Zbornik 19. mednarodne multikonference

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Kognitivna znanost
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PREDGOVOR MULTIKONFERENCI INFORMACIJSKA DRUŽBA 2016

Multikonferenca Informacijska družba (http://is.ijs.si) je z devetnajsto zaporedno prireditvijo osrednji srednjeevropski dogodek na področju informacijske družbe, računalništva in informatike. Letošnja prireditev je ponovno na več lokacijah, osrednji dogodki pa so na Institutu »Jožef Stefan«.

Informacijska družba, znanje in umetna inteligenca so spet na razpotju tako same zase kot glede vpliva na človeški razvoj. Se bo eksponentna rast elektronike po Moorovem zakonu nadaljevala ali stagnirala? Bo umetna inteligenca nadaljevala svoj neverjetni razvoj in premagovala ljudi na čedalje več področjih in s tem omogočila razcvet civilizacije, ali pa bo eksponentna rast prebivalstva zlasti v Afriki povzročila zadušitev rasti? Čedalje več pokazateljev kaže v oba ekstrema – da prehajamo v naslednje civilizacijsko obdobje, hkrati pa so planetarni konflikti sodobne družbe čedalje težje obvladljivi.

Letos smo v multikonferenco povezali dvanajst odličnih neodvisnih konferenc. Predstavljenih bo okoli 200 predstavitev, povzetkov in referatov v okviru samostojnih konferenc in delavnic. Prireditev bodo spremljale okrogle mize in razprave ter posebni dogodki, kot je svečana podelitev nagrad. Izbrani prispevki bodo izšli tudi v posebni številki revije Informatica, ki se ponaša z 39-letno tradicijo odlične znanstvene revije. Naslednje leto bo torej konferenca praznovala 20 let in revija 40 let, kar je za področje informacijske družbe častitljiv dosežek.

Multikonferenco Informacijska družba 2016 sestavljajo naslednje samostojne konference:

- 25-letnica prve internetne povezave v Sloveniji
- Slovenska konferenca o umetni inteligenci
- Kognitivna znanost
- Izkopavanje znanja in podatkovna skladišča
- Sodelovanje, programska oprema in storitve v informacijski družbi
- Vzgoja in izobraževanje v informacijski družbi
- Delavnica »EM-zdravje«
- Delavnica »E-heritage«
- Tretja študentska računalniška konferenca
- Računalništvo in informatika: včeraj za jutri
- Interakcija človek-računalnik v informacijski družbi
- Uporabno teoretično računalništvo (MATCOS 2016).

Soorganizatorji in podporniki konference so različne raziskovalne institucije in združenja, med njimi tudi ACM Slovenija, SLAIS, DKZ in druga slovenska nacionalna akademija, Inženirska akademija Slovenije (IAS). V imenu organizatorjev konference se zahvaljujemo združenjem in inštitucijam, še posebej pa udeležencem za njihove dragocene prispevke in priložnost, da z nami delijo svoje izkušnje o informacijski družbi. Zahvaljujemo se tudi recenzentom za njihovo pomoč pri recenziranju.

V 2016 bomo četrtič podelili nagrado za življenjske dosežke v čast Donalda Michija in Alana Turinga. Nagrado Michie-Turing za izjemen življenjski prispevek k razvoju in promociji informacijske družbe bo prejel prof. dr. Tomaž Pisanski. Priznanje za dosežek leta bo pripadlo prof. dr. Blažu Zupanu. Že šestič podeljujemo nagradi »informacijska limona« in »informacijska jagoda« za najbolj (ne)uspešne poteze v zvezi z informacijsko družbo. Limono je dobilo ponovno padanje Slovenije na lestvicah informacijske družbe, jagodo pa informacijska podpora Pediatrične klinike. Čestitke nagrajencem!

Bojan Orel, predsednik programskega odbora
Matjaž Gams, predsednik organizacijskega odbora

FOREWORD - INFORMATION SOCIETY 2016

In its 19th year, the Information Society Multiconference (http://is.ijs.si) remains one of the leading conferences in Central Europe devoted to information society, computer science and informatics. In 2016 it is organized at various locations, with the main events at the Jožef Stefan Institute.

The pace of progress of information society, knowledge and artificial intelligence is speeding up, but it seems we are again at a turning point. Will the progress of electronics continue according to the Moore's law or will it start stagnating? Will AI continue to outperform humans at more and more activities and in this way enable the predicted unseen human progress, or will the growth of human population in particular in Africa cause global decline? Both extremes seem more and more likely – fantastic human progress and planetary decline caused by humans destroying our environment and each other.

The Multiconference is running in parallel sessions with 200 presentations of scientific papers at twelve conferences, round tables, workshops and award ceremonies. Selected papers will be published in the Informatica journal, which has 39 years of tradition of excellent research publication. Next year, the conference will celebrate 20 years and the journal 40 years – a remarkable achievement.

The Information Society 2016 Multiconference consists of the following conferences:

- 25th Anniversary of First Internet Connection in Slovenia
- Slovenian Conference on Artificial Intelligence
- Cognitive Science
- Data Mining and Data Warehouses
- Collaboration, Software and Services in Information Society
- Education in Information Society
- Workshop Electronic and Mobile Health
- Workshop »E-heritage«
- 3st Student Computer Science Research Conference
- Computer Science and Informatics: Yesterday for Tomorrow
- Human-Computer Interaction in Information Society
- Middle-European Conference on Applied Theoretical Computer Science (Matcos 2016)

The Multiconference is co-organized and supported by several major research institutions and societies, among them ACM Slovenia, i.e. the Slovenian chapter of the ACM, SLAIS, DKZ and the second national engineering academy, the Slovenian Engineering Academy. In the name of the conference organizers we thank all the societies and institutions, and particularly all the participants for their valuable contribution and their interest in this event, and the reviewers for their thorough reviews.

For the fourth year, the award for life-long outstanding contributions will be delivered in memory of Donald Michie and Alan Turing. The Michie-Turing award will be given to Prof. Tomaž Pisanski for his life-long outstanding contribution to the development and promotion of information society in our country. In addition, an award for current achievements will be given to Prof. Blaž Zupan. The information lemon goes to another fall in the Slovenian international ratings on information society, while the information strawberry is awarded for the information system at the Pediatric Clinic. Congratulations!

