev lupine ekspertnega sistema za splet, dlančnik in telefon, ter omogočen dostop do poljubnih podatkovnih virov in uporabo le teh v procesu odločanja.

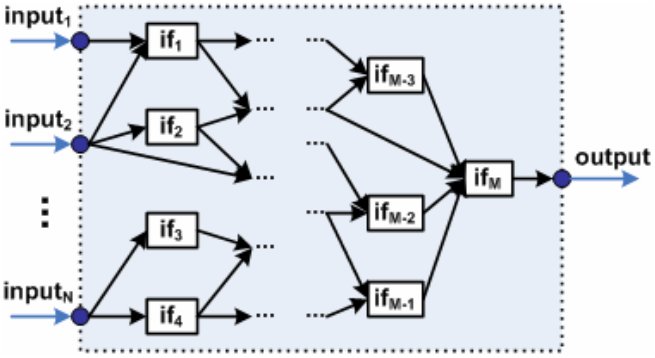
4. VEGA

Sistem Vega omogoča modeliranje postopka odločanja. Predvideva razbitje postopka odločanja do nivoja posameznih aktivnosti oz. funkcij, ki se v okviru sistema Vega imenujejo funkcije sklepanja. Postopek odločanja se modelira z usmerjenim grafom. Vozlišča grafa predstavljajo funkcije sklepanja, povezave pa prehajanje med njimi.

Formalizem za persistenco znanja in tehnika sklepanja posamezne funkcije sklepanja sta za sistem transparentna. Sistem predpisuje le vmesnik, ki ga mora funkcija implementirati, v ostalih pogledih pa je funkcija za sistem 'črna škatla'.

4.1 Odločitveni model

Formalizem za modeliranje procesa odločanja temelji na oz. se zgleduje po več priznanih tehnikah: večparametrski odločitveni modeli [3, 14], nevronske mreže [1, 8], analytic hierarchy process [14] ...



Slika 1: Odločitveni model.

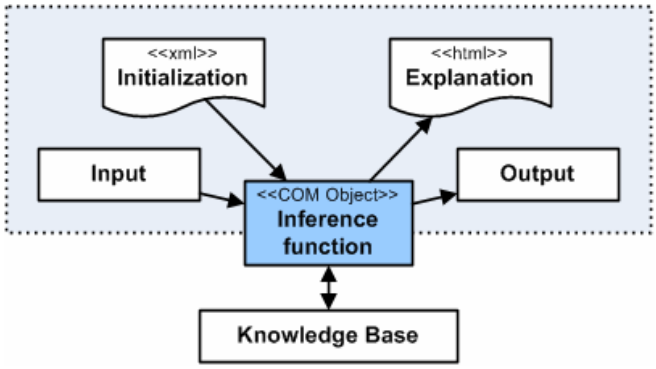
Odločitveni model predstavlja model procesa odločanja eksperta in zajema bazo znanja o modelirani domeni. Formalizem je osnovan na podlagi usmerjenega grafa. Določa ga:

- N **vhodnih vozlišč**, ki predstavljajo atribute posamezne alternative. Lahko gre za konkretne podatke ali parametre na podlagi katerih se v kasnejših fazah pridobijo podatki.
- **Izhodno vozlišče**. Predstavlja predlog odločitve, kot posledico procesa odločanja.
- Množica **notranjih vozlišč** $V = \{if_1, if_2 ... if_M\}$. V vsakem od vozlišč je t.i. **funkcija sklepanja**. Naloga funkcije sklepanja je, na podlagi vhodnih podatkov izvesti in razložiti določen sklep.
- Množica **povezav** $E \subseteq V \times V$. Povezave vsebujejo proceduralno znanje o določenem problemu; določajo zaporedje izvrševanja podproblemov in nalog za rešitev nekega problema.

4.2 Funkcija sklepanja

Funkcija sklepanja je osrednji koncept modela. Gre za element, ki nosi znanje, potrebno za reševanje posameznih podproblemov v okviru ekspertnega sistema. Formalizem za persistenco tega znanja s strani sistema ni niti določen, niti zahtevan. Prav tako ni predpisanega postopka, kako naj funkcija na podlagi tega znanja sklepa. Zaželeno je le, da zna postopek sklepanja čim bolj natančno razložiti.

S strani sistema je predpisan vmesnik, ki ga mora funkcija sklepanja implementirati v obliki COM objekta. To omogoča uporabniku, da sam implementira funkcijo sklepanja v katerem koli jeziku, ki omogoča izgradnjo COM objekta. Uporabnik pa lahko enostavno uporabi tudi že obstoječo funkcijo sklepanja, ki se npr. uporablja pri nekem drugem ekspertnem sistemu.



Slika 2: Funkcija sklepanja.

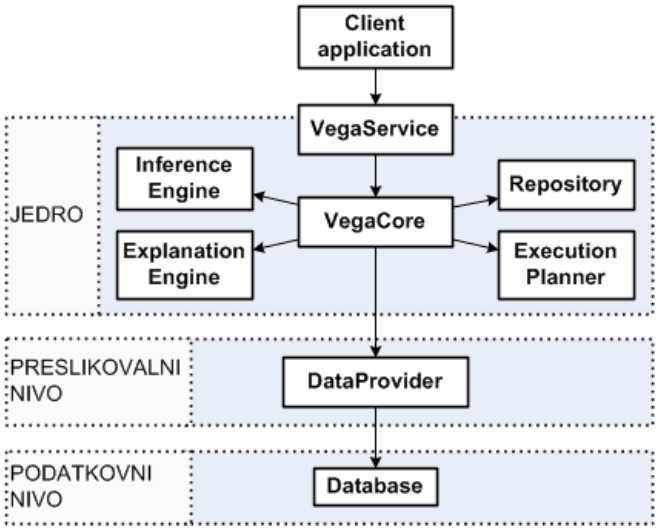
Funkcija sklepanja v bazi znanja vsebuje znanje o tem, kako opraviti določen sklep. Inicializacijski XML (initialization) postavlja funkcijo v kontekst (t.j. jo naredi uporabno v nekem konkretnem ekspertnem sistemu). Ko je funkcija sklepanja tako določena, je sposobna na podlagi vhodnih podatkov v neki problemski situaciji podati sklep in razlago le tega.

V konkretnem primeru bi bila lahko funkcija sklepanja funkcija, ki zna sklepati na podlagi konceptualne sheme podane v obliki ontologije. V inicializacijskem XML-u bi bili podatki o tem, kje se ontologija nahaja in o tem, kaj nas zanima (poizvedba). Tako bi bil statični vidik funkcije določen in s tem bi bila pripravljena za uporabo. V konkretni situaciji bi funkcija sklepanja služila preverjanju, če so vhodni podatki skladni z zahtevo na podlagi podane ontologije. Ista funkcija sklepanja bi se nato lahko uporabila tudi v nekem drugem ekspertnem sistemu, kjer bi prav tako potreboval neko sklepanje na podlagi ontologije. Vse kar bi bilo potrebno spremeniti je inicializacijski XML.

V grobem bi funkcije sklepanja lahko razdelili v tri tipe: funkcije, ki služijo transformaciji podatkov iz ene oblike v drugo; funkcije za pridobivanje novih podatkov iz različnih podatkovnih virov; ter funkcije, ki na podlagi vhodov in lastnega znanja naredijo nov sklep. Sistem med tipi funkcij ne dela razlik.

4.3 Arhitektura sistema

Sistem Vega sestavljajo štirje sloji (glej sliko 3). Najnižji je podatkovni nivo, ki je namenjen persistenci ekspertnih sistemov. Sledi mu nivo za preslikavo podatkov iz relacijskih shem v objekte. Tretji sloj predstavlja jedro sistema namenjeno poganjanju ekspertnih sistemov. Jedro je uporabniškemu nivoju na voljo preko spletne storitve. V tem poglavju bo fokus predvsem na spodnjih treh slojih, ki predstavljajo strežniški del sistema.



Slika 3: Arhitektura sistema.

Jedro sistema je uporabniku dostopno preko spletne storitve. Naloga jedra je, na podlagi vhodnih podatkov pognati ustrezni ekspertni sistem in vrniti predlog odločitve ter razlago; kar je osnovna funkcionalnost sistema. To osnovno funkcionalnost izvaja učinkovito z uporabo paralelnega izvajanja, z začasnim hranjenjem rezultatov ipd.

Jedro je sestavljeno iz šestih komponent (glej sliko 3):

- **VegaService** abstrahira funkcionalnosti jedra sistema v uporabniku razumljiv skupek metod. Le ta je uporabniku dostopen preko spletne storitve.
- **VegaCore** je osrednja komponenta sistema, ki skrbi za pravilno zaporedje delegiranja opravkov ostalim komponentam.
- **InferenceEngine** opravlja klice funkcij sklepanja.
- **ExplanationEngine** tekom izvajanja sestavlja razlago procesa odločanja in posameznih sklepov v skladu z nivojem abstrakcije zahtevanega s strani uporabnika.
- **Repository** je namenjen hranjenju rezultatov za potrebe nadaljnjega izvajanja.
- **ExecutionPlanner** pozna strukturo modela (z vidika grafa) in narekuje zaporedje izvajanja funkcij.

Preslikovalni nivo služi preslikavi podatkov iz relacijske oblike v objekte. Omogoča neodvisnost jedra od načina persistence podatkov (t.j. sistema za upravljanje s podatkovnimi bazami).

5. ZAKLJUČEK IN NADALJNJE DELO

Sistem Vega omogoča enostavno modeliranje procesa odločanja. Omogoča razbitje osnovnega problema na podprobleme. Na nivoju podproblema je moč uporabiti poljubno tehniko sklepanja v kombinaciji s poljubnim formalizmom za zapis znanja, potrebnega za reševanje podproblema.

Tak pristop omogoča koncept funkcij sklepanja. Posameznik lahko za potrebe razvoja nekega ekspertnega sistema sam razvije funkcije sklepanja ali uporabi funkcije sklepanja, ki so jih razvili drugi uporabniki. Funkcija sklepanja je realizirana kot COM objekt, kar omogoča tako enostavno prenosljivost in zamenljivost, kot tudi ponovno

uporabljivost. Posledično je prav tako enostavno ponovno uporabiti tudi večje dele obstoječih ekspertnih sistemov. Enostavno pa je tudi prenašanje ekspertnih sistemov iz enega okolja v drugo.

V času nastajanja članka že poteka vpeljava sistema za potrebe reševanja konkretnih primerov. V planu je tudi izdelava nekaterih aplikacij na uporabniškem sloju: namizne aplikacije, (kontekstno odvisne) mobilne aplikacije in spletne aplikacije. Prav tako je v izgradnji administratorski odjemalec, ki bo služil kreiranju in urejanju ekspertnih sistemov v lupini.

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POSLOVNA PRAVILA V VEČAGENTNIH SISTEMIH

Dejan Lavbič, Rok Rupnik, Marko Bajec, Marjan Krisper
Laboratorij za informatiko
Fakulteta za računalništvo in informatiko
Univerza v Ljubljani
Tržaška 25, 1000 Ljubljana, Slovenija
Tel: +386 1 476 83 67; fax: +386 1 476 87 04
e-mail: Dejan.Lavbic@fri.uni-lj.si

ABSTRACT

The paper presents the incorporation of business rules into multi-agent systems. Agent-Oriented Software Engineering is a new paradigm in developing information systems, targeted especially at distributed systems. With business rules we would like to propose a new layer of abstraction, where business users could manage the rules, despite of their lack of knowledge of programming languages. For that reason a metamodel for the use of rules at different aspects in multi-agent systems is presented.

1 UVOD

Agentna usmerjenost je nova paradigma na področju programske opreme in informacijskih sistemov. Večagentni sistemi predvsem veliko obetajo na področju porazdeljenih informacijskih sistemov. Poslovne procese obvladujejo in usmerjajo akterji (ljudje ali agenti), ki morajo upoštevati socialno dinamiko pri komunikaciji med posamezniki in ustanovami. V okviru poslovnih procesov govorimo o poslovnih pravilih, ki temeljijo na politiki poslovanja. Prispevek predstavlja integracijo poslovnih pravil in sistemov za izvajanje pravil v okolje večagentnih sistemov. Raziskava omenjene integracije je pokazala, da gre za zahtevno področje, predvsem zaradi različnih idej, ki se pri obeh področjih pojavljajo. Smiselnost integracije lahko upravičimo z vedno večjo vlogo sistemov za izvajanje pravil. Zaradi vedno večje dinamike na področju večagentnih sistemov, je uporaba pravil v okviru teh sistemov glede na rezlutate raziskave zelo primerna. Spremembe lahko tako učinkovito obvladujemo v okviru poslovnih pravil oz. sistema za izvajanje poslovnih pravil, ki jih ustrezno ločimo od ostalega izvajalnega dela.

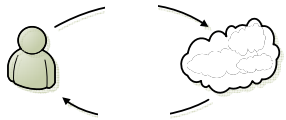
Prispevek v razdelku 2 predstavlja inteligentne agente, osnovne koncepte inteligentnih agentov in delovanje v večagentnih sistemih. V nadaljevanju razdelek 3 opisuje področje poslovnih pravil, kjer so opredeljena na ravni poslovne domene in operativni ravni informacijskega sistema. Osrednji del prispevka, v razdelku 4, opredeljuje možna področja integracije pravil oz. sistemov za izvajanje pravil v večagentne sisteme. Na metamodelu uporabe pravil so prikazani osnovni koncepti in opredelitev uporabe pravil za predstavitev znanja, obvladovanje medsebojnega sodelovanja in upravljanja z agenti.

2 AGENTI IN VEČAGENTNI SISTEMI

Pri agentno usmerjenem pristopu razvoja informacijskih sistemov se pojavljajo naslednji osnovni pojmi: **agent**, **vzajemno sodelovanje** in **organizacija večagentnega sistema**, ki bodo predstavljeni v nadaljevanju pričujočega razdelka.

2.1 Agenti

Ker se agenti uporabljajo na številnih področjih, trenutno ne obstaja enotne opredelitve pojma agent. Obstaja splošno prepričanje, da je **avtonomija** ključna lastnost agenta, medtem ko ostale lastnosti niso tako enotno opredeljene, saj so na različnih področjih uporabe pomembne različne lastnosti.



Slika 1: *Agent v svojem okolju.*

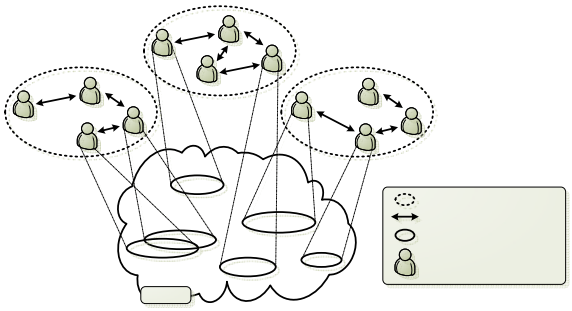
Eno splošnejših opredelitev agenta je podal M. Wooldridge [4], ki pravi, da je **agent računalniški sistem, ki je nameščen v okolje in je sposoben avtonomnih akcij v tem okolju z namenom, da doseže načrtovane cilje**.

2.2 Večagentni sistemi

Slika 2 prikazuje značilno zgradbo večagentnega sistema kot množico agentov, ki s pomočjo komunikacije vzajemno sodelujejo. Agenti se na okolje odzivajo in v njem tudi delujejo, pri tem pa imajo v okolju različna območja vpliva. Med temi območji lahko v nekaterih primerih pride do preseka, kar pripelje do povečane odvisnosti med agenti (npr. dva agenta lahko oba izvedeta določeno dejanje, vendar ne sočasno). Agenti so med seboj povezani z različnimi razmerji; pogosto uporabljano je npr. razmerje moči, s katerim eden od agentov postane ostalim nadrejen.

Večagentni sistemi so zelo uspešni pri podpiranju porazdeljenih procesov za obvladovanje znanja. Agenti za

pridobivanje znanja so eni najbolj uspešnih programskih rešitev agentov, še posebej v okolju svetovnega spleta [5], kjer poznamo specializirane agente za zbiranje informacij, ki dostopajo do različnih porazdeljenih informacijskih virov glede na lastnosti in zanimanja uporabnika. Po drugi strani je prav tako pomemben prenos znanja od akterja, ki je znanje ustvaril, do mesta, kjer je to znanje potrebno, kar zopet predstavlja eno od opravil, primernih za podprtje z večagentnimi sistemi.



Slika 2: *Organizacija večagentnih sistemov.*

Večagentni sistemi so zelo učinkovit način razvoja porazdeljenih sistemov. Raziskave na tem področju so usmerjene predvsem na lažjo in hitrejšo komunikacijo človeka z računalnikom. Agenti so se pokazali kot zelo uporabna orodja pri usklajevanju in načrtovanju v okolju, kjer imamo več akterjev, kateri morajo opravljati določena opravila [4, 13]. Za obvladovanje kompleksnosti in dinamike prispevek v razdelku 4 opisuje uporabo pravil v okviru večagentnih sistemov. V naslednjem razdelku pa bo predstavljeno področje poslovnih pravil.

3 POSLOVNA PRAVILA

Poslovno pravilo lahko opredelimo na ravni poslovne domene ali na operativni ravni informacijskega sistema [12]. Poslovno pravilo na ravni poslovne domene je vsekakor bolj temeljni koncept. V nekaterih primerih ga lahko z določeno stopnjo avtomatizacije implementiramo v informacijskem sistemu v obliki specifikacije izvajanja. Cilj novih tehnologij bi vsekakor moral biti v večji podpori poslovnim pravilom v obliki višjenivojskih specifikacij, ki jih lahko izvajajo tudi računalniki.