Bojan Orel, Programme Committee Chair
Matjaž Gams, Organizing Committee Chair

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PREDGOVOR / FOREWORD

Na letošnji konferenci Kognitivna znanost sodelujejo avtorji z različnih disciplinarnih področij, ki predstavljajo tako empirične rezultate svojih raziskav kot tudi teoretska raziskovanja. Osrednja tema konference je "Utelešena kognicija: od utelešene robotike do udejanjene kognicije". Avtorji so uporabili ali kritično obravnavali pristop utelešene kognicije v razpravah o kognitivni robotiki, odločanju, svobodni volji, zaznavanju, razširjeni kogniciji in bolečini. Poleg prispevkov, ki jih lahko umestimo v okvir utelešene kognicije, pa so avtorji obravnavali tudi druga zanimiva področja. Tako lahko beremo prispevek o novejših spoznanjih o vplivu matematičnih sposobnosti otrok na njihov kasnejši uspeh v življenju, predstavljen je multidisciplinarni pristop k obravnavi pacientov z nevrodegenerativnimi boleznimi. Razprave segajo tudi na področje čustev in vrednotenja ter se dotikajo etičnih vprašanj moralnega izboljševanja. Raznolikost predstavljenih tem zaokrožujeta empirični prispevek s področja lingvistike in v zadnjem času spet zelo aktualno razmišljanje o soočanju človeka in stroja.

Upamo, da bo letošnja kognitivna konferenca odprla prostor za izmenjavo zanimivih misli in idej in povezala znanstvenike različnih disciplin, ki se ukvarjajo z vprašanji kognitivnih procesov.

Olga Markič
Toma Strle
Urban Kordeš

PROGRAMSKI ODBOR / PROGRAMME COMMITTEE

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Mathematical abilities and life success
Matematične sposobnosti in uspešnost v življenju

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ABSTRACT

In the article we provide an overview of novel findings which studied the correlation between mathematical competencies in youth and later success in life.

Mathematical abilities are determined by the ability to process mathematical symbols and quantity determination which are partially inborn. We can stimulate mathematical abilities by preschool stimulation, which includes interventions directed at interaction between mathematics' teacher and student, which pay-off up to four years after intervention. When encouraging economically and socially deprivileged students those interventions lead to less difficult behavioural patterns. Better mathematical competencies correlate with positive socio-emotional control and positive attitudes towards learning and school which contribute to a more engaged academic life-style. The Study of Mathematically Precocious Youth which included talents at the age 13 and followed them to their 40-ies, showed that their adult careers, accomplishments, and psychological well-being far exceeded base-rate expectations.

We can conclude from the findings that mathematical precocity early in life predicts later creative contributions and leadership in critical occupational roles.

General Terms
Human Factors

Keywords

development, brain, mathematical competences, success

POVZETEK

V prispevku pregledamo novejša spoznanja o vplivu matematičnih sposobnosti otrok na njihov kasnejši uspeh v življenju.

Matematične sposobnosti se povezujejo s sposobnostjo procesiranja matematičnih simbolov in sposobnostjo določanja količine, kar nam je vsaj delno vrojeno. Predšolske izkušnje in spodbudno predšolsko okolje, usmerjeno zlasti na odnose med učenci in učitelji matematike, pomembno določajo kasnejše uspehe pri matematiki, ki se kažejo še štiri leta po učinkoviti intervenci.

Če spodbujamo učenje matematike pri ekonomsko in socialno manj privilegiranih učencih, pri njih pride do boljšega uravnavanja in nadzora vedenja in zmanjšanja težavnih vedenj. Učenci pridobijo več samonadzora in pripadnosti šoli in učenju, kar vodi v večjo akademsko zavzetost. Raziskava o matematično nadarjenih mladih (angl. The Study of Mathematically Precocious Youth - SMPY), ki je vključila 13-letnike in jim sledila tri desetletja, je pokazala, da v odrasli dobi njihovi dosežki, kariere in psihološko blagostanje daleč presegajo običajno populacijo.

Lahko zaključimo, da prav matematično nadarjeni mladi predstavljajo kritični človeški kapital, ki predstavlja kreativno in profesionalno vodstvo z jasnimi ekonomskimi učinki na družbo, v kateri delujejo.

Ključne besede
razvoj, možgani, matematične kompetence, uspeh

1. UVOD

Včasih je veljalo, da je nekdo, ki je zelo dober pri matematiki, tudi sicer zelo bister in ga čaka svetla bodočnost. Novejše raziskave laičnemu opazovanju pritrjujejo. Najverjetneje je temu tako, ker je procesiranje matematičnih problemov izjemno kompleksno in zahteva usklajeno in brezhibno delovanje različnih predelov možganov in zahteva tako dober priklic aritmetičnih znanj, torej delovanje spomina, kot tudi delovanje višjih, kognitivnih procesov.

2. MATEMATIČNE SPOSOBNOSTI

Matematične sposobnosti ali kompetence nam omogočajo razumeti matematiko in matematične pojme. Omogočajo reševanje vsakdanjih problemov z matematičnim mišljenjem in zajemajo poleg občutka za količino in računanja tudi veščine logičnega mišljenja, prostorske predstave in sposobnost abstrakcije, kar se kaže v razumevanju formul, modelov, konstruktov, grafov in razpredelnic [1].

Razumemo jih kot osrednjo komponento človekovega uma, ki pomembno določa izobrazbo in poklicne dosežke [2]. Razmislek, ki vsebuje matematično analizo, nam pomaga informacijo ustrezno uporabiti, zato ni presenetljivo, da obladovanje podatkov, povezanih z zdravjem, vodi v daljše in bolj kakovostno življenje [3].

K matematičnim kompetencam sodi tudi intuitivno znanje matematike, ki je vrojeno. Evolucijsko starejše sposobnosti, ki smo jih podedovali od naših prednikov in si jih delimo z nekaterimi živalskimi vrstami, omogočajo teritorialnim vrstam najti življenjski prostor, kjer je hrane za preživetje dovolj [4, 5]. Presoja glede tega je presoja količine. Ključna možganska struktura, ki si jo delimo z nekaterimi živalskimi vrstami, se nahaja v temenskem režnju in smo z njo že rojeni.

Brezhibnost delovanja strukture, število nevronov in povezljivost so genetsko – biološko določene lastnosti, ki pa jih lahko nadgradimo z izkušnjami zlasti iz predšolskega, manj iz šolskega obdobja. Predšolsko obdobje je namreč obdobje, ko so kritična obdobja za razvoj marsikaterih veščin, tudi matematičnih, široko odprta in omogočajo hitrejše, robustnejše učenje z manjšim vložkom energije, saj so možgani pripravljeni na tovrstne izkušnje [6]. Za celotno otroštvo je namreč značilno izjemno hitro in učinkovito učenje, ki je zvezano z občutljivimi obdobji, ki so časovno širša kot kritična obdobja. V občutljivem obdobju, ki ga uravnavajo posebne molekule, vezane na biološko notranjo uro, izkušnje nepovratno vplivajo na razvoj določenih predelov živčevja [6]. Vrojene sposobnosti v kombinaciji s priučenimi lastnostmi in veščinami, pa pomembno vplivajo na naš kasnejši, akademski uspeh, hkrati pa celo določajo višino naše plače in vplivajo na ekonomsko uspešnost države [7].

3. VPLIVI NA MATEMATIČNE SPOSOBNOSTI

Na genetske danosti zaenkrat ne znamo učinkovito vplivati, oziroma na to vplivamo že s samo izbiro partnerja. Lahko pa vplivamo na okoljske dejavnike, kamor sodita zlasti vzgoja in izobraževanje. Predšolske izkušnje in spodbudno predšolsko okolje so tisti dejavniki, ki vplivajo na kasnejše uspehe pri matematiki [8]. Učinki obogatenih materialov, dejavnosti in interakcij med vzgojitelji-učitelji in učenci v najzgodnejših letih učenja se kažejo še štiri leta po učinkoviti intervenciji, usmerjeni v matematiko [9].

Eden razvojno zanimivejših konceptov, povezanih z razumevanjem matematike, je osvojitev in razumevanje lastne telesne sheme. Telesna shema je miselni konstrukt, ki opisuje, kako si predstavljamo svoje telo v prostoru, kar vključuje postavitev našega telesa v prostor, dolžino in meje naših udov glede na prostor, razmerja delov telesa, razporeditev in razmerja med deli telesa in ob ustreznem treningu tudi podaljške našega telesa kot je npr. palica ali violina [10]. Sprva povsem senzorične izkušnje, ki se pričnejo že v obdobju dojenčka, omogočajo razumeti osnovne, vendar pa kasneje povsem abstraktne koncepte: več-manj, močno-šibko, daleč-blizu, preteklost, sedanjost in prihodnost ipd. Različne zaznave omogočajo prepoznavo različnih dražljajev: slušno zaznamo daljši zvok: hrumenje in oddaljeno bučanje vode; vidno zaznamo večjo površino vode, ki se nam bliža in telesno-taktilno zaznamo višino vode, ki nam sega že preko kolen; kar imenujemo različne modalnosti. Dobra telesna shema, ki smo jo oblikovali v ustrezno spodbudnem okolju, nam vse življenje predstavlja miselno oporo: kaj je za nas veliko, majhno, ipd., saj si jo antropomorfno – sebi lastno, prikrojimo.

Če spodbujamo učenje matematike pri ekonomsko in socialno manj privilegiranih učencih, pri njih pride do boljšega uravnavanja in nadzora vedenja in zmanjšanja težavnih vedenj. Ti učenci pridobijo več samonadzora in pripadnosti šoli in učenju. Bolj pogosto kot pred intervenco so pridružena pozitivna socialno-čustvena vedenja [11]. Na ta način otrokom postane akademsko okolje bližje in si želijo vstopa vanj, hkrati pa na ta način postanejo opremljeni za akademski svet.

4. USPEH V ŽIVLJENJU

Uspeh v življenju lahko definiramo na različne načine. Pri večini raziskav definicijo uspeha nadomestimo z akademsko izobrazbo, hierarhično višjimi pozicijami v službi, karierami z višjo odgovornostjo, kar je praviloma vezano tudi na plačilo dela in zaslužek. Zanimiva raziskava o matematično nadarjenih mladih (angl. *The Study of Mathematically Precocious Youth - SMPY*), ki je vključila 13-letnike, ki so dosegali tako matematične kot verbalne sposobnosti najboljših 3%, je sedaj delno zaključena, saj so bivši študenti matematike dopolnili 35 let [12]. V vključeni kohorti je 1,037 moških in 613 žensk do svojega 35. leta objavilo: 85 knjig, 7.572 člankov, 681 patentov in pridobilo za $358.000.000 sredstev (štipendij). Proučevani matematično nadarjeni moški in ženske v odrasli dobi predstavljajo kritični človeški kapital, ki predstavlja kreativno in profesionalno vodstvo z jasnimi ekonomskimi učinki na družbo, v kateri delujejo. Danes so zadovoljni s svojim življenjem, vendar pa imajo moški praviloma visoko profilirane kariere, medtem ko matematično nadarjene ženske znatno več časa in energije posvečajo družini in družbi.

Poleg proučevanja skupine so raziskovalci na Centru Johns Hopkins izpostavili tudi znane posameznike, ki so vključevali kriterije za vključitve v skupino nadarjenih, ko so bili otroci. Zanimivo je, da so v tej skupini poleg matematikov, kot je npr. Terence Tao in Lenhard Ng, tudi Mark Zuckerberg, Sergey Brin in glasbenica Lady Gaga (Stefani Germanotta) [13]. Več raziskav je potrdilo, da matematično nadarjeni otroci – to so tisti, ki spadajo med zgornji 1% kognitvno najuspešnejših, postanejo znanstveniki in akademiki, a tudi najbolj vplivni in bogati vodje podjetij, državni sodniki, tudi nekateri senatorji in bilijonarji. Eden od raziskovalcev, psiholog Jonathan Wai zanje pravi, da »Če nam je prav ali pa ne, ti ljudje vodijo družbo« [13]. Bolj prijeten slovenski prevod bi se glasil, da nam vladajo, a ne bi držal povsem, saj med njimi ni prav dosti politikov in vladarjev.

5. SKLEPI

Biti vrhunski matematik pomeni znatno prednost tako za posameznika kot družbo nasploh. Če v družbi negujemo matematično mišljenje že v otroštvu, lahko pričakujemo več blagostanja za celotno družbo, ko bodo ti posamezniki odrasli. Lahko pa smo tudi skeptični: če so ti posamezniki tako zelo bistri, zakaj potem za svoje področje delovanja ne izberejo politike, da bi končno lahko končali vojne, izčrpavanja ljudi in narave, neenakosti in revščino? Morda so raziskovalci spregledali kakšno pomembno lastnost ali pa morda kot človeštvo potrebujemo še kaj poleg bistrosti in matematičnih kompetenc?

6. REFERENCE

[1] KEYCONET. 2006. Mathematical competence and basic competences in science and technology. *Recommendation of the European Parliament and of the Council of 18 December 2006 on Key Competences for Lifelong Learning (2006/962/EC): Mathematical competence.* DOI=http://keyconet.eun.org/maths-science-tech

[2] Schmidt, F. L. and Hunter, J. E. 1998. The validity and utility of selection methods in personnel psychology: practical and theoretical implications of 85 years of research findings. *Psychol Bull, 124*, 262–274.

[3] Reyna, V. F., Nelson, W. L., Han, P. K. and Dieckmann, N. F. 2009. How numeracy influences risk comprehension and medical decision making. *Psychol Bull, 135*, 943–973.

[4] Libertus M.E., Feigenson L. and Halberda J. 2011. Preschool acuity of the approximate number system correlates with school math ability. *Dev Sci*, *14* (6): 1292–1300.

[5] Bregant, T. 2012 Razvoj, rast in zorenje možganov. *Psih obzorja*, *21* (2): 51-60.

[6] Bregant, T. 2013. Ali je matematika doma le v človekovih možganih?. *Proteus, 75* (5): 209-216.

[7] Bregant, T. 2004. Ali malček spoznava matematiko že v vrtcu?. V: Vrbovšek B. (ur.). *Spodbujanje matematičnega mišljenja v vrtcu.* Ljubljana: Supra, 12-17.