Modeliranje poslovnih pravil, ločeno od ostale izvajalne logike, nam prinaša večjo prožnost. Še posebej na področju informacijskih sistemov, kjer poslovni analitik, ki ponavadi poslovna pravila pripravi, nima ustreznega znanja programskih jezikov, da bi pravila naknadno popravil. V praksi pa pride do spreminjanja poslovnih pravil bolj pogosto, kot do spreminjanja programskih rešitev. Izločitev poslovnih pravil iz poslovne logike prav tako vodi do boljše strukturiranosti sistema, kar seveda izboljša in poenostavi vzdrževanje.

3.1 Poslovna pravila na ravni poslovne domene

Na ravni poslovne domene je poslovno pravilo opredeljeno kot:

- trditev o načinu poslovanju, npr. o smernicah in omejitvah glede na stanje in procese v organizaciji [6]
- zakon ali običaj, ki usmerja obnašanje ali akcije akterja, povezanega z organizacijo [7]
- izjava o politiki ali pogojih, ki jih je potrebno izpolniti [8]

Poslovno pravilo temelji na politiki poslovanja. Primer politike poslovanja podjetja za izposojo avtomobilov je "strankam se lahko izposojajo le avtomobili, ki so tehnično ustrezni". Poslovna pravila so deklarativne izjave, saj opisujejo kaj je potrebno narediti ali kaj mora držati in ne kako.

Poslovna pravila so tudi izjave, ki izražajo del politike poslovanja, kot je opredelitev poslovnih izrazov, etičnih dolžnosti (deontic assignments) v obliki pravic, moči in obveznosti ter operacij v deklarativni obliki (brez opisa podrobnosti implementacije).

Literatura v splošnem opredeljuje tri različne skupine poslovnih pravil [12]:

- **omejitve integritete**, ki se imenujejo tudi omejitvena pravila
  (Primer: Stranka, ki želi izposojo avtomobila, mora biti stara najmanj 25 let)
- **izpeljana pravila**
  (Primer: Cena izposoje avtomobila je enaka ceni izposoje skupine avtomobila, v katero le ta spada)
- **odzivna pravila** se imenujejo tudi reakcijska ali avtomatizacijska pravila.
  (Primer: Ko pride zahteva po rezervaciji avtomobila določene skupine, mora podružnica na sedežu podjetja preveriti ali prosilec ni na seznamu slabih strank)

Četrta skupina poslovnih pravil, **etične dolžnosti** (npr. samo ravnatelj podružnice lahko strankam dodeli dodatne popuste), je le delno opredeljena. Predlog [9] pravi, da lahko pooblastitev tudi obravnavamo kot poslovno pravilo.

3.2 Poslovna pravila na ravni informacijskega sistema

V določenih primerih lahko poslovna pravila na ravni poslovne domene enostavno pretvorimo v izvajalno kodo na ravni informacijskega sistema, kot je to povzeto v tabeli 1.

Področja, kamor se poslovna pravila pri implementaciji preslikajo, so večinoma omejena na različne programske jezike, podatkovne baze in ekspertne sisteme. Na tržišču obstajajo tudi določeni produkti, ki nam olajšajo omenjeno preslikavo z uvedbo dodatni ravni z različnimi stopnjami abstrakcije.

Koncept	Implementacija
omejitev integritete	IF-THEN stavek v programskih jezikih DOMAIN, CHECK in CONSTRAINT stavki v opredelitvi SQL tabele CREATE ASSERTION stavek v opredelitvi SQL podatkovne sheme
izpeljano pravilo	SQL stavek CREATE VIEW deduktivna podatkovna baza pravil (Prolog)
odzivno pravilo	IF-THEN stavek v programskih jezikih CREATE TRIGGER stavek v SQL produkcijsko pravilo v ekspertnih sistemih

Tabela 1: *Preslikava poslovnih pravil iz ravni poslovne domene na raven informacijskega sistema, s tehnologijo, ki je trenutno na voljo.*

Eden vodilnih na tem področju je ILOG [15], ki ima v svoji ponudbi številna orodja. Eno od njih je tudi ILOG JRules, ki predstavlja celostni sistem za izvajanje in obvladovanje poslovnih pravil ter je primerno za poslovne uporabnike, kot tudi za programerje, ki lahko določene preslikave še bolj eksplicitno določijo [3].

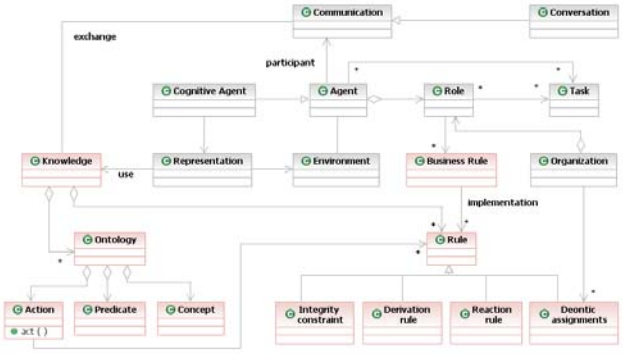
4 UPORABA PRAVIL V VEČAGENTNIH SISTEMIH

Večagentni sistemi v zadnjem času počasi postajajo vedno bolj uporabljan način razvoja porazdeljenih informacijskih sistemov. Z lastnostmi, ki so predstavljena v razdelku 2, omogočajo bolj prilagodljivo načrtovanje in implementacijo, predvsem porazdeljenih sistemov. Uporaba pravil pri implementaciji informacijskih rešitev pa prinaša boljšo prilagodljivost, kot je to omenjeno v razdelku 3. Pri uporabi pravil v večagentnih sistemih se tako odpira več področij uporabe, kjer je integracija smiselna in nam prinaša dodano vrednost. Izločitev pravil iz poslovne logike prav tako vodi do boljše razdeljenosti sistema, kar seveda izboljša in olajša vzdrževanje. Možna področja integracije pravil v večagentne sisteme lahko tako strnemo v:

- **predstavitev znanja**
  - interno delovanje agenta
  - interna predstavitev spomina
  - profil uporabnikov
- **obvladovanje medsebojnega sodelovanja**
  - pogajanje
- **upravljanje z agenti**
  - opredelitev politike delovanja

V nadaljevanju bodo omenjeni predlogi predstavljeni bolj podrobno. Med zgoraj opredeljenimi področji obstajajo preseki, saj je npr. predstavitev znanja za interno delovanje agenta močno povezana z opredelitvijo politike delovanja, ki je omenjena pri upravljanju z agenti.

Zaradi lažjega razumevanja je na sliki 3 prikazan metamodel uporabe pravil v večagentnih sistemih. Izhodišče pri izgradnji je predlog metamodela večagentnega sistema, skupine AOSE TFG2 [14] v okviru združenja AgentLink.



Slika 3: *Metamodel uporabe pravil v večagentnih sistemih.*

Del metamodela na sliki 3, ki je označen s sivo barvo, predstavlja združitev številnih predlogov na področju večagentnih sistemov: ADELFE, Gaia, INGENIAS, PASSI, RICA in Tropos. Prispevek predlaga elemente, potrebne za integracijo koncepta pravil v okvir večagentnih sistemov, ki so na metamodelu označeni z rdečo barvo.

Osrednjo vlogo igra **agent**, ki se nahaja v svojem okolju. Za **kognitivnega agenta** velja, da si lahko ustvari tudi svojo **predstavitev okolja**. Agent pa je lahko tudi del okolja ostalih agentov – zato v metamodelu med entitetama agent in okolje ni usmerjene povezave. Agent z ostalimi **komunicira**, z določenim namenom pa lahko uporablja tudi (FIPA) pogovor (pogajanja). Agent lahko opravlja določene **vloge**, nekateri agenti pa lahko izvajajo **naloge** brez vlog. **Organizacija** je sestavljena iz več agentov in tudi vlog, kar je prikazano s povezavo med agentom in organizacijo preko vloge.

V metamodelu uvajamo **znanje** (knowledge), ki se izmenjuje v medsebojni komunikaciji med agenti. Prav tako je znanje osnova za predstavitev okolja kognitivnega agenta. Baza znanja je v splošnem sestavljena iz **ontologij** (Ontology) in **pravil** (Rule). Ontologije predstavljajo eksplicitno predstavitev strukture problemske domene. Ontologijo sestavljajo **koncepti** in kategorije domene, **akcije**, ki se izvajajo v domeni in spreminjajo stanje konceptov ter **predikati** trditev o določeni podmnožici domene (npr. o stanju konceptov). V okviru znanja igrajo pomembno vlogo **pravila**, ki jih v večagentnem sistemu lahko opredelimo kot implementacijo formaliziranih **poslovnih pravil**. V metamodelu na sliki 3 so omenjene vse glavne vrste pravil: **omejitev integritete**, **izpeljana pravila**, **odzivna pravila** in **etične dolžnosti**. Z organizacijo so neposredno povezane **etične dolžnosti**, saj v obliki moči, pravic in obveznosti opredeljujejo strukturo etike v organizaciji. Kot je že bilo omenjeno, agent opravlja svoje delo v skladu z vlogo, ki mu je dodeljena. Vlogo pa omejujejo poslovna pravila, ki jih je potrebno upoštevati pri delovanju organizacije.

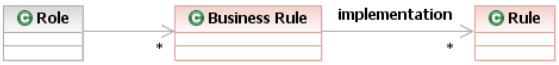
Vsa predlagana področja integracije pravil v večagentne sisteme lahko identificiramo tudi v predstavljenem metamodelu.

Slika 4: *Uporaba pravil pri predstavitvi znanja.*

Uporaba pravil pri **predstavitvi znanja** predstavljata entiteti znanje (Knowledge) in predstavitev okolja (Representation), kot je prikazano na sliki 4, saj so pri učinkoviti predstavitvi znanja pravila (Rule) nujno potrebna. V percepcijo okolja, uvrščamo tudi profil uporabnikov oz. kontekst, kot širši pojem.

Slika 5: *Uporaba pravil pri obvladovanju medsebojnega sodelovanja.*

Slika 5 prikazuje del metamodela, ki predlaga uporabo pravil pri **obvladovanju medsebojnega sodelovanja**, v povezavi s komunikacijo (Communication) in znanjem (Knowledge).



Slika 6: *Uporaba pravil pri uprabljanju z agenti.*

Upravljanje z agenti lahko v metamodelu vidimo v povezavi vloge (Role) s pravili (Rule) preko poslovnih pravil (Business Rule), kot je prikazano na sliki 6. Gre predvsem za opredelitev politike delovanja, kjer mora biti določeno, kdaj se agent začne izvajati, katere elemente iz okolja potrebuje za svoje delovanje itd.

5 ZAKLJUČEK

Poslovna pravila so, kot pravila, v večji meri implementirana kot omejitve in prožilci v kontekstu podatkovnih baz, produkcijska pravila v ekspertnih sistemih in IF-THEN stavki v različnih programskih jezikih. V prispevku to razširimo na področje večagentnih sistemov, kjer je predlagana uporaba pravil za predstavitev znanja, obvladovanje medsebojnega sodelovanja in upravljanje z agenti. V ta namen je bil razvit metamodel uporabe pravil v večagentnih sistemih. Integracija pravil v večagentne sisteme lahko izboljša kakovost in enostavnost razvoja rešitev z uporabo poslovnih pravil. Tako imamo ločeno izvajalno raven in poslovno raven, kjer lahko analitiki, brez potrebe poznavanja programskih jezikov, obvladujejo poslovna pravila. Omenjena integracija postane veliko bolj enostavna, če so poslovna pravila zapisana in dostopna v enotni obliki. Na področju, ki se ukvarja s takim zapisom, so aktivne številne raziskovalne skupine. Trenutno je najbolj obetajoč predlog zapisa pravil RuleML, ki je pripravljen tudi za področje semantičnega spleta in posledično tudi za večagentne sisteme.

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A GENETIC ALGORITHM BASED TOOL FOR THE DATABASE INDEX SELECTION PROBLEM

Viktor Kovačević
Hermes SoftLab, Litijska 51, SI-1000 Ljubljana, Slovenia
E-mail: viktork@hermes.si

Bogdan Filipič
Department of Intelligent Systems, Jožef Stefan Institute
Jamova 39, SI-1000 Ljubljana, Slovenia
E-mail: bogdan.filipic@ijs.si

ABSTRACT

One of the key issues in improving the performance of modern data-intensive applications is selection of a proper set of indexes that minimize the response time of a given database workload. This problem is known in the literature as the Index Selection Problem (ISP). In this paper, we propose a design of a tool for resolving the ISP that makes use of a genetic algorithm. The employed genetic algorithm is presented together with preliminary experiments and results.

1 INTRODUCTION

In modern data-intensive applications, such as decision support and data warehousing, selection of a proper set of indexes is crucial for the performance. Most database design tools automatically create primary indexes that assure uniqueness of primary keys, as well as indexes on unique fields that assure uniqueness of some other fields in the table. Additionally, certain tools create reference indexes for table fields with reference constraints. However, secondary indexes, which optimize update and query search time in databases, must be explicitly created. Although they can be unique, in most cases they are not. In our approach to the ISP we are, therefore, focused on a search for an optimal set of secondary indexes.

An important drawback of the creation of secondary indexes is that the query performance will be almost certainly improved, whereas the performances of insert, update and delete operations will be significantly decreased. Each time a database is changed, the indexes are also changed. This means, for example, a change of the database by some query will cost one table access plus one or more accesses per index. This can reduce the performance of the database system, especially when dealing with a huge number of records [1].

The ISP is NP-complete, which means the time required to solve the problem is super polynomial in the input size and it is unknown whether there are any faster algorithms [2]. Therefore, solving the ISP requires a heuristic approach. A heuristic should be based on the query optimization principles as heuristic hints should be usable for the query optimizer and heuristic rules should constrain a search space in order to make the search algorithm efficient. It should also be noted that, since the query optimization principles of commercial database management systems vary to a great extent, it is infeasible to implement a general-purpose index selection tool.

Even though modern index selection tools take the query workload into account, they suffer from being disconnected from query optimizers [9]. These tools adopt an expert system like approach, where the knowledge of "good" design is encoded in the form of rules. However, this may be questionable for two reasons. First, a selection of indexes can be considered as good if the indexes are actually used by the optimizer. Second, the tools operate on their specific models of the query optimizer's index usage [6]. If an index selection tool does not take into account the properties of the optimizer, it can result in an inefficiency and a poor quality of the index design. The prototype presented in this paper uses a query optimizer for the estimation as well.

A selection tool iterates through a space of index configurations (i.e. alternative sets of indexes), and searches for the configuration with the lowest cost for the given query workload [8]. Clearly, evaluating a configuration by physically materializing it is not practical because materializing the configuration requires adding and deleting indexes. This can be very resource-consuming and can affect operational queries on the production database. Therefore, the tool needs to simulate index configurations without materializing them [10].

The purpose of the prototype presented in this paper is to show that a genetic algorithm based tool is suitable for resolving the ISP. The prototype tool GAIIO (Genetic Algorithm for Index Optimization) has been implemented for Oracle 9 in order to assist database administrators in designing optimal index configurations. The paper gives the ISP definition, describes the employed genetic algorithm, and reports on preliminary tests and results.

2 PROBLEM DEFINITION

Let $T = \{1, 2, ..., n\}$ be a set of tables and $I = \{1, 2, ..., m\}$ a set of all combinations of secondary indexes on the tables T (from one indexed column to the predefined number of columns for indexes Δ_c – usually 3 or 4), and $Q = \{1, 2, ..., n\}$ a set of queries or query workload. We also have a parameter $N = N_1, N_2, ... N_n$ which is the number of executions of each query in the workload. Furthermore, we define an index configuration or schema $\Omega = T \otimes I$, which means that for each table in T we define a subset of secondary indexes $SI \subset I$. For a configuration we also define the maximum number of indexes per table Δ_t – usually up to 5.

When all indexes of a certain configuration *SI* are built, the query workload cost on that configuration is estimated. The estimation is based on two criteria. One is the cost estimated for each query on the index configuration by the database optimizer. The other is the *SI* maintenance time, which is estimated from the index statistics. The index statistics include the number of columns indexed, the size of the index, the index clustering factor, the number of index leaf blocks, the percentage of the direct accesses, etc. For building our prototype tool, only the number of indexed columns is used. The estimation of the total cost for a query workload is given by

$$COST_{\Omega} = \sum_{q_i \in Q} N_i * COST_i^{\Omega}(q_i) + \sum_{I_i \in SI} INDEXSTAT^{\Omega}(I_i)$$

where $COST_i^{\Omega}(q_i)$ represents the cost estimation given by the database optimizer and calculated through a query explanation plan mechanism. An explanation plan for the query workload also gives the information about the index access paths as well as the index usage. Therefore, the final schema is re-evaluated by $COST_{\Omega}$ and the index usage. At the end, we get a new index configuration $SI' \subset SI$ that contains only the usable indexes. Our goal is to build the indexes in order to minimize the total cost of the execution of all queries *Q*:

$$COST_{\Omega_{BEST}} = \min_{T \times I} \left(\sum_{q_i \in Q} N_i * COST_i^{\Omega}(q_i) + \sum_{I_i \in SI} INDEXSTAT^{\Omega}(I_i) \right) \Bigg|_{\Delta_c, \Delta_t}$$

Due to different relations between the query cost estimation result on one side and the value and index statistics of the index set on the other side, we need to define two empirical factors to balance the final cost formula. In the prototype tool, these factors are: $F_1 = 10$ and $F_2 = 1$. The final cost formula is then

$$COST_{\Omega_{BEST}} = \min_{T \times I} \left(F_1 \cdot \sum_{q_i \in Q} N_i * COST_i^{\Omega}(q_i) + F_2 \cdot \sum_{I_i \in SI} INDEXSTAT^{\Omega}(I_i) \right) \Bigg|_{\Delta_c, \Delta_t}$$

The values of factors F_1 and F_2 depend on the query cost evaluation type (different database optimizer types) and the type of the index statistics evaluation.