[8] Brooks-Gunn, J., Fuligni, A.S. and Berlin, L.J. 2003. *Early child development in the 21st Century: Profiles of current research initiatives,* New York: Teachers College Press.

[9] Preisner-Feinberg, E.S., Burchinal, M.R. and Clifford, R.M. 2001. The relation of preschool child-care quality to children's cognitive and social developmental trajectories through second grade. *Child Dev, 72 (* 5), 1534-1553.

[10] Bregant, T. 2016. Matematične sposobnosti pri otrocih : nekaj vrojenega, nekaj pridobljenega, a vedno lahko vir zadovoljstva. *Obzornik Mat Fiz*, *63 (*1), 18-24.

[11] Dobbs, J., Doctoroff, G. L., Fisher, P. H., and Arnold, D. H. 2006. The association between preschool children's socio-emotional functioning and their mathematical skill. *J Appl Dev Psychol, 27,* 97–108.

[12] Lubinski, D., Benbow, C., P., and Kell, H. J. (2014). Life paths and accomplishments of mathematically precocious males and females four decades later. *Psychol Sci, 1* (12), 2217–2232.

[13] Clynes T. (2016). How to raise a genius: lessons from a 45-year study of super-smart children. *Nature, 537,* 152-155.

A matter of degree: Free will and decision making in light of the enactive approach to cognition

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ABSTRACT

Enactivism is an integrative approach to cognition that offers an alternative to representationalist and functionalist accounts. However, the enactive approach so far has not tackled one of the central topics in cognitive science, decision making and free will. In this paper we suggest that, from the enactive perspective, free will and decision making may be viewed as the capacity to (control action) make sense of the world and thus could be understood not as an all-or-none phenomenon, but rather as a matter of degree that is rooted in autonomous organisation and expands into mental/experiential domain.

Keywords

free will, decision making, mind, brain, enactivism, prospection, complex systems, social cognition

1. INTRODUCTION: ON ENACTIVISM

Since the early 90's when The Embodied Mind was published (Varela et al. 1992), enactivism has been challenging cognitivism as an alternative paradigm in cognitive science. There are five highly intertwined concepts that constitute the core of enactivism: autonomy, sense-making, emergence, embodiment and experience (Di Paolo et al 2010). The enactive approach differs from cognitivist accounts in at least two crucial aspects:

1) It rejects representational accounts of cognition that view organisms as passive receivers of external information that is translated into internal representations – abstract cognitive structures with semantic content (knowledge of the world) – and combined with internal drives and beliefs in syntax-like rules to shape behaviour. Rather, cognition is irreducible to an isolated cognitive system; it emerges dynamically from its sensorimotor engagement with environment as its constitutive element, the subject proactively probes the world (as its own model) like hypothesis testing, it "enacts the world", thereby interpreting (according to its normativity) and at the same time, co-constructing it.

2) It rejects computational/functional accounts of cognition (including functionalist accounts of extended mind) because of the constitutive role of embodiment for cognition. The body, according to the enactive approach, is not trivial, in the sense of being a multiply-realisable carrier and executor of cognitive functions. Rather, embodiment is "radical": the body is a physical manifestation of autonomous agency and thus the fundamental locus of significance for cognitive processes. Put another way, the body is not a means but an end of being a cognitive system (Thompson and Di Paolo 2014). Autonomy is generally the capacity of a system to generate conditions for its continued viability, namely, organisms are not designed by an external principle but follow their own intrinsic laws[1].

The constitutive roles of embodiment and environment together comprise the central tenets of the enactive approach: sense-making and life-mind continuity (Thompson 2004). Sense-making is the adaptive regulation of states and interactions by a cognitive system with respect to the consequences for the agent's own viability: whatever an organism senses and acts upon in the environment has a value or significance for it with respect to the autonomous identity that aspires to preserve itself. To the enactivist, sense-making is a defining property of cognition which applies to all domains of organisation, from basic forms of sensorimotor regulation (e.g., bacterial chemotactic behaviour where an encountered molecule can have a survival value) to subjective experience. The mind is constituted by the value of a situation with respect to the organisationally closed identity that aspires to sustain itself as a living and feeling body. It is thus through sense-making that continuity of life and mind is brought about (Thompson 2004, Di Paolo 2009).

Despite its integrative ambition, however, the enactive approach has been rightfully criticised for not being able to sufficiently explain higher level cognition that requires abstraction from immediate sensorimotor engagement (Di Paolo et al. 2010, Di Paolo 2016). The argument is that such "offline" forms of cognition – which may include anything from mind wandering to complex decision making – inevitably requires some form of internal representations to account for such decoupled states (Clark and Toribio 1994). Although much of this debate is redundant due to confusion surrounding the concept of representation itself (Hutto 2013), a convincing enactive account of one of the central topics in cognitive science, decision making and free will, is still missing.

2. FREE WILL DILEMMA AND DECISION MAKING: MAINSTREAM VS. ENACTIVE PERSPECTIVE

Free will is most generally the capacity to choose between different courses of actions, and it is discussed in various neurological, social and philosophical contexts. It is often assumed that free will is an "all-or-none" phenomenon: either we (humans) have a full control over our actions or our consciousness (including decision making) is reduced to a passive "bystander" of deterministic processes (Dennett 2015, Libet 1999, Wegner 2004). This is because the problem is framed either in terms of conscious motor control, typically in a narrow context of neurological experiments where it seems that decisions' intents are made

[1] Or intrinsic teleology, following natural philosophy tradition from Kant to its contemporary reinterpretations by Hans Jonas, Andreas Weber, Francisco Varela and others (see for example Weber and Varela 2002).

before we are aware of them, or, on the other hand, the pro-free will phenomenology of action ownership (Gallagher 2006, Pacherie 2010). Such all-or-nothing view is in our view at least in part a legacy of behaviourist and cognitivist approaches to cognition which enforce explicit mind-body dualism.

Traditionally, the free will question has been mostly considered from metaphysical perspectives and applied to human conscious deliberation in the psychology and neuroscience field (Haggard 2008, Libet 1999). However, still others stress the time-scale and content continuum with subconscious processes as an integral part of generating final decisions, thereby rejecting the all-or-none view (Dennett 2015, Kane 2011). While these views put the dilemma out of metaphysical domain, they deny our instinct and common sense understanding of of authentic freedom. However, such line of thought may lead to vulgar deterministic theories[2] of free will as a mere illusion of mind (Heisenberg 2009), arguing that decisions are predetermined by physico-chemical processes in the brain (stemming from Libet 1999 research). Paradoxically, a "compromise" to preserve free will comes from this same field of science by introducing the so called veto function (inhibition) (Libet 2003) which itself according to such views should be based on the same physico-chemical processes. Yet another way of camouflaging explanatory deficits is the monistic argument strictly equating brain and mind, i.e. "…but we are our brain, so also unconscious processes of it", implying that therefore we somehow should again preserve our willpower, although it is quite evident that the brain according to their own view is still primarily defined as a deterministic machine. Some other functionalist views also land in contradiction because on the one hand they proclaim the problem of free will as redundant, but on the other hand still argue for the legitimacy of ethical responsibility for our actions, e.g. as Gazzaniga M. put it: "brains are determined, but people are free" (Gazzaniga 2011).