Finally, the data statistics of a table is another important issue in searching for the optimum index configuration. The data statistics of a table helps in constraining a large search space of index configurations and making the search heuristics efficient. It is therefore added to the cost formula constraint as the DATASTAT parameter:

$$COST_{\Omega_{BEST}} = \min_{T \times I} \left(F_1 \cdot \sum_{q_i \in Q} N_i * COST_i^{\Omega}(q_i) + F_2 \cdot \sum_{I_i \in SI} INDEXSTAT^{\Omega}(I_i) \right) \Bigg|_{\Delta_c, \Delta_t, DATASTAT}$$

3 THE APPLIED GENETIC ALGORITHM

A genetic algorithm is a stochastic, biologically inspired search method suitable for finding (near)optimal solutions in complex search spaces [1, 4, 5, 7]. The basic elements of our genetic algorithm are represented in the following subsections.

3.1 Solution Representation

Each solution (index configuration) is represented in the form of a matrix, where the matrix columns are table columns sorted in the lexical order and grouped by tables in the configuration. The matrix rows are index representations with the sequential number of the column in the index or empty value if the column is not part of the index, as it is shown in Figure 1.

	|T1.C1	T1.C2	.. T1Ci ..	T1Cn| .. |Tn.C1	Tn.C2	.. TnCi ..	TnCn|
1	1	2			1		
.							
i		1	2	3	2	1	
.							
n	1		2				

Figure 1: Representation of an index configuration

Each table in the index configuration has a data statistics structure which contains all parameters used in the creation of a new index set. The number of different values is one of the column parameters used in the evaluation of the probability that the column will be used in the index. Previously used columns are not used in the subsequent steps of search for the next index column, and the probability of the unused columns increases.

The propagation of good genetic material (usable indexes) among index configurations is part of the evolution mechanism. It is performed by two genetic operators: recombination and mutation. When genetic operators are applied to an index configuration, the fitness value of a new or changed configuration is re-evaluated. The usability of indexes is also checked and all unusable indexes are removed from the configuration.

3.2 Recombination

Individuals are chosen for recombination from a mating pool with uniform probability not depending on fitness. Parents simply add their index configurations, checking for possible equality of indexes. Each equal index is added only once. The recombination operator is shown in detail in Figure 2.

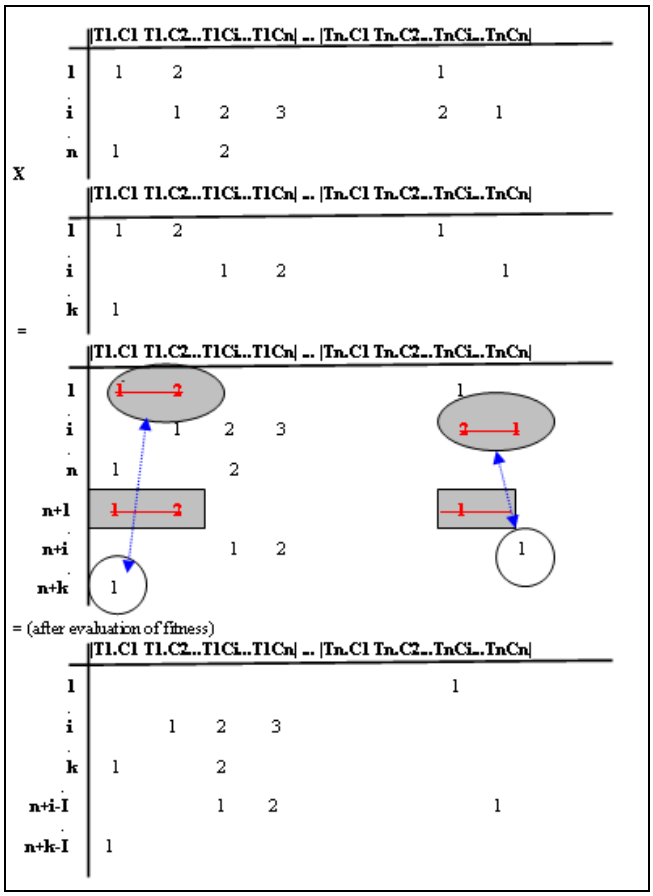

Figure 2: The recombination operator

3.3 Mutation

There are two kinds of mutation used in our genetic algorithm. One adds a new column to the existing index, and the other one adds a new index to the existing index configuration (if the number of table indexes $< \Delta_t$). The mutation operator is illustrated in Figure 3.

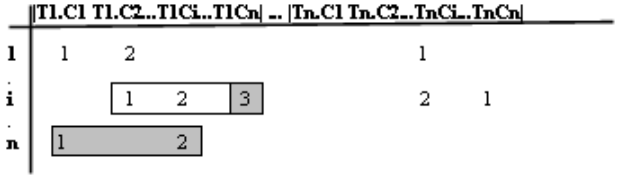

Figure 3: The mutation operator

3.4 Selection

After the execution of genetic operators, the new population members are added to the mating pool. Furthermore, the fitness is evaluated for all new population members and the members are sorted by their fitness values. The first N individuals, where N is the population size, are then chosen for the next step of the evolution process.

4 PRELIMINARY TESTS

4.1 The Test Problem

To test the implemented prototype tool in minimizing the cost of the query workload, we used the Order Entry example in the Oracle database [3]. We simulated a typical set of queries that can be potentially executed in a typical application. The entity relationship diagram of the Order Entry example is shown in Figure 4.

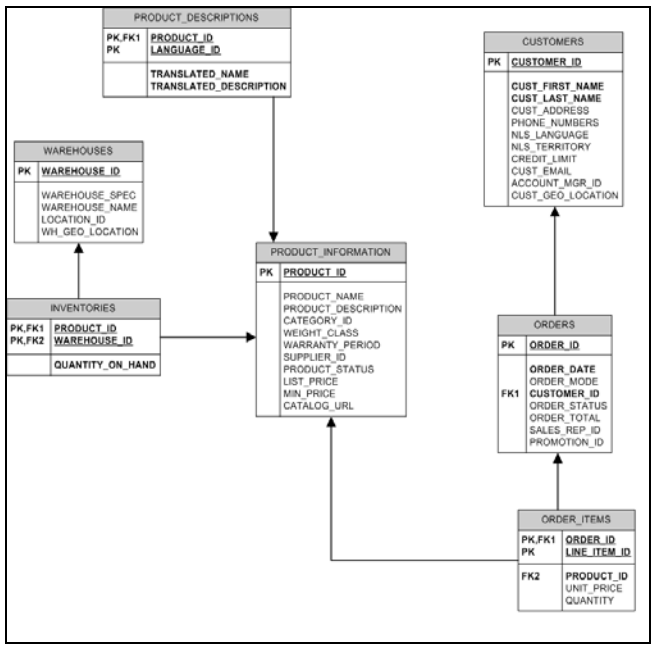

Figure 4: The entity relationship diagram for the test database

The test query workload consisted of 15 typical application queries (50% select queries, 30% update queries and 20% insert queries). The number of query predicates was between 1 and 5. This was very important for the configuration of input parameters of the genetic algorithm, especially for the maximum number of index columns. The maximum number of indexes was set to 4 which is a typical number of indexes on production tables.

4.2 Results and Findings

The developed prototype tool includes a graphical user interface showing the input query workload, the

optimization procedure performance, and the resulting index configurations. An example is shown is in Figure 5.

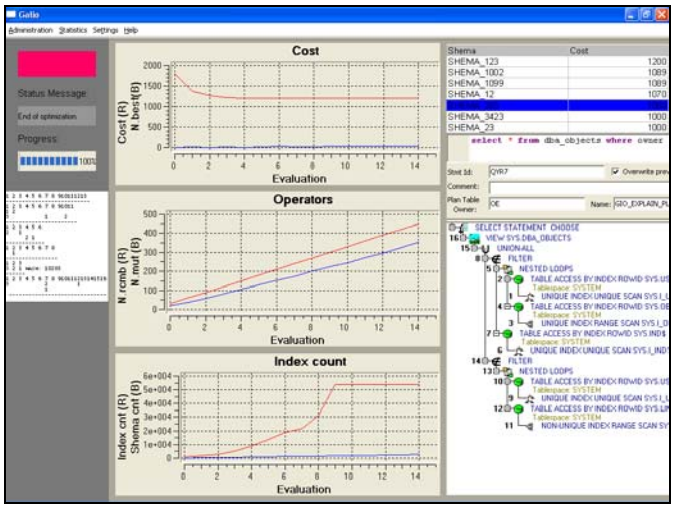

Figure 5: GAIIO graphical user interface

The diagrams show the influence of the recombination and mutation operators on the average fitness of the population during the algorithm execution. On one side, the recombination operator gives the algorithm lower precision and faster convergence. The mutation operator, on the other side, contributes to higher precision and slower convergence.

For each query, it is also possible to review the explanation path and compare it with explanation paths of other index configurations in the population. Some queries in the test workload do not have good (indexable) predicates in the WHERE clause, hence there is no appropriate binary index for them. Some tables, on the other hand, have a small number of records (e.g. the warehouse table contains only 9 records) and there is no need for indexing. The full table scanning in this particular case is even better then index access to the data. The algorithm also covers these specific cases and it can be used for tuning not only minimum query workload cost in general, but also adjusting to one single query on a specific table.

Preliminary test results on this particular example show that, using the genetic algorithm based tool, it is possible to get an applicable index configuration for a realistic database in acceptable time.

5 CONCLUSION

Development of database management systems nowadays often involves processes and tools that make use of human knowledge and judgment. This is considered necessary to maintain and continuously run complex database systems. However, in this specific area of information technologies, there is still a lot of space for implementing various computational intelligence techniques. This paper describes one of them – a genetic algorithm approach to the database index selection problem.

We have implemented a genetic algorithm based tool to iteratively search for a database index configuration with minimum cost of a given query workload. The tool is now at the prototype stage, but capable of visualizing the optimization process. It was preliminarily evaluated on an Oracle test database where it produced reasonable solutions and demonstrated its potential in assisting database administrators in selecting appropriate index configurations.

Future work on this tool will include tuning of the genetic algorithm to achieve the best possible performance, systematic tests on real databases under various query workloads, and evaluation of the obtained index configurations, particularly in comparison with human-defined solutions.

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OVERVIEW OF MULTI-AGENT TECHNOLOGIES AND EXAMPLE OF BUSINESS APPLICATION

Jadran Prodan, Viljem Tisnikar
Jožef Stefan International Postgraduate School
Jamova 39, 1000 Ljubljana, Slovenia
e-mail: jadran.prodan@mtt-solution.si, vili@inka.si

ABSTRACT

FIPA standards and recommendations are base for many multi-agent platforms and development environments, two of them are: JADE and SPYSE. We envision the use of agents and multi-agent systems in information systems of corporations. We present an e-procurement system as example prototype.

1 INTRODUCTION

Today society in general and business environment in particular is very dynamic and constantly changing. To be successful, in such environment, an organization has to prepare itself to constant reshaping. The enabling tool for such organizational changes is information system (IS). IS enable organization:
- To inter-connect people inside the organization and with outside partners
- Inter-operation between specialized experts
- To deal with situation that was not known in advance

Most appropriate founding paradigm for building IS which can deal with such requirements is Multi Agent Systems (MAS). MAS are systems of many intelligent agents interacting with each other. MAS define communication language, interaction protocols, and agent architectures that facilitate the development of such system.

In last 15 years were developed more than 60 MAS platforms and frameworks [2] which were mostly proprietary and 'close source'. Most of them were incompatible and based on agent-centric vision that wanted them (agents) to be everywhere.

2 FIPA

In 1996 was formed a non-profit organization with mission to produce standards for the interoperation of heterogeneous software agents, namely Foundation for Intelligent Physical Agents (FIPA) [2]. FIPA provides an abstract architecture of agent platform and a collection of standards for communication between them, specifically for: Agent Lifecycle Management, Message Transport, Message Structure and Interaction Protocols.

As we can see within focus of FIPA are many aspects of MAS with one noble exception – agent. Developers have to provide own solutions for agents which can then use FIPA standards for their interaction.

2.1 FIPA Agent Platform Model

In FIPA agent platform model is composed of: Agent Management System (AMS), Directory Facilitator (DF) and Message Transport Service (MTS) (Figure 1).

For agent life cycle management is used AMS which support registration, deregistration and search (White Page service). The DF provides a Yellow Pages service which offers an agent a possibility to register its services and find other agents that provide the services it requires. MTS provide means for agents to communicate between themselves.

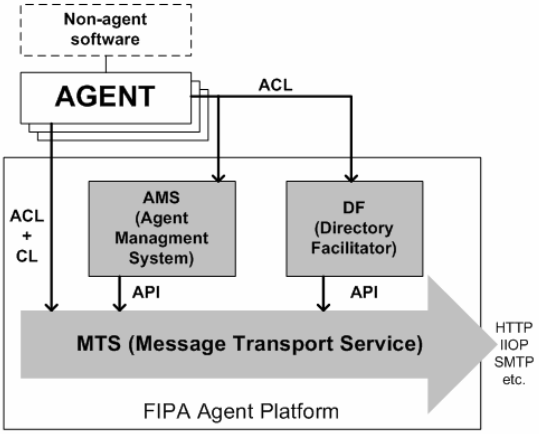

Figure 1: *FIPA Agent Platform [2]*

An agent communicates with AMS and DF by using Agent Communication Language (ACL) and standard management ontology. When agents communicate among themselves they use ACL too, but the content of the message have to be encoded in one of the supported Content Languages (CL): SQL, Binary Large Objects, FIPA SL, FIPA RDF, etc.

FIPA Communicative acts (CA) is based on Speech Act theory and as such may be understood in terms of an intentional level description of an agent, which leads to beliefs, desires and intentions of agents (BDI agents). Many times a simple message exchange between agents is not enough and for this reason FIPA defined Interaction Protocols (IP) (FIPA-Request, FIPA-Subscribe etc.). IP are

patterns of message exchange between agents also called conversations. The semantics of conversation is defined at IP level rather than on individual CAs level.

All the terms (concepts) in conversation and their relationship can be defined in ontology of the domain. With use of ontology and IP semantics agents can reason and behave according to the meaning off conversation.

On 8 June 2005 FIPA was officially accepted by the IEEE as its eleventh standards committee.

There are many MAS platforms/frameworks that have implemented the FIPA specifications, the most popular ones are FIPA-OS, Zeus and JADE. In next sections are presented JADE and less known FIPA implementation SPYSE which is used for development of our prototype.

3 JADE

Java Agent DEvelopment Framework (JADE) is an enabling technology, a middleware for the development and run-time execution of peer-to-peer applications which are based on the agent's paradigm as advised by FIPA standards and recommendations [3].

JADE was conceived and developed at Tilab (Telecom Italia R&D Lab) and organized as Open Source project in February 2000. In May 2003 Tilab and Motorola launched a new initiative, the JADE Governing Board, a not-for-profit organization, with the intent of promoting the evolution and the adoption of JADE as de-facto standard middleware for agent based applications. JADE is distributed under LGPL license and now the actual version is 3.3.

JADE is fully implemented in Java language and can be used on all Java platforms: servers (J2EE), desktops (J2SE) and portable devices (mobile-phones) (J2ME).

3.1 The Architectural model

JADE includes the libraries (i.e. the Java classes) required to develop application agents and the run-time environment that provides the basic services that must be active on the device before agents can be executed (Figure 2).

Each instance of the JADE run-time is called container (since it "contains" agents). The set of all containers is called platform and provides a homogeneous layer that hides to agents (and also to application developers) the complexity and the diversity of the underlying tires (hardware, operating systems, types of network, JVM).

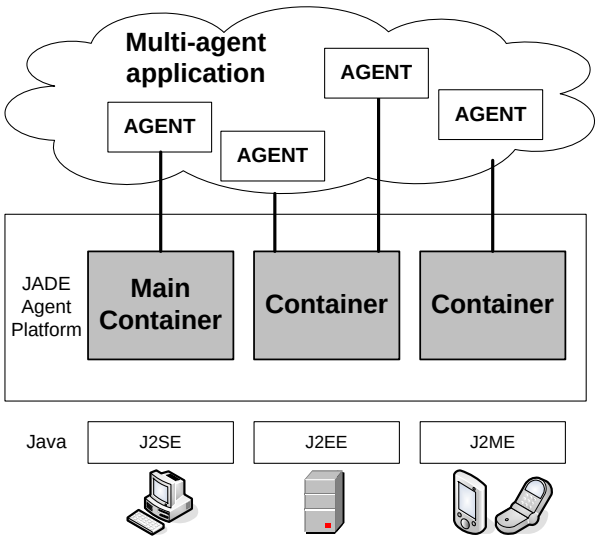

Figure 2: *JADE Architectural model [3]*

3.2 JADE as runtime environment

JADE run-time environment provides the FIPA compliant services AMS, DF and MTS that agents can use. JADE also provides a Graphical User Interface (GUI) for the remote management, monitoring and controlling of the status of agents, allowing, for example, to stop and restart agents. The GUI allows also creating and starting the execution of an agent on a remote host, provided that an agent container is already running. The GUI allows also to control other remote (non JADE) FIPA compliant agent platforms.

3.3 JADE as development platform

On one hand JADE is FIPA compliant, on the other hand it hides FIPA complexity and low-level details from agent programmer. Programmer has no need to:

- Implement the Agent Platform (AMS, DF, MTS)
- Implement Message Transport and Parsing
- Implement Interaction Protocols

JAVA roots lead to the possibility for extending JADE in unlimited ways. One of the extensions is JADE Semantics Agent (JSA) which presentation follows.

3.4. JADE Semantics Agent

Almost always agents only interact with agents they have been designed to interact with. One reason is that implementing agents with finite state machines in order to conform to a limited set of interaction protocols generally results in rigid agents. On the contrary, an agent which could interpret the sense of messages, as defined by its semantics rather than its syntax, could intrinsically support more flexible interaction [4].

JADE use agent communication language as is defined in FIPA standards, namely FIPA-ACL. This language has the

advantage that it relies not only on a syntactic definition, but also on a semantic one. In other words, the FIPA-ACL standard formally specifies a precise meaning for each communication primitive in the language.

JADE Semantic Agent framework (JSA) is developed by France Telecom R&D department with mission to facilitate the programming of agents which naturally conform to the semantics of FIPA-ACL. In this way agents automatically interpret the incoming messages according to their formal meaning and also automatically send proper messages (or take some domain action) in response to the interpretation.

The main activity of a JADE Semantic Agent consists of interpreting and acting upon the received FIPA-ACL messages. This can be refined into two main functions:

- first to produce some sense about the input message
- second to consume produced sense i.e. update its beliefs and future activities.

4. SPYSE

Secret Python Multi-Agent Systems Environment (Spyse) is a software development framework and platform for building multi-agent systems that are compliant with FIPA and the Semantic Web [5].

Spyse in many ways look like JADE but is written in the Python programming language which fits well with MAS concepts by being dynamic, platform-independent and concise. For agents that need providing graphical user interface Spyse provide tree options: Tkinter, wxPython and Zope. Zope is web application server and as such can provide web interface to the agents.

5. EXAMPLE OF BUSINESS APPLICATION

As we stated in introduction of this paper corporations have to use IS to reshape themselves to constantly changing environment.

One of the possible paradigm for such IS is to organize (and represent) all activities of corporation in tree structure. On top of the tree are more strategic activities and down the tree are more operational ones [6] [7].

In such IS every activity is represented with one software agent and connected with other activities (and documents) to form a multi-agent system.

Why use agents and MAS? There are many benefits to use agents and MAS paradigm for implementation of IS but two most fundamentals are: communication and intelligent behavior. They came for characteristic of agents i.e. agents are social and proactive.

Those benefits can further be translated to one development and one business benefit: easier and more productive software development and better (business) interactions between users of IS.

MAS standards and development environments enable developer more straightforward use of communication (standard messages, protocols etc.). Developers can be focused on domain application and "just use" agent communication primitives.

Businesses can largely benefit from semantically founded and intelligent behavior of agents which can help users interact more productively. In this way users can be focused on actual work and not on communication techniques.

For every user in such IS there will be one Personal Assistant (PA) agent. PA agent will be the interface between person and system (human-computer interface). PA agent will provide standard PIM (Personal Information Management) and specific domain functionalities. PA agents will also have important role in overall security plan, too. They will provide different view of the system for internal users and for external users (domain experts, suppliers etc.).

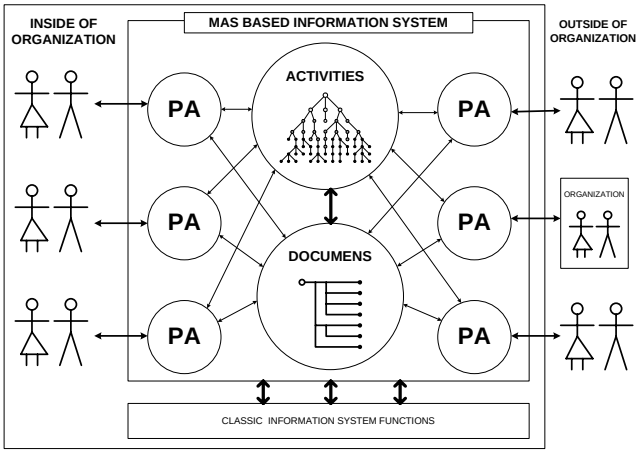

Figure 3: *Architecture of proposed IS*

In the following section we present a multi-agent approach for e-procurement system which is one of important parts of overall IS.

5.1 Business procurement changes

Process of procurement is undergoing rapid technical changes as ERP systems are designed to talk to one another and seamlessly integrate the requirements of the customer with those of the supplier. This integration is called Supply Chain Management.

Procurement is a name given to the process of ordering and receiving materials, goods and services used in the corporation and has following basic steps:

a) First there is business need and than it's documented as requisition for goods or services.

b) When the requisition is approved it becomes a purchase order.
c) The purchase order is transmitted to the supplier.
d) The goods/services are received.
e) The invoice [bill] is paid.

The above described basic steps suppose a stable business where in step a) there is no need for domain expert with new knowledge about goods or services needed and, in step c) there is no need for searching new possibly more competitive suppliers. These suppositions aren't true anymore in today's turbulent economic environment.

Corporations have to involve the domain expert especially when they procure more complex goods/services. He can advise them about important attributes of needed goods/services, criteria for creating the set of possible suppliers and about criteria for choosing the best supplier at time. In other words the expert prepares a Tender.

5.2. E-procurement system

Most of mentioned systems support users from the perspective of procurement as business process and as data collection process for accounting. We envision an e-procurement system which also adds support for integrated communication between participants and decision support.

5.2.1 Communication in e-procurement system

If we wanted to support and enhance communication we have to identify first who the communication participants are. In the first place we have buyers which use the procurement system, than we have the domain experts which advice users about goods/services and last but not least we have suppliers.

In addition to standard PIM functionalities PA agents will provide for each participant in procurement process support for domain specific (procurement) functions.

5.2.2. Decision Support

At the early stage of the procurement process we sometimes involve a domain expert to better define goods/services and provide us with model how to evaluate supplier's offers.

Domain expert interacts with the system via his/her PA agent, which in turn communicate with Decision Support Assistant (DSA) agent. DSA agent helps domain expert to build a model for evaluation of offers. DSA agent uses classic (non-agent) decision support tools for building the model, for example Multi-Attribute (MA) model.

Suppliers use their PA agents for interaction with DSA agents which help them to fill the offers forms. Collected data about offers are next used in evaluation of offers.

At the end of Tender business user use DSA agent (via his/her PA agent) for evaluating all the offers and choosing the best one. The evaluation is done by using previously built model.

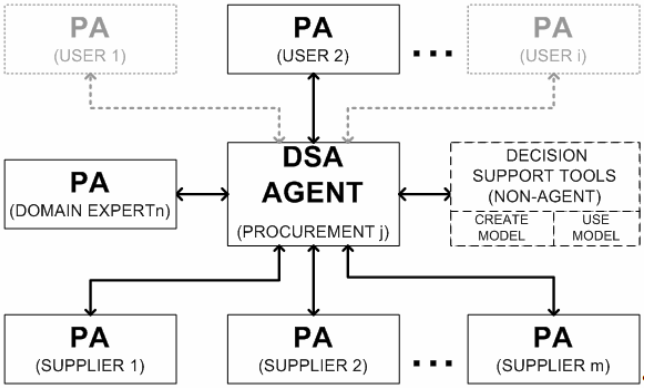

Figure 4: Architecture of e-procurement system

5.2.3. Prototype

Prototype of described system is being built by authors. For MAS platform is selected Spyse primarily because it is Python based and provide Zope web user interface. This way the only technical requirement for using the system is internet connection.

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ANALIZA ZASTAV VREDNOSTNIH PAPIRJEV S PROGRAMOM WEKA

Saša Burian[1], Miha Černelč[2], Matjaž Gams[3]
1 KDD d.d., Tivolska cesta 48, 1000 Ljubljana
2 Autocommerce d.d., Baragova 5, 1000 Ljubljana
3 Inštitut Jožef Štefan, Jamova 39, 1000 Ljubljana

Abstract: S programskim paketom WEKA so bile analizirane zastave v Sloveniji. Podatki so bili pridobljeni iz centralnega registra vrednostnih papirjev KDD, ki obsega približno 800 izdanih vrednostnih papirjev (delnice, obveznice, ipd.) in približno 800.000 aktivnih računov vrednostnih papirjev. Podatki zajemajo vse zastave opravljene v Sloveniji od leta 1996. Za učenje je bilo uporabljenih skoraj 20.000 primerov. Inteligentni sistemi so potrdili večino zdravorazumskih hipotez, ki sta jih prva avtorja postavila pred analizo.

1. UVOD

Današnji čas, kakor tudi bližnja bodočnost postavlja družbi nove, dinamične predvsem pa tudi drugačne in zanimive izzive. Trendi razvoja, pred katere je postavljena sodobna informacijska družba se odražajo predvsem v hitrih spremembah, obračanju od lokalnega k globalnemu in v nedeterminiranost (navideznosti) zaznave sveta. Informacijska družba se med vsemi izzivi sooča tudi s »poplavo« razpoložljivih dnevnih informacij, oziroma s težavo upravljanja in s tem tudi razumevanja obilice informacij. Z uvedbo in razširitvijo interneta je velika večina informacij lahko dostopna vsem. Prehod med pridobitvijo informacij in spremembo le teh v razumevanje oziroma znanje je velik izziv za vse uporabnike informacij. V ta namen se v svetu informacijskih tehnologij pojavlja vse več orodij oziroma programskih rešitev, ki omogočajo lažje obdelave in tudi vse bolj inteligentne analize podatkov in informacij. Za analizo nabora podatkov o zastavah z vrednostnimi papirji je bil uporabljen programski paket Weka™.

Uporabljeni podatki vsebujejo osnovne informacije vezane na zastavo vrednostnih papirjev. Podatki so bili pridobljeni iz centralnega registra vrednostnih papirjev, ki ga vodi KDD – Centralna klirinško depotna družba d.d. (v nadaljevanju KDD), in za nazornejšo in jasnejšo obdelavo poenostavljeni. Centralni register vrednostnih papirjev obsega približno 800 izdanih vrednostnih papirjev (delnice, obveznice, ipd.) in približno 800.000 aktivnih računov vrednostnih papirjev. Večino računov predstavljajo računi fizičnih oseb, ki so bili tudi predmet analize. Podatki zajemajo vse zastave opravljene v Sloveniji od leta 1996 pa do konca aprila 2005. Ker je množica podatkov o zastavah fizičnih oseb precej velika, je bilo potrebno podatke za potrebe klasifikacije pripraviti v manjšem obsegu.

Oblika podatkov za uvoz v program Weka v primarni obliki ni bila primerna, zato so bili podatki dodatno obdelani s pomočjo Microsoft Excel-a. Zaradi relativno velike količine različnih podatkov je bilo potrebno poleg oblikovnih sprememb (formata podatkov) pripraviti tudi transformacijo podatkov. Datum zastave ter datum konca zastave sta bila združena v število mesecev zastave; glede na rojstni datum dolžnika je bila določena njegovo starost; kraj bivanja dolžnika je bil transformiran v poštne številke področnih pošt (Ljubljana, Maribor, Celje, Kranj, Nova Gorica, Koper, Novo Mesto in Murska Sobota); pri tipu zastavljenega vrednostnega papirja je bila možnost delnice, dolžniškega vrednostnega papirja, pravice, opcije, terminskega VP in drugih vrednostnih papirjev.

Ker je bila količina podatkov, ki predstavljajo realno statistično sliko, relativno velika in je v zvezi z zastavami težko dobiti ali pa določiti natančnejša pravila oziroma odvisnost zastav glede na podane atribute, bi bila odločitev za postavitev hipotez neposredno iz podatkov dokaj zahtevna.

2. TRANSFORMACIJA PODATKOV

Kot izhodišče za postavitev hipotez sta bila tako postavljena splošen razmislek o gospodarski razvitosti in delno poznavanje situacije kapitalskega trga v Sloveniji.

Postavljene hipoteze so bile:

1) največ zastav je bilo narejenih v največjih slovenskih mestih oziroma regijah,
2) največ zastav je bilo narejenih v gospodarsko in kapitalsko najmočnejših regijah, z večjo koncentracijo gospodarskih družb in močno razvojno politiko,
3) čas zastave vrednostnih papirjev je v povprečju krajši (leto in pol do dve leti),
4) največ zastav je bilo narejenih s strani fizičnih oseb nižjih in srednjih let od 25. do 45. leta starosti,
5) na kapitalskem trgu Republike Slovenije je zastavljenih več delnic kot drugih vrednostnih papirjev.

Datum zastave	Datum konca zastave	Rojstni datum dolžnika	Kraj bivanja dolžnika	Tip zastavljenega vrednostnega papirja
…	…	…	…	…

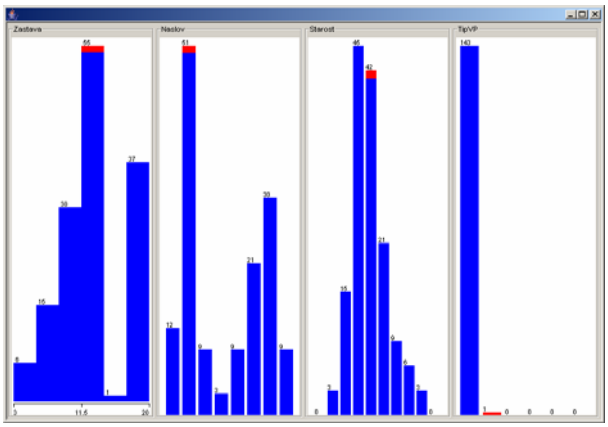
Čas zastave oz. zastava (v mesecih)	Starost dolžnika oz. starost (v letih zaokroženo na 10 let)	Naslov dolžnika (po poštah)	Tip VP
…	…	…	…

Slika 1: transformacija podatkov

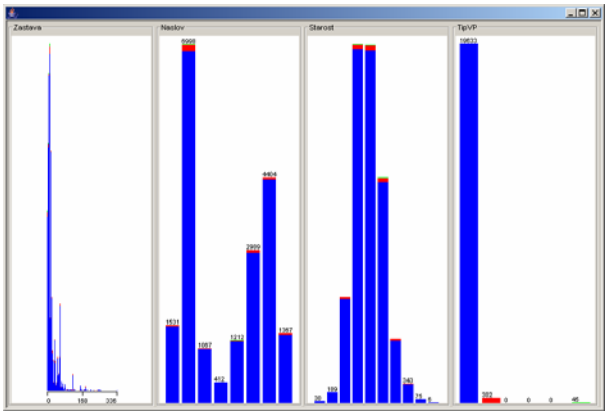
Na osnovi uporabljenih podatkov (4 atribute, 19.980 primerov), je bilo ugotovljeno, da je velika večina zastav opravljena z delnicami (več kakor 99%), zato je bil četrti atribut (tip vrednostnega papirja) iz nadaljnjih analiz odstranjen in nadaljnje delo je potekalo s tremi atributi in sicer časom zastave vrednostnega papirja (numeričen atribut v mesecih), kraj oziroma glavna pošta zastave (nominalen atribut z osmimi vrednostmi in starost dolžnika (nominalen atribut z desetimi vrednostmi).

Analiza podatkov je bila najprej, zaradi boljše preglednosti, narejena na učni množici (144 primerov), kasneje pa še na testni množici (vseh 19.980 primerov). Podatki, ki so bili izbrani za učno množico že pri zastavi kažejo na to, da jih največ zastavlja za obdobja do 20 mesecev medtem, ko je največje obdobje pri kontrolni skupini vse do 336 mesecev z ugotovitvijo, da je takih zastav manj kot 1%. Pri preostalih atributih, na prvi pogled ni vidnih večjih odstopanj.

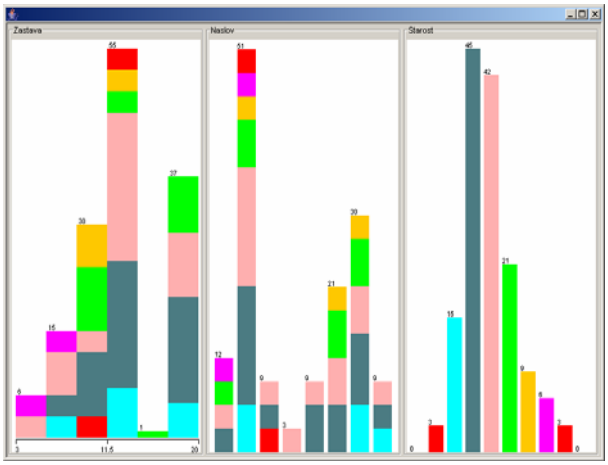
3. UČENJE, UČNA IN TESTNA MNOŽICA



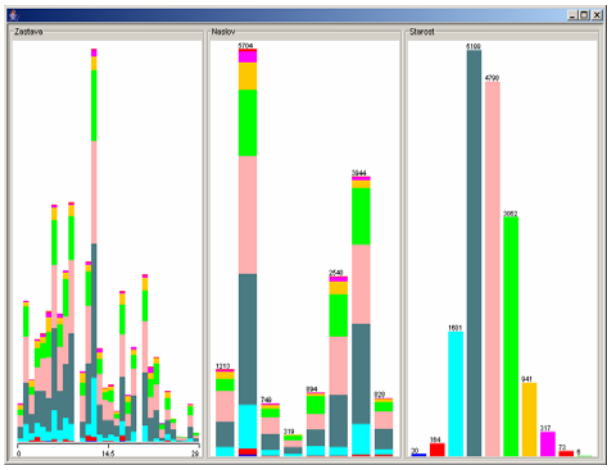
Slika 2: predstavitev vseh štirih atributov z izbranimi 144 primeri (učna množica)



Slika 3: predstavitev štirih atributov z vsemi primeri (testna množica)



Slika 4: predstavitev izbranih treh atributov z izbranimi 144 primeri (odstranjen atribut TIP VP)



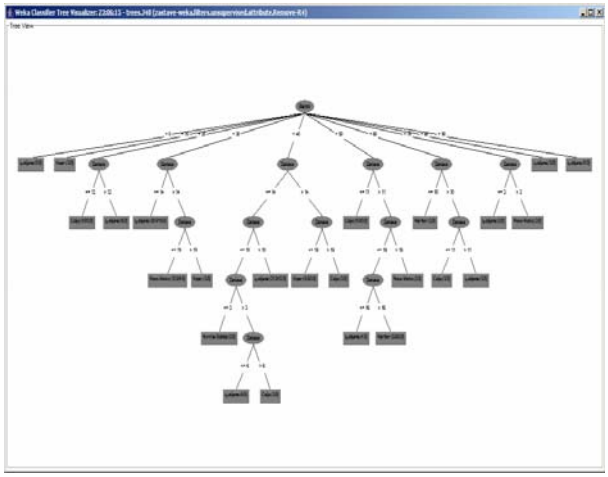
Slika 5: predstavitev izbranih treh atributov z vsemi primeri (odstranjen atr. TIP VP), filter na času zastave

Za modeliranje podatkov se lahko v Weka Explorer-ju [1], [2], [3], [4] odločamo med štirimi algoritmi strojnega učenja, toda za preizkus postavljenih hipotez sta bila izbrana le dva in sicer klasifikacija in razvrščanje v skupine.