So the primary dilemma obviously does not get resolved, as all these views remain inconsistent, limited to the internalist paradigm searching for the "free will code" inside the brain only.

2.1 Enactive perspective: Basic autonomy and action control

Following the enactive approach (or any other kind of dynamical systems approach), the problem could be framed at a much more basic level of autonomous agency itself. If autonomous systems are able to maintain organisational closure (i.e., identity) despite continuous environmental perturbations and spontaneous tendencies towards their own dissolution, they are already "free" in the sense of not being determined by immediate environmental constraints – that is, of being able to control, by themselves and for themselves, their adaptive regulatory interactions, while retaining the capacity for open-ended evolution. In this sense, an organism that can actively move towards or away from a source of food or poison has a larger repertoire of available options in response to environmental challenges, compared to a non-motile organism – in other words, it has more liberated ways of making sense of the world. This is of course a minimalistic account of freedom (sometimes referred to as needful freedom, e.g. Di Paolo 2009) that does not involve any kind of metaphysical indeterminism or conscious control over actions. Indeed, if the problem of free will – or rather, the capacity to choose action, to avoid transcendental connotations – is framed in terms of autonomy and sense-making, it does not necessarily have to be viewed as an all-or-nothing phenomenon, but as the extent of control over one's own actions and possibilities, i.e., a matter of degree.

2.2 Higher cognition level from enactive perspective: degrees of freedom

Consciousness (mind) is of course a major evolutionary transition. It seems likely that the mind itself is not an all-or-nothing phenomenon but emerged gradually (and possibly multiple times) from some sort of basic sentience, or feeling of being alive (cf. Thompson 2004). We suggest that, similarly as the enactivists consider the mind itself, decision making processes as inherently coupled with the mind, should thus be grounded on the same dynamical system principles. Thus, free will – in terms of control of available choices – is here understood as the emergent property of the complex systems, which include the circular continuum of brain (including interactions inside brain itself)-body-environment interactions (including mental causation) within and between autonomous agents, from which the mind(s) and decision(s) emerge (Di Paolo 2009, Thompson and Varela 2001, Beauregard 2007, Pacherie 2010). There is a need for final top-down implementation and output of decisions made in the subject's mind, where the level of ideas gets channeled to behavioural (motor etc.) realization. Subject's thereby exploit their specific mental capacities first to increase the horizon of available choices afforded in the interaction with environment and finally decide between them.

2.2.1 Prospection

Humans can creatively combine and extrapolate mental images by utilising capacities such as abstraction, reflection, imagination and symbolic understanding to exert conscious control over choices be-tween different available actions – that is, they are decision makers. These capacities enable humans to mentally transcend the immediate context "here and now" by recalling past events (retrospection) or predicting non-existent events (prospection) – the capacity generally termed mental projection or mental simulation (Buckner and Carroll 2007). Prospection, the ability to predict future possibilities and evaluate their outcomes, drastically increases the control over available actions and is according to Seligman and co-workers (2013) crucial for understanding choice and agency. In contrast to the theories that emphasise heuristics, biases and errors in prospection, Seligman emphasises its construc-tive and fundamental role in human decision making. The prospecting organism continuously constructs an evaluative landscape of possible future actions and outcomes, and compares them on the basis of affective valences – a common 'currency' for comparing often conflicting and incommensurable outcomes – that they elicit when brought forth. Such constructive understanding of prospection transcends the traditional view of individual as a passive responder to external inputs, motivated by fixed drives, and puts emphasis on individual as future oriented, proactive navigator driven by goals and values acquired through social interaction (Seligman et al. 2013).

[2] Interestingly, on the other extreme, in sociological theory, we can find social materialists/determinists, which find the whole »code« of actions for any individual in the environmental context, situational pressures, economy production process etc. only (e.g. vulgar/orthodox line of marxism)

There are many conceptual similarities between the enactive approach and prospective psychology. Prospection is basically a meaning-generating activity that extends sense-making beyond the present situation, by enabling the prospector to direct her ongoing engagement on the basis of events that have not yet come about, or may not even occur at all. This may seem like some spooky backward time causation, but it is a consequence of a creative projection of episodic memories (Schacter and Addis 2007). Prospection is not about an accurate representation of sensory details and other aspects of the world, and neither does it entail disembodied cognition. It is about evaluating a hypothetic scenario by mentally simulating a particular sensorimotor engagement that concerns the prospector as an autonomous agent here and now. In this sense, prospection could be viewed as a form of enaction that is free from immediate context, and may thus provide a complimentary avenue towards high-level cognition which enactivism lacks.[3]

2.2.2 Social cognition

Individual level of decision making with all the processes mentioned insofar must be additionally viewed in synergy with social cognitive level [4], in situations where two or more subjects (especially in higher social cognitive beings) are interdependently cooperating, e.g. in semi-automatic (like narrow hallway bypassing of two persons), coordinated thoughtful group activities (e.g. common games, music, work etc.), or more affective crowd psychology-type of social interactions (like unified chearing, applauding in sports etc.).

Crucially, in relation to the leading thread of this article is that here, the very interaction between subjects itself generates a higher level of autonomy on its own, providing boundary conditions and exerting top-down effects in a mutual feedback loop on involved individuals (Di Paolo 2007, 2016; Froese 2011). Such interactions could be mechanistically mediated through interbrain synchronization, as confirmed and consistent with system neuroscience perspective (e.g. Saenger et al., 2011 and so called “hyperbrain hypothesis”). Via these processes the collective consciousness, collective affect, with its own values, in other words, collective sense making emerges (Di Paolo 2010). These processes are different and more complex than individual interacting with non-living environmental objects and stimuli.

Social interaction is yet another example where we can no more speak of individualistically oriented all-or-none free will but instead the new horizon as a new balance, new emergent property of »collective free will« and collective knowledge sharing is formed, produced according to the interplay between: a) dynamic (more or less fluid) common rules of the collective (e.g. different in hierarchical vs. horizontal group structure), b) autonomous agents' inter-individual one-to-one and one-to-many interactions, and c) still the relatively distinct level of individual autonomy. The latter does not get abolished, but only adapted to the collective dynamics (Di Paolo et al. 2010). Though, not even in this context can we speak of any free will illusion, as the individuals' constitutive share is inherently intertwinned into the collective network dynamic. This means the content and organisational level of (en)action in such cases is to be searched for only in synergy of individual and social components.