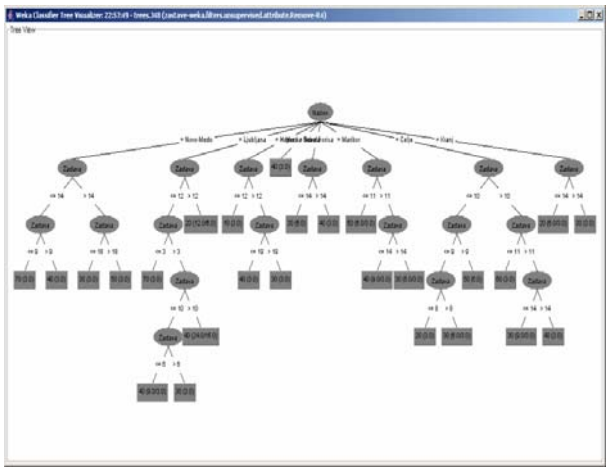
Za klasifikacijo z odločitvenimi drevesi je bil vzet klasifikacijski algoritem poimenovan J48 (C4.5). Zaradi obilice podatkov je bilo potrebno odločitvena drevesa »porezati« (zmanjševanje dreves je običajen postopek, ker v nasprotnem primeru postanejo prevelika in nepregledna). S tem so postala manjša in lažje razumljiva. Če imamo velika drevesa, se leta lahko preveč prilegajo učnim primerom - overfitting. Da bi se izognili slabosti rezanja odločitvenih dreves (majhna drevesa se lahko premalo prilegajo učnim primerom - underfitting), so bili za kontrolno oz. testno skupino vzeti kar vsi primeri.

Klasifikacija z odločitvenimi drevesi je bila narejena tudi s testno množico, a je zaradi slabe preglednosti izpuščena.

Za drugi algoritem strojnega učenja je bilo izbrano razvrščanje v skupine (clustering). V okviru tega pristopa primerom ne določamo razreda, ampak jih razvrščamo v skupine glede na podobnost. Uporabilljen je bil algoritem Simple k-Means, ki zgradi skupine okrog k centrov.



Slika 6: klasifikacija z odločitvenimi drevesi (J48) - atribut »Starost« kot razred z učno množico



Slika 7: klasifikacija z odločitvenimi drevesi (J48) - atribut »Naslov« kot razred z učno množico

4. ZAKLJUČEK

Pri analizi podatkov sva prva dva avtorja prišla do zanimivih ugotovitev, ki nakazujejo neko statistično predvidljivost, postavitev točnih pravil iz pridobljenih podatkov pa po najini analizi ni možna. Hipoteze so se v štirih od petih primerov pokazale za resnične in so potrdile zdravorazumsko razmišljanje.

Razlaga ugotovitev in hipotez:

1) Hipoteza 1: »Največ zastav je bilo narejenih v največjih slovenskih mestih oziroma regijah« ne drži, zaradi odstopanja pri celjski regiji.
2) Hipoteza 2: »Največ zastav je bilo narejenih v gospodarsko in kapitalsko najmočnejših regijah, s večjo koncentracijo gospodarskih družb in močno razvojno politiko« drži. Lahko jo potrdiva, saj se vidi največje število zastav prav v Ljubljanski in Celjski regiji.

3) Hipoteza 3: »Čas zastave vrednostnih papirjev je v povprečju krajši (leto in pol do dve leti)« drži. Povprečni čas zastave je res med 6 in 24 meseci. VP kot instrument zastave časovno (v daljšem obdobju) ne predstavlja zanesljivega zavarovanja za izposojeni kapital.
4) Hipoteza 4: »Največ zastav je bilo narejenih s strani fizičnih oseb nižjih in srednjih let od 25. do 45. leta starosti« drži. Tudi tu lahko potrdimo hipotezo, saj je največ zastav opravljenih pri starosti med 25 in 45 let. To obdobje predstavlja običajno za posameznika največjo verjetnost, da bo potreboval finančna sredstva.
5) Hipoteza 5: »Na kapitalskem trgu Republike Slovenije je zastavljenih več delnic kot drugih vrednostnih papirjev« drži. Hipoteza je potrjena takoj na začetku, z prikazom, da je več kot 99% vseh zastav opravljenih z delnicami. Tu lahko morda špekuliramo predvsem s stališča, da je večina fizičnih oseb pridobila lastništvo nad delnicami zaradi privatizacijskega procesa, oziroma je kultura varčevanja z nakupom dolžniških VP relativno majhna.

Ko vse hipoteze združimo in jih primerjamo z ugotovljenimi podatki s pomočjo modeliranja, lahko z določeno verjetnostjo predvidevamo, da so upniki srednjih let, da se dolžina zastave na osnovi delnic večinoma giblje med šestimi meseci in dvema letoma in da je največ zastav opravljenih v Ljubljanski regiji (pošti z vodilno številko 1000).

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PRIVACY OF MAIL WITH A HELP OF BAYESIAN ANALYSE

Tomaž Bizjak
The National Education Institute of the
Republic of Slovenia
Poljanska 28, 1000 Ljubljana, Slovenia
Tel: +386 1 3005 184
e-mail: tomaz.bizjak@zrss.si

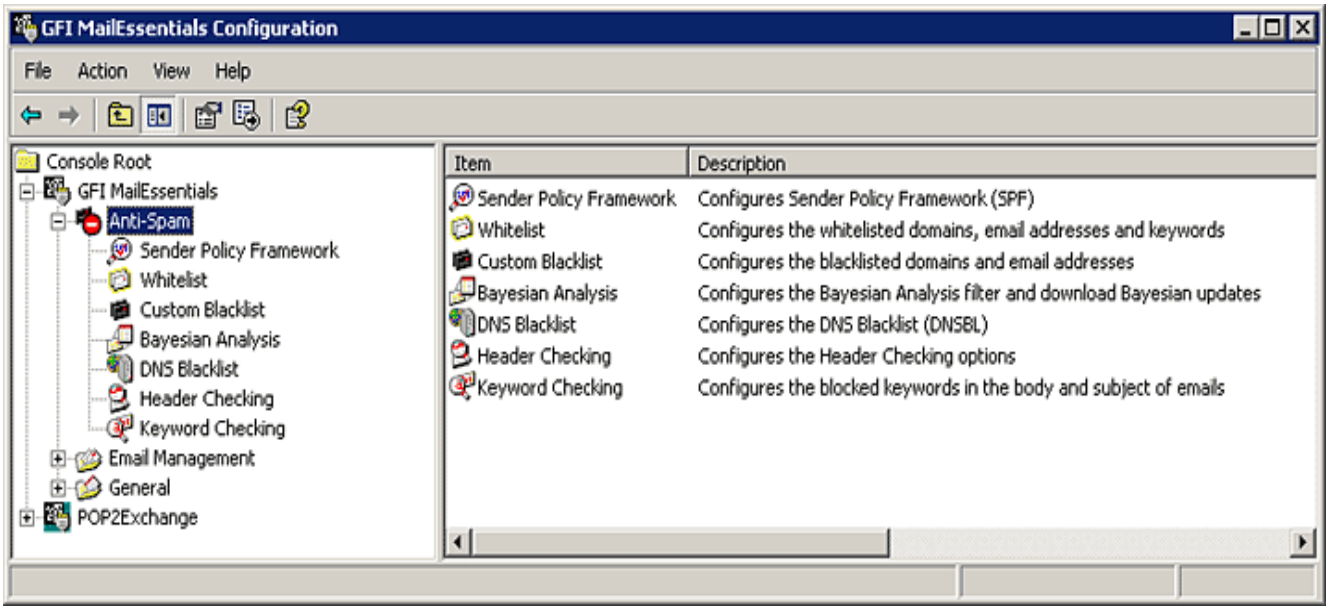
1 INTRODUCTION

This paper describes how Bayesian mathematics can be applied to the spam problem, resulting in an adaptive, 'statistical intelligence' technique that achieves very high spam detection rates.
It also explains why the Bayesian approach is the best way to tackle spam once and for all, as it overcomes the obstacles faced by more static technologies such as blacklist checking, comparing to databases of known spam and keyword checking. These technologies are not obsolete, but cannot be relied upon without a Bayesian filter.

2 INTRODUCTION TO ANTISPAM PROGRAM GFI MAILESSENTIALS

GFI MailEssentials is easy to install and tackles spam protection at server level and eliminates the need to install and update anti spam software on each desktop. GFI MailEssentials uses various methods to identify spam:

- **Custom blacklist** – This feature allows you to specify domains and email addresses from which you do not wish to receive mail.
- **Bayesian analysis** – This feature analyses the content of the inbound mail and based on mathematical rules decides if the mail is spam or not. The Bayesian filter is discussed in the chapter 'The Bayesian anti spam filter'.
- **DNS blacklist** – This feature allows you to configure GFI MailEssentials to query whether the email sender is on a public DNS blacklist of known spammers such as ORDB.
- **Header checking** – This feature analyses the header of the mail to detect whether a mail is spam or not.
- **Keyword checking** – This feature allows you to configure keywords which indicate if a mail is spam.



Picture 1: Anti spam configuration

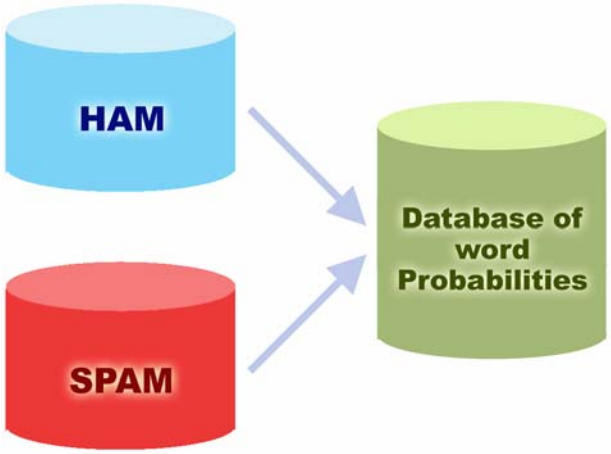
3 HOW THE BAYESIAN SPAM FILTER WORKS

Bayesian filtering is based on the principle that most events are dependent and that the probability of an event occurring in the future can be inferred from the previous occurrences of that event. It is based on the following formula:

$$P(C|A_1, A_2, \ldots, A_n) = P(C) \prod_{i=1}^{n} \frac{P(C|A_i)}{P(C)}$$

3.1. CREATING A TAILOR-MADE BAYESIAN WORD DATABASE

Before mail can be filtered using this method, the user needs to generate a database with words and tokens (such as the $ sign, IP addresses and domains, and so on), collected from a sample of spam mail and valid mail (referred to as 'ham').



Picture 2: Creating a word database for the filter

A probability value is then assigned to each word or token; the probability is based on calculations that take into account how often that word occurs in spam as opposed to legitimate mail (ham). This is done by analyzing the users' outbound mail and by analyzing known spam: All the words and tokens in both pools of mail are analyzed to generate the probability that a particular word points to the mail being spam.

This word probability is calculated as follows: If the word "mortgage" occurs in 400 of 3,000 spam mails and in 5 out of 300 legitimate emails, for example, then its spam probability would be 0.8889 (that is, [400/3000] divided by [5/300 + 400/3000]).

3.2 CREATING THE HAM DATABASE (TAILORED TO YOUR COMPANY)

It is important to note that the analysis of ham mail is performed on the organization's mail, and is therefore tailored to that particular organization. For example, a financial institution might use the word "mortgage" many times over and would get a lot of false positives if using a general anti-spam rule set. On the other hand, the Bayesian filter, if tailored to your company through an initial training period, takes note of the company's valid outbound mail (and recognizes "mortgage" as being frequently used in legitimate messages), and therefore has a much better spam detection rate and a far lower false positive rate.

Note that some anti-spam software with very basic Bayesian capabilities, such as the Outlook spam filter or the Internet Message Filter in Exchange Server, does not create a tailored ham data file for your company, but ships a standard ham data file with the installation. Although this method does not require an initial learning period, it has 2 major flaws:

- The ham data file is publicly available and can thus be hacked by professional spammers and therefore bypassed. If the ham data file is unique to your company, then hacking the ham data file is useless. For example, there are hacks available to bypass the Microsoft Outlook 2003 or Exchange Server spam filter.
- Such a ham data file is a general one, and thus not tailored to your company, it cannot be as effective and you will suffer from noticeably higher false positives.

3.3 CREATING THE SPAM DATABASE

Besides ham mail, the Bayesian filter also relies on a spam data file. This spam data file must include a large sample of known spam and must be constantly updated with the latest spam by the anti-spam software. This will ensure that the Bayesian filter is aware of the latest spam tricks, resulting in a high spam detection rate (note: this is achieved once the required initial two-week learning period is over).

3.4. HOW THE ACTUAL FILTERING IS DONE

Once the ham and spam databases have been created, the word probabilities can be calculated and the filter is ready for use.

When a new mail arrives, it is broken down into words and the most relevant words – i.e., those that are most significant in identifying whether the mail is spam or not – are singled out. From these words, the Bayesian filter calculates the probability of the new message being spam or not. If the probability is greater than a threshold, say 0.9, then the message is classified as spam.

This Bayesian approach to spam is highly effective – a May 2003 BBC article reported that spam detection rates of over 99.7% can be achieved with a very low number of false positives!

3.5 WHY BAYESIAN FILTERING IS BETTER

1. The Bayesian method takes the whole message into account - It recognizes keywords that identify spam, but it also recognizes words that denote valid mail. For example: not every email that contains the word "free" and "cash" is spam. The advantage of the Bayesian method is that it considers the most interesting words (as defined by their deviation from the mean) and comes up with a probability that a message is spam. The Bayesian method would find the words "cash" and "free" interesting but it would also recognize the name of the business contact who sent the message and thus classify the message as legitimate, for instance; it allows words to "balance" each other out. In other words, Bayesian filtering is a much more intelligent approach because it examines all aspects of a message, as opposed to keyword checking that classifies a mail as spam on the basis of a single word.
2. A Bayesian filter is constantly self-adapting - By learning from new spam and new valid outbound mails, the Bayesian filter evolves and adapts to new spam techniques. For example, when spammers started using "f-r-e-e" instead of "free" they succeeded in evading keyword checking until "f-r-e-e" was also included in the keyword database. On the other hand, the Bayesian filter automatically notices such tactics; in fact if the word "f-r-e-e" is found, it is an even better spam indicator, since its unlikely to occur in a ham mail. Another example would be using the word "5ex" instead of "Sex". You would probably not have a word 5ex in a ham mail, and therefore the likelihood that its spam increases.
3. The Bayesian technique is sensitive to the user - It learns the email habits of the company and understands that, for example, the word ‘mortgage’ might indicate spam if the company running the filter is, say, a car dealership, whereas it would not indicate it as spam if the company is a financial institution dealing with mortgages.
4. The Bayesian method is multi-lingual and international - A Bayesian anti-spam filter, being adaptive, can be used for any language required. Most keyword lists are available in English only and are therefore quite useless in non English-speaking regions. The Bayesian filter also takes into account certain languages deviations or the diverse usage of certain words in different areas, even if the same language is spoken. This intelligence enables such a filter to catch more spam.
5. A Bayesian filter is difficult to fool, as opposed to a keyword filter - An advanced spammer who wants to trick a Bayesian filter can either use fewer words that usually indicate spam (such as free, Viagra, etc), or more words that generally indicate valid mail (such as a valid contact name, etc). Doing the latter is impossible because the spammer would have to know the email profile of each recipient - and a spammer can never hope to gather this kind of information from every intended recipient. Using neutral words, for example the word "public", would not work since these are disregarded in the final analysis. Breaking up words associated with spam, such as using "m-o-r-t-g-a-g-e" instead of "mortgage", will only increase the chance of the message being spam, since a legitimate user will rarely write the word "mortgage" as "m-o-r-t-g-a-g-e".

3.6 BAYESIAN FILTER OR UPDATED KEYWORD LISTS?

Some types of anti-spam software regularly download new keyword files. While this is, of course, better than not updating keyword lists, the fact is a rather patchy approach that is easily circumvented. Downloading updates makes it a little bit harder, but the principal system is flawed compared to a Bayesian filter.

3.7 WHAT’S THE CATCH?

Bayesian filtering, if implemented the right way and tailored to your company is by far the most effective technology to combat spam. Is there a downside? Well, in a way there is one downside, but this can easily be overcome: Before you can use and judge the Bayesian filter, you have to wait for it to learn for at least two weeks – that or create the ham or spam databases yourself. This task can be quite complex, so it is best to wait until the filter has had time to learn. Over time, the Bayesian filter becomes more and more effective as it learns more about your organization’s email habits. To quote the old saying, good things come to those who wait.

It is important, therefore, to keep this in mind when evaluating anti-spam software. If the product has advanced, customized Bayesian analysis, then it can only be judged after a few weeks. It is probable that basic anti-spam software might perform better initially, but after a few weeks the Bayesian filter catches up and well outperforms the conventional anti-spam filters once and for all.

4 CONCLUSION

GFI MailEssentials for Exchange/SMTP offers spam protection at server level and eliminates the need to install and update anti-spam software on each desktop. GFI MailEssentials offers a fast set-up and a high spam detection rate using Bayesian analysis and other methods - no configuration required, very low false positives through its automatic whitelist, and the ability to automatically adapt to your email environment to constantly tune and improve spam detection. It also enables you to sort spam to users' junk mail folders. GFI MailEssentials also adds key email tools to your mail server: disclaimers, reporting, mail archiving and monitoring, server-based auto replies and POP3 downloading.

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READY FOR EINVOICING?