[3] Although there is plenty of empirical support for embodied cognition in general, research on the embodied aspects of mental simulation is missing. Such research could reveal to what extent can the bodily perspective (such as sensorimotor schemes) and contextually stored information influence simulation. See for example Stanford Encyclopedia of Philosophy: Embodied Cognition, Section 5.3.

[4] The details of differences between collective decision making vs. individual-only processes in terms of content generation and dynamic operating mechanisms in social cognition are beyond the scope of this article, but a good review can be seen here: MIT Handbook of Collective Intelligence.

3. CONCLUSIONS

To conclude, we propose an upgraded enactivist complex system-based reconceptualization of the free will question in an integrative way on more levels of explanation, considering its constitutive mechanisms, not only on the individual (e.g. prospection) but also in combination with social level.

Although prospection and other types of abstract cognition such as logical reasoning, reflection, intuition, creative insight or even mind wandering vastly increase the capacity to choose and control our actions, it does not mean that there is some sort of absolute, transcendental will that is context-free. Although freedom may be rooted in basic autonomy, the mind, as constituted by the body and environment cannot but be contextual and hence constrained by biological, psychological and social values, goals, needs and structures (e.g. at the latter, sociological theories come into play but in a non-vulgar/ non-reductionist sense). The extent of freedom of possible choices and their selections thus reflects liberation of ways to make sense of the world.

Considering the ethical perspective, existant free will is tightly connected with and is a precondition of the concept of personal social responsibility, considering the consequences of our actions. If there is no »other«, as no other human being, there we cannot be responsible to any (besides ourselves), so the whole ethical part which is focused on effect of individual on others, would become redundant without considering social context. Our proposal is compatible - considering all the consequences of still arguing pro-free will in principle - with bringing forth the possibilities of social and legal responsibility. However, such debate can only become sensible in itself if we firstly re-approach the whole issue of volitional decision making dynamical processes at their founding principles as complex contextual phenomena in itself, not merely focusing on its secondary derivative implications at the level of individual.

4. REFERENCES

[1] Beauregard M (2007). Mind does really matter: evidence from neuroimaging studies of emotional self-regulation, psychotherapy, and placebo effect. *Prog Neurobiol.81(4):218-36.*

[2] Buckner, R. L., & Carroll, D. C. (2007). Self-projection and the brain. *Trends in Cognitive Science, 11, 49–57.*

[3] Clark, A. and Toribio, J., (1994). Doing without representing? *Synthese, 101: 401-431.*

[4] De Jaegher, H., Di Paolo, E., and Gallagher, S. (2010) “Can Social Interaction Constitute Social Cognition?” *Trends in Cognitive Sciences 14(10): 441-447.*

[5] De Jaegher H, Di Paolo E, Adolphs R. (2016). What does the interactive brain hypothesis mean for social neuroscience? A dialogue. *Phil. Trans. R. Soc. B 371:20150379.*

[6] Dennett DC (2015). Elbow room: The varieties of free will worth wanting, *MIT Press London*

[7] Di Paolo, E., (2009). Extended life, *Topoi. 28, 9-21.*

[8] Di Paolo, E.A., Rohde, M. and De Jaegher, H., (2010). Horizons for the enactive mind: Values, social interaction, and play, in: *Stewart, J., Gapenne, O. and Di Paolo, E.A. (Eds.), Enaction: Towards a new paradigm for cognitive science. pp. 33-87.*

[9] Di Paolo E., De Jaegher H., Durt, C., Fuchs, T. and Tewes, C. (eds) Neither individualistic, nor interactionist. Embodiment, enaction, and culture. *MIT Press*, forthcoming

[10] Di Paolo (2016). Participatory Object Perception. *Journal of Consciousness Studies, 23, No. 5–6, 2016, pp. 228–58*

[11] Froese T., Di Paolo E. (2011). The enactive approach. Theoretical sketches from cell to society. *Pragmatics & Cognition 19:1 1–36.*

[12] Gallagher, S. (2006). Where's the action? Epiphenomenalism and the problem of free will. *In W. Banks, S.Pockett, and S. Gallagher. Does Consciousness Cause Behavior? An Investigation of the Nature of Volition (109-124). Cambridge, MA: MIT Press.*

[13] Gazzaniga M (2011). Interview with Michael Gazzaniga. *Ann. N.Y. Acad. Sci. 1224, 1–8, New York Academy of Sciences.*

[14] Haggard P (2008). Human volition: towards a neuroscience of will. *Nature Reviews Neuroscience 9, 934-946*

[15] Heisenberg M (2009). Is free will an illusion? *Nature 459(7244):164-5*

[16] Hutto D. (2013). Exorcising action oriented representations: ridding cognitive science of its Nazgu, *Adaptive Behavior. 21(3) 142–150*

[17] Kane R. (2011). *The Oxford handbook of free will: second edition, Oxford University press.*

[18] Libet B. (1999). Do We Have Free Will? *Journal of Consciousness Studies, 6, No. 8–9, 47–57*

[19] Libet B. (2003). Can conscious experience affect brain activity? *Journal of consciousness studies 10, No. 12, 24–28*

[20] Mossio M, Bich L, Moreno A (2013) Emergence, closure and inter-level causation in biological systems. *Erkenntnis 78 (2):153-178*

[21] Pacherie E. (2010). SELF-AGENCY. *The Oxford Handbook of the Self, Oxford University Press (Ed.),440-462.*

[22] Ruiz-Mirazo K, Moreno A (2012) Autonomy in evolution: from minimal to complex life. *Synthese 185 (1):21-52*

[23] Sänger, J., Lindenberger, U., & Müller, V. (2011). Interactive brains, social minds. *Communicative & Integrative Biology, 4, 655-663.*

[24] Schacter, D. L., & Addis, D. R. (2007). The ghosts of past and future: A memory that works by piecing together bits of the past may be better suited to simulating future events than one that is a store of perfect records. *Nature, 445, 27.*

[25] Seligman MEP, Railton P, Baumeister RF, Sripada C (2013). Navigating Into the Future or Driven by the Past. *Perspectives on Psychological Science 8: 119*

[26] Thompson, E. and Varela, F.J.(2001). Radical embodiment: neural dynamics and consciousness, *Trends in cognitive sciences. 5, 418-425*

[27] Thompson, E., (2004). Life and mind: From autopoiesis to neurophenomenology. A tribute to Francisco Varela, *Phenomenology and the cognitive Sciences. 3, 381-398.*

[28] Thompson E, Di Paolo (2014). The Enactive Approach. *In Lawrence Shapiro, ed., The Routledge Handbook of Embodied Cognition. (Routledge Press)*

[29] Varela FJ, Rosch E.,Thompson E.(1992). The Embodied Mind. *Cognitive Science and Human Experience, MIT press.*

[30] Varela FJ (1997) Patterns of life: Intertwining identity and cognition. *Brain and cognition 34 (1):72-87*

[31] Weber A., Varela FJ (2002) Life after Kant: Natural purposes and the autopoietic foundations of biological individuality. *Phenomenology and the Cognitive Sciences 1: 97–1*

[32] Wegner DM (2004). Précis of The illusion of conscious will *Behavioral and Brain Sciences, Volume 27, Issue 5 pp. 649-659.*

Man vs Computer

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ABSTRACT
In this paper, the relation between humans and computers is analysed through the Turing test. The major object of analysis is a question whether computers will overcome humans: in all, most, many, some or a couple of tasks; how fast; what are the lesions from the past. A couple of tasks will be more carefully analysed, e.g. chess.

General Terms
Human Factors.

Keywords
Human and computer progress, Moore's law, computer games, Turing test, superintelligence.

1. INTRODUCTION
In 1950, Alan Turing , the pioneer and father of artificial intelligence, made a prediction that around the year 2000, the answers of a computer would be indistinguishable from those of human beings, when asked questions by a human interrogator [1]. Since it is 2016 now and computers have not yet managed to overcome the Turing test, one could reason that it might not be only over-optimism, but some deeper cause. By analysing the Turing test, trends and comparisons between humans and computers, we present past and current understanding of the human-vs-computer issue and propose probable trends.

2. THE TURING TEST
The Turing test was developed by Alan Turing in 1950 [1]. The test consists of a human evaluator whose task is to distinguish between a human and a machine that is designed to generate human-like responses. The communication is through a computer keyboard and screen so that the result would not be dependent on the machine's ability to render words as speech. If the evaluator cannot reliably tell the machine from the human with sufficient probability given a reasonable time span, the machine is said to have passed the test. Symbolically, the test is presented in Figure 1.

The test was introduced by Turing to set a mark point in the progress of computers when humans would have to acknowledge that the computer is indeed intelligent, that it can think and provide other intellectual tasks a human can.

The Turing test is probably the best known test of all times with profound consequences. If indeed the test had been passed, computers would be generally accepted as intelligent, as was the original Turing claim.

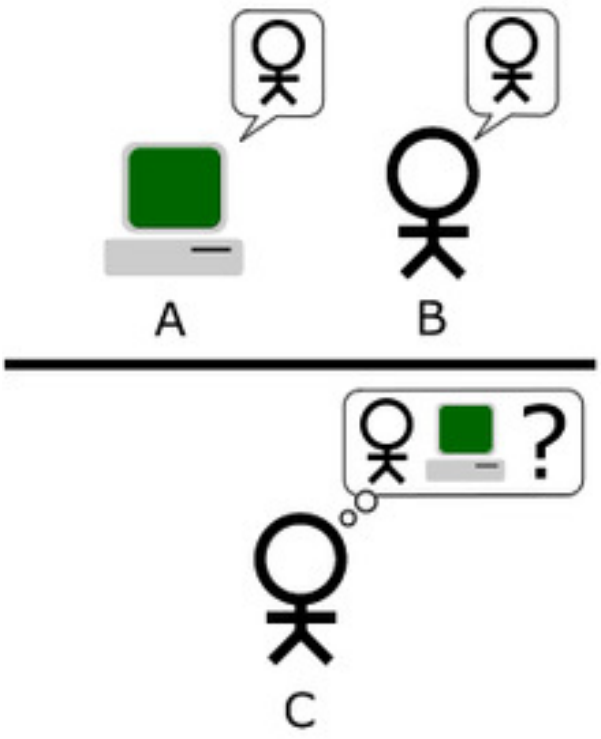

Figure 1. The Turing test (source: Wikipedia). Can a human evaluator distinguish between a computer pretending to be a human and a human given a certain amount of time? The communication is limited through written natural language.

There are several versions of the Turing test, several predictions when it will be fulfilled, and several bets. One of the best known bets is the Long Bet Project Bet Nr. 1 for $20,000 between Mitch Kapor (pessimist) and Ray Kurzweil (optimist). It is a prolonged version of the original Turing test where each of three Turing test judges will conduct online interviews with each of the computer and the three Turing test human foils for two hours totalling in eight hours of interviews.

Besides several critics, versions and discussions, there are two main opinions:

a) the computers are getting better and better at passing the Turing test each year
b) the time needed to decipher humans from computers is more or less stable in recent decades.

The optimist claim that a computer program has already passed the standard/ original Turing test: 5 minutes interrogation, fooling 30% of human judges. It was Eugene Goostman, first developed in Saint Petersburg in 2001 by a group of three programmers; Vladimir Veselov, Eugene Demchenko, Sergey Ulasen. Goostman is displaying itself as a 13-year-old Ukrainian boy not familiar with English or Western-European knowledge. It has competed in a number of Turing test contests, including finished second in the 2005 and 2008 Loebner Prize contest. In June 2012 as the 100th birthday of Alan Turing, Goostman won a competition promoted as the largest-ever Turing test contest, in which it successfully convinced 29% of its judges. On 7 June 2014, at the 60th anniversary of Turing's death, 33% of the event's judges thought that Goostman was human; consequently, mass media propelled the news of a program passing the Turing test [2]. However, a quick look at the replies reveal the biasness of the procedure: Goostman used a bag of well-known tricks on top of hiding behind not understanding well English and now knowing much about Europe. In addition, Goostman was not able to reply several trivial questions such as "How many legs does a camel have?" and in particular no semantic one.

The catch in the Turing test is that computers can manipulate symbols, yet they have no (!) true semantic understanding [3, 4]. For example, the author of this paper in advance warns the students at his exam that they will have to present a line of questions no computer can reply. Students are even given a schema: state or ask an arbitrary sentence. From the potential semantic meanings of that sentence, choose one and ask a sentence that can be passed by a human having semantics in the mind and not a computer, which has no semantics. Thus, it is important to realize the semantics of an average humans and also to delete those questions/replies that a computer can find on the Web or have the answer prepared in advance.

Consider an example: "Computers are stupid. Are you stupid?" Humans would of course rely "No", but a computer program masking itself as human might have that well preprogramed. Similar case is with facts or statements that can be found on the Web, which was demonstrated by the Jeopardy game and Watson winning over humans. However, consider an arbitrary sentence, e.g. "The night is black" and the following questions: "Did anybody colour the night black?" and/or "Would a child use black colour to represent the night?" and/or "You claimed that nobody coloured the night black, but the child did. Explain!" and /or "What is the difference in the semantics in the two cases?" Everybody knows that the nights are mostly black due to the lack of light and that it is not a matter of colour unless somebody paints a picture.

The first statement does not have to be valid at all; usually, it helps if it is a bit vague or even untrue. Nevertheless, just every nontrivial sentence enables the line of semantic-related queries and that makes students unable to prepare the line of reasoning in advance and pass their test unless they comprehend this version of the Turing test in depth and follow the semantic line given a sentence by the professor.

This is the Gams version of the Turing test, for the first time presented in this paper.