Kornelia Pupakova, Ali Saravirta, Kari Korpela
Dept. of Computer Science, Faculty of Technology
University of Vaasa
P.O.Box 700, 65101 Vaasa, Finland
Tel: +358-40-876 8934
e-mail: kornelia.pupakova@tuke.sk

ABSTRACT

Many companies have realized that making business in nowadays condition of preferring Internet applications and approaches of Information Technologies developments is no longer the same as it used to be. There is a need for re-design of companies' business processes and implementation of newly developed applications into their internal information system.

The main scope of this paper is to present some results of previously done survey and research in the area of eInvoicing service implementation. The research was carried out in South-Karelia region in Finland within years 2004 - 2005.

The main focus of the survey was on the state of the SMEs' readiness for adopting the eBusiness solutions, mostly prefering the usage of electronic applications within financial business transactions. Financial management processes are not always the greatest interest of managers, but the benefits gained through the adoption can be massive.

The research aimed to make companies aware of what and how to change when converting their business operations and processes into eInvoicing. The main part of the research included determination of reasons for slow adoption of this service among 146 SMEs, as well as testing of interoperability among involved stakeholders, concretely 10 SMEs and big companies using 3 banks and 6 operators. The testing was carried out in two parts, each time 90 real invoices were sent and received. It was found out that the reason for slow adoption of this service are non-technical, that the most obstacles which stand in the way of raised penetration, is the motivation and trust of the companies into the new eBusiness solutions. It seems that it means to convince the SMEs, that the final cost savings could scale up to 50% or even more. With the 20 € savings per invoice through eInvoice and with 25 billion invoices per year, this would means huge cost savings potential. [1] By converting financial transactions from paper invoices into eInvoices, it will increase the efficiency of information and payment flows, and reduce the administration burden related to the current paper work.

Key words: *eBusiness processes, eInvoicing service, adoption, interoperability*

1 INTRODUCTION

Actual trends are more oriented on the usability of Information Systems with the support of ICTs in every-day business processes. This fact requires implementation of new ICT into the internal information systems, through which company provides services or products to their customers.

Technology Centre Kareltek in Finland has been conducting a special eBusiness 2004-2006 venture focusing on South Karelian SMEs. They introduced new eBusiness solutions to the SMEs and aimed to improve the competitive position of the whole business network in South Karelia region. [3] The electronization of financial processes has proceeded slower than it was expected. The research carried out was focusing on detection of the reasons why, even when the new technology was already available.

2 EINVOICING PROCESS

The service to be presented is an *eInvoicing service* for cost-efficient and paperless method of handling and processing invoices.

The invoicing process starts when the supplier sends a paper or electronic invoice and ends when the payment and achievement of the invoice have been done. The majority of invoices are still in the old-fashioned paper format. Basically the electronic invoicing process is quite similar to the manual process. After making a purchase, the goods will be received, and the supplier sends an invoice to the purchaser. If the supplier sends a paper invoice, it must be scanned to the electronic system. Electronically sent invoices come directly from the supplier's electronic system into the purchasing company.

The eInvoicing operators and banks have an important role in the whole eInvoicing process. Due to these intermediaries, it is possible that the sender of an eInvoice uses a different form of an invoice than the receiver. The service provider will take care of the modifications between the sender and the receiver.

The Total eInvoicing Service has two alternatives for the SMEs and other organizations, and two support services for FM applications providers and other banks and operators. The eInvoicing service can be used in two alternative ways for service delivery, i.e. via:

1. Net-Banking eInvoicing Service
2. eInvoicing File Transfer Service

eInvoicing through Net-banking Service, is most suitable for SMEs that want to send and receive electronic invoices without a separate financial management application (FM).
The File Transfer type of eInvoicing suits companies and other organizations that want to use the in-built capability of FM applications. In the latter alternative the eInvoices are generated directly in companies' own ERP / FM system and are transferred between the FM application and the bank.
The Total eInvoicing Service Offering also includes two support services that are necessary for ensuring the use of eInvoicing. These support services are not targeted to the end users, but for raising and speeding up the penetration of the service.

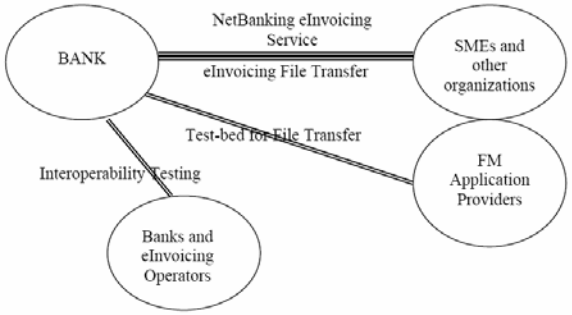

Figure 1. Total eInvoicing Service Offering.

3 NOWDAYS SITUATION AND BENEFITS

The nowadays situation of eInvoicing service in Finland is monitored as a successfully running service within one bank, more precisely Nordea, and recently (September 2004) among three Finnish banks (Nordea, Osuuspanki and Sampo).
This service had been tested for its interoperability among several companies, mostly SMEs, application operators for financial management applications and service operators. These tests were carried out in May 2005 in South-Karelia, Finland. The interoperability means testing of eInvoicing service for its usability from the seller via one bank or operator to another bank or operator all the way to the buyer.

Using electronic methods to generate, deliver and receive invoices have several benefits over paper invoicing. eInvoicing automates the routines of financial management processes, fastens the sending of invoices, saves money and time, because there's no need to print and post the paper versions. The biggest gains from implementing this service into business processes are the costs savings for invoices. The cost savings come from the disappearing paper transportation costs and reduction of achievement costs. Retrieving a transaction can be done in less time, too, because the invoice data is stored in an electronic file.
We can also not forget about the decreased number of errors. By using eInvoices the potential for errors in the accounts is reduces. Solving errors takes a long time but with eInvoicing a company will spend less time sorting out problems and more time running the business.

4 RESEARCH METHODS AND STRUCTURE

This whole study consisted of two parts. First; the survey focused on the detection of the reasons that facilitate or delay the adoption of eInvoicing. Second; the real eInvoicing tests of interoperability were carried out for stating the current status of usability of eInvoicing service in companies' every-day business transactions.

4.1 The survey

The empirical part of the study discusses the adoption of electronic invoicing in South Karelian SMEs. Data were collected in March and April 2005 with a mail survey for detection of the current situation of using the eInvoicing service within SMEs. The aim of the survey was to try to answer the question of how long it will take to the companies to adopt this service, and if they decide for non-adoptions, what are the reasons. The data collection was performed in two parts, in the first part the target companies were contacted by telephone in order to find the right person to answer the questions. The second part was the mailing of a questionnaire and later on, the data collection. [3]

4.2 The eInvoicing tests

The real eInvoicing tests detected the interoperability between eInvoicing operators and banks. Before an organization starts to use electronic invoicing, it is needed to test the connections with the company's operator. It is better to test the connections with company's own operator and after that with some reliable invoicing company. [3] The Technology Center Kareltek performed two eInvoicing tests to find out the current connections of organizations and operators/banks in sending and receiving electronic invoices.

5 RESULTS

5.1 The survey

The data for the empirical part of the study were collected by a mail survey during March and April 2005. The sample composed of 146 South Karelian companies.. The survey was sent to 932 companies and response rate was 15.7 %. Most of the firms (22.9 %) were operating in the field of real estate, renting and business activities. Manufacturing (21.4 %) and wholesale and retail trade (19.1 %) were almost equally common.
Respondents were asked if they have Internet connection in their organization.

Network access	Amount in %
Broadband (ADSL/Cable)	79.9
ISDN	10.4
Modem	8.3

Table 1. Type of network access

A majority of the respondents had a broadband Internet. 15 companies had ISDN and 12 companies had modem. Two companies did not have Internet at all. [3]

Companies were also asked about the types of electronic applications, they are using.

Use of electronic applications	In use in %	In plans in %	Not in use, not in plans in %
E-mail	96.5	2.8	0.7
Home pages	60.7	17.9	21.4
Extranet	18.9	6.8	74.2
Intranet	19.8	5.6	74.6
Production manag.	16.5	9.1	74.4
Financial manag.	55.7	7.6	36.6
Customer manag.	47.2	11.2	42.6

Table 2. Use of electronic applications

Table 2 presents the usage of certain applications. As we can see, most of the companies use e-mail (96.5 %); only one company didn't even consider it. Also home pages (60.7 %), financial management applications (55.7 %) and customer management applications (47.2 %) were quite common in respondent companies. [3]

The respondent companies were asked about the adoption of electronic invoicing.

We heard the first time	Amount in %
Before 2000	2.9
2000 – 2002	26.3
2003	40.9
2004	27.7
2005	2.2

Making decision	Amount in %
Before 2000	0.8
2000 – 2002	0.8
2003	3.8
2004	21.4
2005	6.1
No decision	67.2

We considered for the first time	Amount in %
Before 2000	0.7
2000 – 2002	3.6
2003	11.7
2004	38.7
2005	19
No consideration	26.3

Routine	Amount in %
2005	22.7
2006	18.8
2007 – 2008	30.5
After 2008	11.7
Never	3.1
Already users	13.3

Table 3. Results on current status and future orientation in area of adoption of eInvoicing service

Respondents were also asked about their experiences in electronic invoicing.

eInvoicing users	Agree	Neutral	Disagree
Sending of eInvoice is easy	84	12	4
The progress of eInvoice in the system is reliable	70.8	20.8	8.3
Sending of eInvoice is problem-free	52.2	21.7	26.1
Problems with contracts between buyer and operator	36.4	22.7	40.9
Problems with contracts between seller and operator	13.6	22.7	63.6

Table 4.: Experience with eInoicing among users

According to the respondent companies already using eInvoicing service, 84 % (21 companies) says that sending eInvoices is easy. Also quite large amount (70.8 %) of companies thinks that eInvoices travel reliably from seller to buyer. 36.4 % of respondents say that the receivers of the eInvoices have some problems with the contracts with operators/banks; 40.9 % of the respondents say though that there are no problems. 63.6 % of the companies do not see problems with contracts concerning the sender and his operator. [3]

In the questionnaire there was one question that measured the reasons why non-adopters have not adopted electronic invoicing yet.

1. Our suppliers haven't demanded.
2. Our customers haven't demanded.
3. We aren't convinced of the benefits of eInvoicing.
4. We wait the actions of our competitors.
5. Our competitors don't use eInvoicing either.
6. Integrating eInvoicing to our systems is difficult.

As we can see from the answers, the pressure (suppliers, customers, competitors) outside the company is an important factor for adoption/rejection. [3]

5.2 The eInvoicing tests

Invoices in the real-life tests were sent by 8 SMEs to specific receivers. The aim was to see if there are any particular problems need to be solved.

The interoperability testing has been studied between banks, between operators, between banks and operators. The main focus will be given to the existing channels.
The players as well as the functionality of created channels are needed for the eInvoicing Service testing. As a starting point in the framework is the one used in South-Karelia in May 2005 (Figure 2).

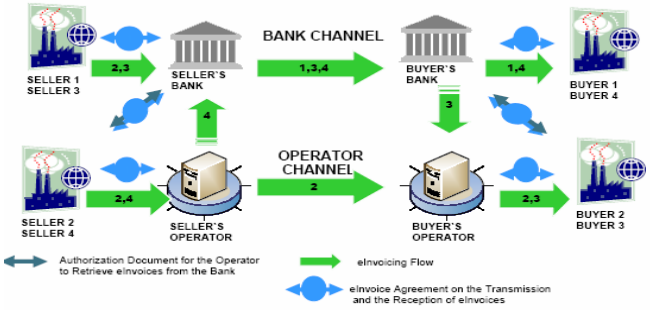

Figure 2. Framework for interoperability testing [2].

In the first stage of deployment the eInvoicing service operates within one bank or operator connectivity was tested. The second stage of deployment is to ensure the interoperability of the eInvoicing service between different banks and operators. This is necessary to raise the penetration of eInvoicing among the critical mass of SMEs.

South-Karelia was the first region where the interoperable eInvoicing Service was tested. Since 13.9.2004 two successful tests have been completed. In the first eInvoicing Test, eight companies sent the invoices and ten companies were the receiving parties. Of 52 sent eInvoices only 17 was correctly received, in other words the go-through percent was 33 %. In the second eInvoicing Test, 72 test invoices were sent, 44 % of them were operator-to-operator eInvoices, 28 % bank-to-operator eInvoices, 17 % operator-to-bank and 11 % bank-to-bank eInvoices. Bank-to-bank services managed to pass through 88 % of the invoices.

Technically there are no more obstacles for interoperable eInvoicing. The obstacles were related to other than technical factors.
From the impact point of view, the potential impact of adopting the eInvoicing service could be measured in relation to the main obstacles the SMEs are dealing with (see
Figure 3). These obstacles were the main factors prohibiting the fast adoption of eBusiness solutions among SMEs.

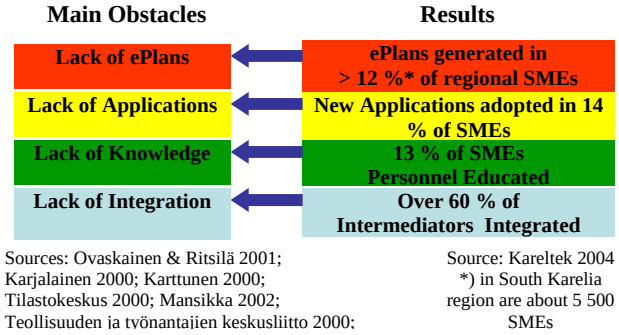

Figure 3: The main obstacles for the adoption of eInvoicing service and the results from South-Karelian eInvoicing pilot

After the obstacles were removed, the big clients started then rightly to demand the fast adoption of the eInvoicing solutions. The final impact was enormous because the activities were focused on the top 20 % of the biggest SME invoicers, which accounted for 80 % of the total volume of invoices. At the end of the testing the amount of companies sending and receiving eInvoices was about 20 000. At the time of writing this paper (September 2005) the number of companies was double that high.

6 THE CONCLUSION

Many companies go through stages that lead to the decision whether to adopt or not a particular innovation. At a certain point of time, organizations can be divided as adopters or non-adopters. At that time, 26 % of South Karelian companies had adopted eInvoicing and 74 % had not done so. The study shows that there is still much work to do with these non-adopters. They have to be convinced of the potential benefits that can be achieved with invoicing electronization. The most important reason for non-adoption among SMEs was the lack of pressure from their partners.

The present study shows the need for more intensive promotion of electronic invoicing because many of the companies have not made any decision concerning this innovation yet. Penetration level should be rising even more rapidly. This study explored the current situation of eInvoicing in South Karelia region in Finland. It might be motivating enough for the other non-adoptors, to convince them about the final benefit they would be able to gain after adopting this service.

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IMPACT OF ICT INVESTMENTS: THE PERCEPTION AMONG ICT MANAGERS

Vasja Vehovar, Tina Zupanič
Faculty of Social Sciences
University of Ljubljana
Kardeljeva ploščad 5, 1000 Ljubljana, Slovenia
e-mail: vasja@ris.org

ABSTRACT

We present the results of 2005 RIS representative study among Slovenian companies, which is related to the impact of the information-communication technology (ICT) investments. The study was performed by telephone among 750 Slovenian companies with a response rate of around 50%. Managers responsible for ICT evaluated the effects of the ICT investments in their company. They estimated various aspects of the satisfaction with ICT investments and the corresponding organisational changes. We found relatively low satisfaction with the ICT investments. The size and nature of the ICT investment was the most important factor for the perception of the effects of ICT investments.

1 INTRODUCTION

Measurement of the impact of the investments in information-communication technologies (ICT) is methodologically very difficulty topic. There are various approaches to attack this problem, however, in this paper we approach it from the perception and attitudes of ICT managers. For this purpose we performed an empirical study among Slovenian companies in June 2005 within RIS project (Research on Internet in Slovenia, http://ris.org).
We should add that all available international comparisons confirm that Slovenian companies are using ICT in a sufficient extent, so the findings are relevant also for other developed economies.

2 ICT IN SLOVENIA

In last years, various studies were conducted on ICT sector in Slovenia, e.g. Stare et al. (2004), IDC (2004), and Eurostat (2004). In addition to this we should mention the following:

(1) Vehovar and Jovan (2003a) compared Slovenian companies with SIBIS research. Results show that Slovenia is above the EU15 average in some basic ICTs (computers, internet access, web pages); however it lags in advanced technologies (video-conferencing, intranet, etc.).
(2) Similar findings arose from Eurostat (2004) study on ICT among companies.
(3) Study on informatics and IT workers (Vehovar et al., 2003b) showed that 5% of all Slovenian companies have IT organized in their own department, 3% within mother company and 84% without it.
(4) Turk et al. (2001) analysed effects of ICTs and found that companies, which have more ICT usage, are also more efficient.
(5) Lesjak and Vehovar (2005) showed that only 13% of companies with sizeable e-commerce projects evaluate their e-commerce projects.

3 PERCEPTION OF ICT INVESTMENTS

A special study has been conducted among Slovenian companies in June 2005, which addressed the perception of companies about their ICT investments.

4 METODOLOGY

Target population of the study were all active Slovenian companies

Table 1: Sample frame of the study RIS – ICT among companies 2005

Size of company	Population	Original sample	Identified units	Eligible units	Responding units
big	282	282	282	246	123
middle	1.195	598	583	478	255
small	8.252	550	511	431	159
micro	29.820	994	752	572	190
Total	39.549	2.424	2.128	1.727	727

Companies were classified in large (above 250 employees), middle (50 – 249 employees), small (5 – 49 employees) and micro companies (fewer than 5 employees). Each stratum included 150- 200 companies (Table 1).

ICT managers responded to questions about ICT investments in years 2003, 2004 and in the first half of 2005. Companies evaluated all ICT investments or purchases: software, hardware, out-sourcing as well as all their own efforts on ICT applications, expressed with person-months of work.

4.1 Descriptive analysis

Companies had evaluated 7 components of ICT investments (
Table **2**). For each component respondents had the instructions not to include elements or investments of the previous categories. Such questioning assured that companies reported about the entire spectrum of ICT, and not only about what they think belongs to ICT investments.

Table 2: Average ICT investments in Slovenian companies by components, in years 2003-2005

Component of ICT investment	Share (%)	Average in millions SIT*	Std. deviation
Web pages, intranet, extranet	10%	6.1	25.9
E-commerce projects	5%	3.3	20.1
Establishing or expanding information systems	34%	21.6	88.8
Purchase, development, outsourcing of software (application & system)	25%	16.2	55.7
Investment in IT equipment	15%	9.3	28.4
Investments/ modernization of telecommunications	7%	4.4	26.9
ICT education	5%	3.2	13.9
Total	100%	64.1	177.5

* 1 EURO=240 SIT

The survey shows that *investment in company information systems* is far the largest component (average 21.6 million SIT). Because of the nature of the questions the companies may include here also the elements that belong to other categories, e.g. e-commerce or web applications. Within this context, this is not problematic, as we are basically interested in the sum of all investments. At the same time this shows actual perception of ICT investment structure. The sums may be also systematically over or underestimated, but we are not interested here in representative estimates of ICT aggregates but only in their relations to the perception and attitudes.

Standard deviations, which in the case of normal distribution take approximately one third to one half of the mean are extraordinarily large and about 3-6 times exceed averages, even if we eliminate companies, which have value zero. Due to large differences we classified companies in quartiles of ICT investments for further analysis:

- up to 0.7 million SIT investments (1st quartile),
- from 0.7 million to 10 millions SIT investments (2nd quartile),
- from 10 millions to 40 millions SIT investments (3rd quartile),
- above 45 million SIT (4th quartile).

4.2 Effects of ICT investments

For the four groups of companies (quartiles) we analysed perception of the effects related to ICT investments (Table 3). Respondents estimated their agreements on scale from 1 (totally disagree) to 5 (totally agree). The variables addressed:

- satisfaction with ICT investments;
- organizational, managerial and communicational changes induced.

The estimates in Table 3 show positive overall satisfaction (F) with ICT investments (average 3.6). However, this is still relatively low regarding the developments of ICT industry and the corresponding marketing efforts of ICT suppliers. It also does not exceed 4.0 - a boundary for high satisfaction – even with large ICT investments (3.8). With small ICT investments it does not even demonstrate clear positive result (3.0+). Similar is true also for the components of the satisfaction.

In addition, a quarter (25%) of companies in first quartile (up to 0.7 million SIT) expressed their total dissatisfaction (grade 1) with the effects of ICT and similar holds true for 1% in fourth quartile (above 40 millions SIT). In general, one tenth of companies in all groups expressed serious dissatisfaction (grade 2).

Other important finding refers to large differences in the range of attitudes. Certain differences were expected, however they extend from 1.9 to 3.4. This may be understandable for questions, which refer to organizational aspects of ICT projects, while it is more surprising for the satisfaction issues.

We can further summarize Table 3:

- changes in communicating (average 3.0) are relatively high, particularly with large projects (3.6) – statement N,
- given specifics of such a radical change, relatively high number of companies reported changes in managerial hierarchy (statement L) (in fourth quartile around 15%),

- abolition of old r establishment (H, I) of new organizational units occurred in 5% companies. Due to the nature of such a radical intervention into organization this is not negligible,
- the largest agreement had the statement G about increased needs of educating employees (total average 3.1, and for investments above 45 millions SIT even 3.7).

Table 3: Agreement with statements about the effects of ICT investments (RIS - ICT 2005)

Survey question	up to 0.7 million SIT		0.7 millions do 10 millions SIT		10 millions do 45 millions SIT		above 45 millions SIT		Total	
	Avg.	N	Avg.	N	Avg.	N	Avg.	N	Avg.	N
A	3.1	172	3.6	183	3.3	168	2.7	181	3.2	704
B	1.8	169	2.2	183	2.5	168	3.2	181	2.4	701
C	2.2	166	2.8	181	3.2	167	3.5	181	2.9	695
D	2.0	164	2.5	181	2.9	164	3.0	180	2.6	689
E	2.1	161	2.5	179	2.8	165	2.8	181	2.6	686
F	3.0	163	3.6	181	3.8	166	3.8	180	3.6	690
G	2.3	166	3.0	183	3.4	167	3.7	183	3.1	699
H	1.3	166	1.5	182	1.7	167	1.8	182	1.6	697
I	1.2	166	1.5	182	1.5	166	1.7	181	1.5	695
J	1.4	164	1.9	182	2.3	167	2.5	181	2.0	694
K	1.4	167	1.7	181	2.0	167	2.3	181	1.8	696
L	1.5	166	1.9	181	1.9	166	2.1	182	1.9	695
M	1.9	168	2.6	182	2.9	167	3.4	182	2.7	699
N	2.3	166	3.0	182	3.2	167	3.6	180	3.0	695
O	2.1	165	2.8	179	3.0	161	3.4	178	2.8	683
P	2.5	166	3.0	182	3.2	166	3.3	181	3.0	695
R	2.5	165	3.2	182	3.4	166	3.6	180	3.2	693

A - ICT investments were more a renovation and maintenance and not a new development
B - Huge organizational changes occurred.
C - Organizational changes were planed in advance as a component of ICT project.
D - We underestimated the organizational changes.
E - Unexpected organizational changes occurred after implementations.
F - We are happy with effect of ICT investments.
G - ICT investments generated and increase in the needs for educating our employees.
H – We established new organizational units.
I – We abolished some organizational units.
J - ICT investments lead to re-allocation of employees among existent organizational units.
K – We had to re-train of employees.
L – We changed managerial hierarchy.
M – We changed organisation and processes.
N - We changed internal communication.
O - ICT investments lead to the improvement of market position of company.
P – The employee satisfaction increased.
R – The productivity increased.

5 CONCLUSION

We examined the effects of ICT investments thru the perceptions of ICT managers in a representative telephone survey among 727 Slovenian companies in June 2005. We classified companies in four quartiles regarding the size of the ICT investments in the last three years. We can conclude:

(1) Results enable insight into structure of ICT investments. Relatively small share of investments is related to equipments (only about one tenth) compared to figures from official statistics or commercial sources (IDC, 2004). However, here the ICT investment is treated broader including developmental work of employees (e.g. costs of own development of web page). On the other hand the largest category of ICT investments (»*information systems*«) may also include hardware and other investments in equipment.
(2) Surprisingly large share of ICT investments relates to buying or development of software, and to company information systems.
(3) Investments in web page or intranet occupy one tenth of investments, and investments in ICT education around 5%.
(4) Size of ICT investments determines the perception of ICT investments, what was to expected, but not in such sharp extent,
(5) General satisfaction with ICT investments is relatively low. In minor ICT investments is on a border of positive effect (3.0), and it does not exceed value 4.0 in large investments.
(6) Specific aspects of satisfaction (satisfaction of employees, satisfaction with productivity, satisfaction with improved market position) show even lower values. Certain part of companies (25% in the first quartile) is even extremely unsatisfied with ICT investments.
(7) Dissatisfaction with ICT investments in small companies can be explained by wrong implementation but also with false expectations about effects of ICT investments;
(8) Organizational changes occurred with large investment, where they were in most cases planed as part of ICT investments. Despite this in many cases they were still underestimated.
(9) The most explicit effect of ICT investments is enlarged need to educate employees.

Additional analysis also showed that small ICT investments are typically oriented towards renovation and maintenance of existent ICTs (statement A), e.g equipment, applications or infrastructure, and not to development or expansion of ICT. The former (maintenance) had essentially much better effects than the latter (new ICT projects). Vice versa, with large ICT investments, the type of new investments had much better effects in sense of satisfaction and also in sense of organizational changes, than the type of investments oriented into renovation and maintenance.

We can explain above discrepancy with the fact that in smaller - but new ICT investments - the indirect effects of organisational environment are frequently underestimated, and as a result the entire ICT investment may not be successful. For efficient ICT investments, the consideration of the company environment is extremely important. With large ICT investments in new or expanded targets these aspects are usually systematically provided and foreseen, so the results are much better.

On the other hand, thanks to improved technological characteristics of new ICTs, the minor »maintenance« investments do have surprisingly favourable effects with high satisfaction. An example would be the replacement of old PCs with new ones, which can give employees a strong impression of a positive change, while at the same time this kind of investments does not interfere with any of more complicated organisational factors.

The above findings basically support the thesis that the entire environment of the company and proper integration of ICT investment actually decide whether ICT investment will be successful or not.

Our analysis here presents only a first general insight into collected empirical data of the survey RIS – ICT 2005 among companies. We limited here only on univariate and bivariate analyses. More complete picture would be obtained by multivariate analyse and causal modelling, what may provide the insight into structure of factors that define the perception of ICT investments. Final picture could also gain qualitative research in the companies for which we have survey data, as well as with the corresponding analyses of official statistical and balance sheet data (Goldrige and Clayton, 2004). Along with this, further theoretical analyse should be also undertaken on ICT impact on organizational structure of the company to upgrade the concepts that come into existence before appearance of internet (e.g. Eason, 1988; Markus in Robey, 1988). We strongly believe that recent ICT innovations require another wave of conceptual rethinking related to the understanding of the interaction between ICT and the company environment.

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BUSINESS PROCESS RENOVATION TOWARDS E-GOVERNMENT – THE ROLE OF KNOWLEDGE MANAGEMENT

Andrej Kovačič, Jaka Lindič
Faculty of Economics
University of Ljubljana
Kardeljeva ploščad 17, 1000 Ljubljana, Slovenia
Tel: +386 1 5892 610; fax: +386 1 5892 698
e-mail: andrej.kovacic@ef.uni-lj.si, jaka.lindic@ef.uni-lj.si

ABSTRACT

The main objective of the paper is to present the characteristics of business renovation efforts, readiness for e-government in Slovenia, and how the business process modeling can be used for these purposes. The paper presents the business process renovation as the key element of e-business orientation and the highest level of strategy for managing change that commonly cannot be handled by continuous improvement and reengineering methods or organizational restructuring, and introduces a business rule-transformation approach to business renovation. The case of business process management project in one of the Slovene Ministries, where the process modeling and simulation were extensively used, is also presented. The process modeling proved useful since it shows the process as a whole, drawbacks of the existing process, bottlenecks in the process execution, provides critical insight into process execution etc. The results of the process modeling are a good foundation for a business process reengineering as a next step towards e-government.

1 INTRODUCTION

Practically all of the developed countries' governments are aware of the potential of e-government. Some of them (e.g. Singapore, Great Britain) had been successful in providing large number of e-services. But the key problem is that societies can only benefit from e-government initiatives if offered e-services are being consumed. The most obvious problem governments face today is low demand for their e-services. Governments realize that it is not only about transformation of services to the new technology platform, but rather about changes in organizational and process domain.

Therefore we discuss the role of business renovation in e-government initiatives. Business rule-transformation approach to business renovation and the value of modeling in BR projects are briefly presented. The main part of the paper is Section 4, where the e-government strategy and BR in Slovenia and the case business renovation project in one of the Slovene Ministries are presented.

We also introduce a case study of business process modeling and simulation usage in the field of e-government enrolment in Slovenia is presented.

2 E-GOVERNMENT

E-government is electronic execution of interactive, inter-organizational processes and represents a shift in business doctrine that is changing traditional organizational models, business processes, relationships and operational models that have been dominant in the public sector in the past decades. Electronic government is no longer just an option but a necessity for countries aiming for better governance (Gupta and Jana, 2003). The new doctrine of e-government requires organizations to integrate and synchronize the strategic vision and tactical delivery of services to its clients with the information technology and service infrastructure needed to meet that vision and process execution. In the next few years, successful countries will restructure their public sector, process and technology infrastructure for successful e-government execution.

The term “e-government” focuses on the use of new information and communication technologies (ICTs) by governments as applied to the full range of government functions. In particular, the networking potential offered by the Internet and related technologies have the potential to transform the structures and operation of government. E-government has been conceptualized as the intensive or generalized use of information technologies in government for the provision of public services, the improvement of managerial effectiveness, and the promotion of democratic values and mechanisms. Information technology (IT) has the potential to transform government structures and to improve the quality of government services. Technology provides two main opportunities for government: (1) increased operational efficiency by reducing costs and increasing productivity, and (2) better quality of services provided by government agencies (Gil-Garcı´a and Pardo, 2005).

Governments were rather slow in realizing the potential of e-business compared to businesses. But that gave them an opportunity to learn from mistakes other have made. One of the key lessons for success was to change processes first, and then change the technology. By being slower to invest in e-business technologies, governments were given a change to get the sequence right.

According to Forrester research (Bartels, 2002) the top priorities for e-government should include (1) rigorousness in prioritizing introduction of e-services, (2) use e-reengineering technologies and techniques to improve internal government efficiencies, (3) G2E portals to support internal efficiency efforts, (4) e-CRM initiatives to ensure agency responsiveness and measure citizen satisfaction, (5) e-learning initiatives and (6) security initiatives.

When the first governments realized the potential of e-business, they rushed into providing as many electronic services as possible. Singapore had one of the leading e-government initiatives in the world. They had identified all the services that could be offered by electronic means. Singapore reached the 77% mark back in 2002. Great Britain planed to offer all of 657 services electronically by the end of 2005.

But governments missed an important lesson businesses had offered. It is not only the service you provide that is important, it is the business model that lies behind it. Of course there are important differences. The main problem early e-business initiatives faced was how to provide a strong and continuous cash inflow. In similar way governments wrongly estimated the benefits of e-governments. These benefits do not become benefits when services are offered, but rather when they are consumed. The key problem of leading e-governments today is not in supply of government services, but rather in their demand.

Beside technology related reasons the main reasons for low usage are unchanged processes that are just transferred into electronic form and lack of real incentives for e-government usage. With rare exceptions governments rushed into offering the most services possible. But rather they should make priorities, which services can add the most value when transformed to e-service. Governments should redefine the underlying processes, look for innovative ways to improve their service. E-enabled business models should (Rohleder and Jupp, 2004) be personalized, tailored, flexible and they should integrate services both horizontally and vertically. Therefore, the business renovation (BR) or business process renovation methods should be used in the framework of e-services introduction.

2 Business renovation (BR)

BR integrates radical strategic method of Business Process Reengineering (BPR) and more progressive methods of Continuous Process Improvement (CPI) with adequate Information Technology (IT) and e-business infrastructure strategies. Process renovation is a re-engineering strategy that critically examines current business policies, practices and procedures, rethinks them through and then redesigns the mission-critical products, processes, and services (Prasad, 1999). The modeling and simulation of business processes is suggested for use in BR projects as it allows the essence of business systems to be understood, the processes for change to be identified, process visions to be developed, new processes to be designed and prototyped and the impact of proposed changes on key performance indicators to be evaluated (Greasley and Barlow 1998). Usually, public sector organizations are faced with challenges differing from challenges for private firms. They have to meet multiple, often conflicting goals, and they are subject to constraints of financial, legal, contractual, personnel and institutional nature. Normally these constraints are much more binding than they are in private sector. The radical process-focused change in public sector organizations can only be achieved with deep changes in their bureaucratic practices. This, in turn, normally cannot be achieved without either change in the law or privatization. BR in public sector emphasizing mostly on quality and productivity improvement, bureaucracy elimination, process simplification and processing time reduction. Also, government reform initiatives at all levels of government are placing more emphasis on accountability and results to meet citizen expectations for public services and products. The desired outcome for a private organization is a growing, profitable, competitive enterprise; for a public organization, desired outcomes center on the delivery of necessary, cost-effective services for citizens or members (for not-for-profits).

3 Business process modeling

The traditional ‘old economy’ companies urgently need to build on and re-evaluate their current business models and create new ones. Accordingly, e-business initiatives have truly strategic imperatives: creating a totally different business model. An e-business model generally means the adapting of a company’s current business model to the Internet economy.

A business model is an abstraction of a business that shows how business components are related to each other and how they operate. Its ultimate purpose is to provide a clear picture of the enterprise’s current state and to determine its vision for the future. The goal of business process modeling is to reach a common understanding about how activities should be carried out (e.g. in which order) and what it produces, it has become largely agreed that knowledge management activities should be integrated within day-to-day business processes to ensure continual process improvement and facilitate learning and the gradual development of organizational memory. Modeling should be divided into strategic (business), tactical (business-process) and operational (information system, workflow) levels. Business modeling includes the analysis of corporate strengths, weaknesses, and culture, the

assessment of information systems in the organization, and organization and management competencies. It is the basis of all further actions and is carried out by corporate management. Corporate goals, strategies, and critical success factors form the basis of selecting and modeling core business processes at the global level of description. Business process model on the tactical level, together with information on the organization's current state, is fundamental for evaluating and benchmarking vis-à-vis other corporations. Detailed information system modeling of the processes or workflow structures takes place at the operational level. Workflow systems are able to support business processes if the business process is clearly structured and defined (Kovačič et al., 2001). Workflows are refined and modeled at the level of particular interdependent business activities that are performed by actors (resources) in an organization in order to achieve common goals. At this level, the more exact and certain information about a workflow is, the better the modeling results will be. The problem lies in the conflict of aims between the need for accurate information and the difficulties of obtaining it due to the often obsolete documents describing flow structure, varying or even contradictory statements from employees, and time constraints (Grover et al., 1995).

For many years now, there has been increased recognition in Information Systems (IS) modeling of the dynamic behavior of organizations (Green and Rosemann, 2000). Business process models are maps or images of the logical and temporal order of business activities performed on a process object. Business process modeling has been embraced as an appropriate way to describe business behavior. Every process is represented by its precise description, which contains both the behavior and structure of all objects that may be used during process execution. Business-process modeling as an approach focuses on understanding the underlying business processes where business rules are one of the most important elements for the detailed and formalized description of all facts or business knowledge, which are to be implemented during business process renovation and IS development.

The aims of using business process modeling are: (1) to help the BR team obtain a holistic view of the process under study; (2) to identify areas for improvement; (3) to visualize the impacts and implications of new processes (Chen, 1999); and (4) to describe the rules that underlie the business process. The enterprise model, such as business process models, captures knowledge, which explains the motivation for the existence of rules (Bajec and Krisper, 2005). If enterprise models represent process knowledge then we must better understand the role of business rules, the process of knowledge transformation and extend of knowledge externalization (codification of tacit knowledge) from tacit to explicit.

3.1 Business rules and business-rule meta model

Business rules have grown in importance and popularity in the last few years. They have become recognized as distinct concepts that play a key role in developing applications, which are flexible and amenable to change (Bajec and Krisper, 2005; Barnes and Kelly 1997; Date, 2000; Youdeowei, 1997). While a lot of work has already been done in various fields of business-rule research, most notably in rule analysis, classification, articulation, and formalisation (Hay and Healy, 1997; Herbst, 1996; Herbst, 1997; Moriarty, 2000; Ross, 1997; Tanaka, 1992), a broader view, namely a behavioural or conceptual view on business rules, is required. The fact is that business rules are constantly changing at the business level, but we are not able to keep up with the changes that are required for supporting IS. Thus, ongoing business-rule management environment is required whereby each business-rule instance can be traced from its origin through to its implementation.

Business rule is an atomic piece of business knowledge, specified declaratively, whose intent is to control, guide, or enhance behavior. A rule may be established in order to ensure that one or more business goals are achieved, to enhance productivity in day-to-day work, to assist the business in making decisions, and/or to regulate or guide external activities.

We define the business process as a subset of business activities performed by the organization to achieve the goals it has been created for. Activities correspond to different stages of process execution. In order to be initiated, some activities require particular artifacts or events as an input, which may be taken directly from the environment, or produced as outputs by other activities.

In the light of our experience we support the rule-transformation approach. This approach suggests transforming a rule-based description of a business process in one or more refinement steps into a rule-based IS/WF specification.

3 Business Renovation Approach (BRA)

The approaches that focus on knowledge management at the business-process level are limited. Knowledge-related perspectives need to be part of business process reengineering (BPR) (Papavassiliou et al., 2003). The importance of the combination of business processes with knowledge management tasks is underscored by the knowledge-value-chain approach proposed by. His knowledge value chain is a continuously repeated process, which is composed of six knowledge-management tasks at the operational level: identify the required knowledge, document the available knowledge, develop, share, apply and evaluate knowledge. These tasks are linked to the strategic level (mission, vision, goals, strategy) and the business process named primary process such as order handling, for instance. The links between the design of business processes and knowledge management are also

stressed by Heisig (2000). He presents an approach to analyze the business process from a knowledge management perspective and tries to integrate knowledge management activities into daily business. The model-based knowledge-management approach proposed by Allweyer (1998) adds a new perspective to the modeling of existing business processes, especially of knowledge-intensive processes.

To support the transition between the business model and the IS/WF model, we propose the Rule Transformation Approach based on a hierarchical derivation of business rules in the rule repository, performed by three subsequent iterative development phases, from the higher (behavioral) to the lower (structural) level of abstraction. During each of these phases business rules are discovered, documented, and modeled. This approach is a radical departure from traditional decomposition approaches to IS development. It exploits "contingency theory" and some advanced ascertaining of the existing business rule approaches. In the context of technology investment, contingency theory would suggest that, while technology and organizational practices (such as Business Process Reengineering – BPR) may have separate impacts on performance, the two together might also affect performance significantly.

Business Renovation Approach (BRA) is an iterative methodological framework that incorporates certain fundamental principles that are already known in business system planning, BPR, and the IS development environment: business rules and business activity meta-model, iterative development and prototyping. It exploits 'contingency theory' and some advanced ascertaining of existing business-rule approaches (Ross, 1999; O'Regan and Ghobadian, 2002; Perkins, 2002; Kovačič, 2004). BRA uses an abstraction approach focusing on business processes, business rules and data in a system from which all knowledge of the business derives.

BRA planning, development, and the implementation process can be divided into several iterative development phases (1) Strategic BR planning, (2) Business process restructuring and IA development, and (3) Information system/WorkFlow (IS/WF) development and implementation.

3.1 Strategic BR planning

The first task of management and specialists in a BR is to establish the strategic plan which should be closely integrated into the business objectives of the organization. A plan which achieves the balance between the various demands made on the company resources. Top down planning process begins by analyzing the company's goals and objectives, its strategies and critical success factors (CSFs), determining core or critical business processes (CBPs) and the business process supportive knowledge infrastructures.

The CSF approach was developed initially by Rockart (1979). Critical success factors are those few things that must go well to ensure success for a manager or an organization, and therefore, they represent those managerial or enterprise areas that must be given special and continuing attention to bring about high performance (Boynton and Zmud, 1989). CSF concept and method has received a wide acceptance among business and IT professionals and is employed in a variety of organizational contexts. Researchers recently demonstrates that CSF concept is interpretive in character and as such it may be employed for research on the system development process (Butler and Fitzgerald, 2002). In our extended CSF approach, which is derived from the Pareto's Law (the philosophy of the "80/20"), CSF method of strategic control (van Veen-Dirks and Wijn, 2002), and some ascertaining of the business rule approach, the first steps are to establish the goals and objectives of the company as a whole, and determine its business strategy. The next step is to generate the critical success factors required to realize this strategy. This is done by electing critical information set from the top management and the key staff. The data obtained from the interviews and other sources is further refined and prioritized through group sessions during which the core business processes (CBPs) and key performance indicators (KPIs) are agreed. Core business processes are those with the highest total impact on the level of performance, and by management team opinion essential to fulfill the mission, goals, and CSFs of the company.

The strength of using CSFs is that they provide the important link between the business strategy, business process renovation strategy and the information system development strategy. To be able to establish this link extended CSF approach recognizes and determines two distinct results: the key information requirements of top executives and business rules or business knowledge statements relating to overall business (Global rules). Information requirements and global rules should be written in business language. They should be concise and clear. They should state business requirements, not system requirements (Perkins, 2002) All these results are captured in the rule repository and used in next phases of BR process.

3.2 Business Process Renovation and Information Architecture Development

First, in the business process renovation phase a re-engineering strategy, that critically examines, rethinks and then redesigns current business processes, practices and rules, is applied. The methods of business renovation, which combine business process modeling and simulation modeling enabling quantitative estimations of alternative renovated business processes (Bhaskar et al., 1994), are one of the possible approaches to address the above-mentioned problem of the evaluation of alternative solutions. Nowadays, e-business renovation strategies focus on the processes between business partners and the applications supporting these processes.

Many different methods and techniques can be used for modeling business processes in order to give an

understanding of possible scenarios for improvement. IDEF, eEPC, Petri Nets, System Dynamics, Knowledge-based Techniques and Discrete-Event Simulation are only some examples of widely used business process modeling techniques.

Simulation modeling is being widely used in manufacturing, but also in areas such as the government, health care, the service industry, network communications, traffic modeling and the military. The simulation of business processes is suggested for use in BR projects as it allows the essence of business systems to be understood, the processes for change to be identified, process visions to be developed, new processes to be designed and prototyped and the impact of proposed changes on key performance indicators to be evaluated (Greasley and Barlow, 1998). The reasons for the introduction of simulation modeling into process modeling can be summarized as follows: simulation allows for the modeling of process dynamics, the influence of random variables on process development can be investigated, re-engineering effects can be anticipated in a quantitative way, process visualization and animation are provided, and simulation models facilitate communication between clients and an analyst. The final reason for using simulation modeling is the fact that it can be increasingly used by those who have little or no simulation background or experience.

During the analysis, a simulation of the AS-IS model is performed to reveal the actual time spent and costs of the process activities. The AS-IS model is developed in several iterations. In each iteration the model is validated against the real process in the sense of process flow by following several process executions, and in the sense of performance by comparing times obtained in the simulations to average times measured for the entire process and its segments. The final AS-IS model is reasonably close to the actual process; with some minor discrepancies resulting from the fact that not all real situations can be anticipated and modeled. Finally TO-BE model is developed and its efficiency is analyzed.

The main difficulty in business process modeling is to develop a model that represents the process as it is, as employees usually cannot agree upon how the work is carried out, particularly in cases such where the process is not well defined. Another difficulty is to determine the time required to perform each activity, as employees are inclined to overestimate or record the largest execution times. Also, the level of detail had to be made uniform for all segments of the process and the number of transactions had to be determined. Some organizations have a tendency to over-analyze existing processes (analysis paralysis).

During this project phase in the second step the information architecture is defined. Information architecture (IA) is the planning, designing and constructing information blueprint which cover the business process rules on the activity level, and satisfy the informational needs of business processes and decision-making. It is derived from TO-BE business process model and the strategic business process renovation plan orientations. This plan is developed in the strategic planning phase. IA calls for full recognition of the importance of business rules and data in the design, and development of information systems, for a perspective which exhibits a balance between processes and data.

The results of the business renovation and information architecture development phase are company's TO-BE business process model (Process Architecture), global data model (Data Architecture), and technological/organizational foundations. Business process model consists of a profile of major business activities performed, how are they triggered (business events), they flow in a sequence and how are they executed (business knowledge - business activity rules), and finally the data which is transferred from one activity to the next. Process modeling is a necessary prerequisite to the data modeling, and needs to be iterative, with well defined deliverables. Here, and also in the further development of information architecture, rule "80/20" is used. Determination of the global data model or data architecture is the next step in information architecture development. Global data model is presented as Entity-Relational model containing company's major data entities and business rules in between them. It reflects global information needs of the company.

Mapping between process and data architecture is recommended (Ohren and Borgen, 1999). This step is carried out by analyzing each activity of the business process model. For each business activity according to related activity rules the information needs are defined. Data objects that contribute to the information needs are identified and assigned to the process model activities. This step is likely to uncover shortcomings in the global data model, and the analyst should therefore iterate between process and data architecture.

4. The e-government strategy and BR in Slovenia

By adopting the ‘Strategy of E-commerce in the Public Administration for the Period 2001-2004, SEP-2004’ (Government Centre for Informatics, 2001) in February 2001, the Government of Slovenia set the primary strategic orientations for the next key phase of informatising the public administration, which means the development of e-government. As a result, Slovenia is following a number of the most developed European countries which are approaching the accelerated development of e-government in a similar way.

Although, Slovenia has accordingly started a new developmental cycle of technological modernisation of the administration and have launched several new projects, we conclude that development is not progressing as planned or expected. This is not just a problem in Slovenia but, based on analyses carried out in the EU, it is also a problem in nearly all other countries. After a year or two, we can see that in most countries it was relatively easy to achieve the first (information) stage, which refers to the

introduction of information services, as this step does not require specific changes in internal operations of the administration and in business processes and procedures. Much more complex is the introduction of more demanding, so-called transaction services, which enable all phases of a selected administrative procedure or process to be executed electronically. As a rule, this requires the complete reworking of administrative operations, internal business processes and procedures, the integration of registers and public databases, the alteration and completion of legislation and the development of new organisational regulations, classifications and standards.

Problems needing to be resolved as soon as possible are, in a minor sense, of a technological nature (Government Centre for Informatics, 2001). They predominantly extend to the internal upgrading of administration operations, their reorganisation, a greater process orientation and close co-ordination and co-operation between various departments, and even branches of power (executive, legislative, and judicial). This involves deep structural changes in the operation of the administration, which will be successfully and quickly implemented only with an overall and well-considered approach, as used in the modernisation and reformation of the administration up to the present. BR projects should be focused on all related key business elements: business processes, people and, finally, the technology. E-government is not only enabling the redesign of internal organisational processes but is being extended to inter-organisational processes.

Within the framework of development of a new "organizational paradigm", which will be based on the operation of e-government, all State Bodies and other institutions from the public sector will have to perform the following as soon as possible:

- analyze all current organizational structures and processes and adjust them to the possibilities and requirements of e-government;
- analyze the delegation of authority in solving administrative and other affairs;
- prepare new organizational regulations, which will regulate internal operations and the implementation of business processes of State Bodies within the framework of e-government;
- analyze in detail all (action and other) administrative procedures and processes and renovate them in accordance with defined starting points and principles of development of e-government, and the possibilities that information technology can offer;
- develop classifications and nomenclature for business processes, administrative procedures and documents, services, life situations, etc., and standardize them;
- develop a Register of Procedures and Documents as the central building block of future operations of e-government;
- develop a Catalogue of Life Situations as a result of upgrading the Register of Procedures and Documents;
- develop (or adopt) metrics for monitoring and measuring the efficiency of the work of administrative bodies;
- develop a strategy for the transition of "classical" e-government from the aspect of optimal utilization of work of administrative bodies;
- develop a strategy for training employees for working with new information solutions (for e-services).

4.1 Business Renovation Project at the Ministry of Education, Science and Sport

The Business renovation project at the Ministry of Education, Science and Sport (Ministry) started as a result of internal and external factors. Internal factors that caused business renovation were the integration of two ministries, Ministry of Education and Sport and Ministry of Science and Technology into the Ministry of Education, Science and Sport, versified business processes that were not well defined and duplication of activities. Externally, the Slovenian government that started the anti-bureaucratic program on the governmental level has stimulated the project. The goal of the program is, according to Action Plan E-government Up to 2004 (Government Centre for Informatics, 2001), to remove inefficiencies in business processes, to change organizational structure and to introduce suitable information technology that will support renewed business processes.

The Business renovation project has three main phases:

- Identification of key business processes and their modeling;
- Analysis of key business processes on the basis of their models;
- Modeling renewed processes and proposing organizational changes.

The project started with formation of project group consisted by members from the Ministry and consultants from Business Informatics Institute (BII), Faculty of Economics, Ljubljana. During the workshop, five core business processes (CBPs) or key business process groups were identified by discussion and brainstorming: (1) Strategic planning, (2) Working program preparation, (3) Laws and provisions preparation, (4) Financial processes, and (5) Administrative processes.

The processes were modeled by interviewing people from the Ministry who perform the activities. This phase of the project was very difficult and lasted for almost six months and models had to be changed several times. Since the scope of the project is too big for the presentation in the paper, only a fragment, subprocess "Promotion of the employees in education to a higher professional title of Administrative processes at General Affairs and Human Resource Service", will be shown.

The Administrative processes group includes some of the most frequently executed processes and are therefore very interesting for a detailed examination and analysis in the BPR and informatization project as significant

improvements in efficiency can be expected. This group consists of more than 30 processes, however some of them are of the same type, but for different areas (e.g. elementary schools, high schools, universities) and therefore their substantial activities are executed in different departments.

In the first phase of the analysis some processes with the highest application frequency were examined in more detail. One of them is "Promotion of the employees in education to a higher professional title" which has about 2500 applications per year. The rate of complete application is 60%, after the completion of incomplete application this rate is 80%. The owner of this process is the General Affairs and Human Resource Service (GAHRS), where the application is professionally executed by four officers. The applications are always accepted only in dispatch centre. The application state is recorded four times, always twice: manually and using a computer program. The Minister signs the decision statement.

The simulation of the process that we have carried out showed that the mean execution time for one application is 49 days. The effective work time is less than one day. The rest of the time is the delay in the process (signing, transfers of documentation, waiting for the completion of the application etc.). One of the important benefits of using simulation in BR projects is the possibility to discover which inefficiencies are worth to deal with, as for some changes a lot of effort is required. In the analysis two different waiting times have to be observed: the one that the Ministry cannot change by changing its own processes (e.g. waiting for the complete application) as they depend on the regulations and on the customer (applicant) behavior and the delays that can be decreased by the improved organization and process flow. The former type of waiting times represents 40% of the total waiting time or 38% of the total cycle time. A great part of the delay is caused by the relatively high rate of incomplete applications. As shown by the simulation with a changed scenario, with no incomplete applications the average cycle time would decrease from 49 to 41 days. Therefore it would be worth to put some effort to better inform the customers about the process itself. What can be also observed is that highly educated professional spend a lot of their working time on administrative work, such as searching possible past applications etc. Some changes in the process have already been implemented, for example the Minister has authorized the head of the GAHRS to sign the decision statements.

However, the quantitative results of the simulation experiment as presented in the simulation report, regardless of how precise and detailed the simulation may be, are only one aspect of the business process analysis. Business process maps themselves can frequently show many problems that have not previously been observed.

5. Conclusion

Experience in introducing e-government in the most developed countries (USA, Singapore, Canada, Australia, New Zealand…) in this field shows that the root of problems to be resolved in introducing e-services has moved from the technological to the organizational and process domain. The essence of e-government is to radically change the ways and mechanisms of operating the administration and, as a result, the basic principles on which these mechanisms have been developing in past decades or even centuries. Therefore, business renovation (BR) or business process renovation methods should be used within the framework of introducing e-services. As an example we used a case study of business renovation at the Ministry of Education, Science and Sport (Ministry) to show how this could be used in practice.

The results of the simulation show several drawbacks of the existing process, which are the consequence of dysfunctional organizational structure, functional instead of process orientation, unnecessary activities, nonexistent tracking of document flow etc. This can be seen from the low ratio between the effective work time and the mean execution time. The simulation also showed the bottlenecks in the process execution (e.g. Minister's signature), which can be diminished by the process redesign. Apart from the quantitative view on the process, the qualitative analysis of the process simulation also adds value to the understanding of the process and the possible improvements.

The goal of the project was process renovation, examination and reengineering of current business policies procedures and activities before the e-government implementation. We believe the new e-government paradigm can be embraced only by:

- Creating an environment of technology, enlightenment and receptivity;
- Treat this as a holistic organizational transformation, not a technical issue;
- Challenge your core assumptions and value propositions;
- Proactively establish a distinctive Internet presence.

With this case it has confirmed that the analysis and carefully used simulation of business processes is useful since it provides insight view of policies, practices, procedures, organization, process flows and consequently shifts people's minds from functional to process organization.

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