3. BEYOND THE TURING TEST

AI magazine (ISSN 0738-4602) is published quarterly by the Association for the Advancement of Artificial Intelligence (AAAI). It is a direct benefit of membership in the AAAI. In Spring 2016 it published a special issue "Beyond the Turing Test" [5]. The special editors were G. Marcus, F. Rossi, M. Veloso. There were the following ideas:

Editorial: Reviews the Turing test including the Goostman boot passing the Turing test and proposes several new AI-oriented solutions to the idea of the Turing test.

My Computer Is an Honour Student — but How Intelligent Is It? Standardized Tests as a Measure of AI by Peter Clark, Oren Etzioni proposes standardized children test for measuring progress of computer intelligence. Why compare adults with computers having in mind that computers might fare batter compared to children at specific age.

How to Write Science Questions that Are Easy for People and Hard for Computers by Ernest Davis proposes an alternative test named SQUABU consisting of questions that are simple for humans and difficult for computers. An example would be: "A cow dies. It will be alive again. When: a) tomorrow, b) next week, c) next year, d) never."

Toward a Comprehension Challenge, Using Crowdsourcing as a Tool by Praveen Paritosh, Gary Marcus considers crowdsourcing comprehension challenge about movies, YouTube etc.

The Social-Emotional Turing Challenge by William Jarrold, Peter Z. Yeh orients itself towards psychology, emotions, motivations and desires.

Artificial Intelligence to Win the Nobel Prize and Beyond: Creating the Engine for Scientific Discovery by Hiroaki Kitano sees major potential of future AI to enable new major scientific discoveries.

Planning, Executing, and Evaluating the Winograd Schema Challenge by Leora Morgenstern, Ernest Davis, Charles L. Ortiz describes the Winograd Shema Challenge in which common-sense is needed in linguistic tasks.

Why We Need a Physically Embodied Turing Test and What It Might Look Like by Charles L. Ortiz proposes construction tests that combine four properties of intelligence: language, perception, reasoning and action.

Measuring Machine Intelligence Through Visual Question Answering by C. Lawrence Zitnick, Aishwarya Agrawal, Stanislaw Antol, Margaret Mitchell, Dhruv Batra, Devi Parikh focuses on visual question-answering instead of just natural-language ones.

Turing++ Questions: A Test for the Science of (Human) Intelligence by Tomaso Poggio and Ethan Meyers also builds on visual tasks, but also deals with human psychology, close to cognitive sciences.

I-athlon: Towards A Multidimensional Turing Test by Sam S. Adams, Guruduth Banavar, Murray Campbell proposes kind of triathlon-type Turing test, not consisting of just short sequences of natural-language dialogs, but a scenarios where computers must express appropriate level of several properties of intelligence.

Software Social Organisms: Implications for Measuring AI Progress by Kenneth D. Forbus similarly to the previous paper highlights that humans are highly social organisms demonstrating multiple levels of skills.

Principles for Designing an AI Competition, or Why the Turing Test Fails as an Inducement Prize by Stuart M. Shieber discusses the existing Turing test and proposes several desired properties that an improved version of the Turing test should have, e.g. reasonableness. Indeed, the Turing test is just one test, and not like an IQ test that provides a numerical value of the achievement. However, one should not expect the Turing test to be more than it is: a final recognition / confirmation of the AI success.

WWTS (What Would Turing Say?) by Douglas B. Lenat recognises the value of the 65 years old test, yet wonders what kind of the test Turing would propose now having in mind the enormous progress of AI and the human civilization. Lenat proposes a combination of human and computer, a synergy and conjoint superhuman intelligence.

4. COMPUTER PROGRESS THROUGH COMPUTER GAMES

Today, computers beat humans in practically all symbolic games from chess to Go. The computer chess provides a good example. Figures 2 and 3 present the computer progress in chess. Figure 1 represents a figure from Chess.com blog, posted on July 2015, where Cavedave claims that the computer rating now has no meaning since no humans come close.

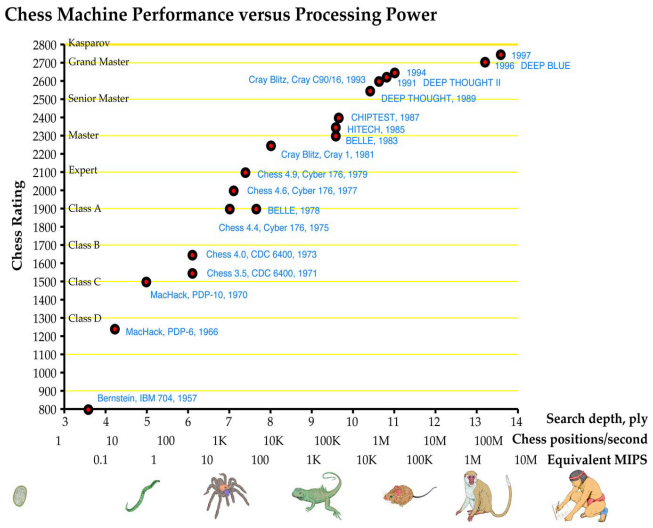

Figure 2. The progress of computer chess. After 1997 computer win, computers are so overpowering that top human experts stand a chance only if given major material advantage in advance (source Chess.com).

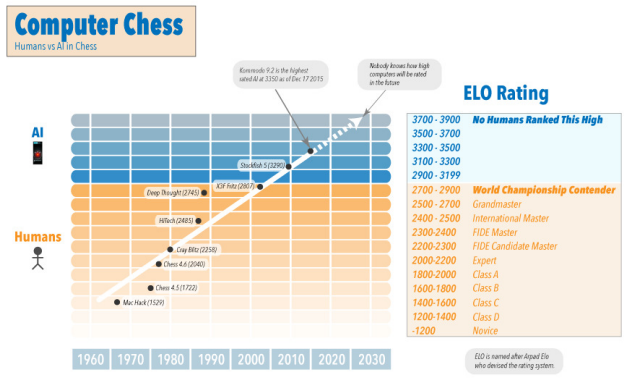

Figure 3. The enormous and rather constant progress of human chess corresponds to the Moore's law. Today, humans are well below computer counterparts in chess ratings (source Patrick Rhodes).

Patrick Rhodes in a Statistics view paper: "Artificial Intelligence: Solving the Chinese Room Argument", 2016 presents similar case: due to the Moore's law the computer power has grown to the level that humans have no chance whatsoever in a chess play against computer. Obviously, the number of all reasonable (!) possibilities is inside computer reach. That has happened to simpler games a long ago.

Dana Mackenzi in 'Why this week's man-versus-machine Go match doesn't matter (and what does)', 'Chess Knightmare and Turing's Dream', Mar. 15, 2016, presents the progress of computer chess and Go. In 1978, International Chess Master David Levy won over the best computer program at that time as a matter of bet. 20 years later the Deep Blue won over Kasparov, the best player at that time. 20 years later, computer won over the best Go player, which is not present yet at Figure 4.

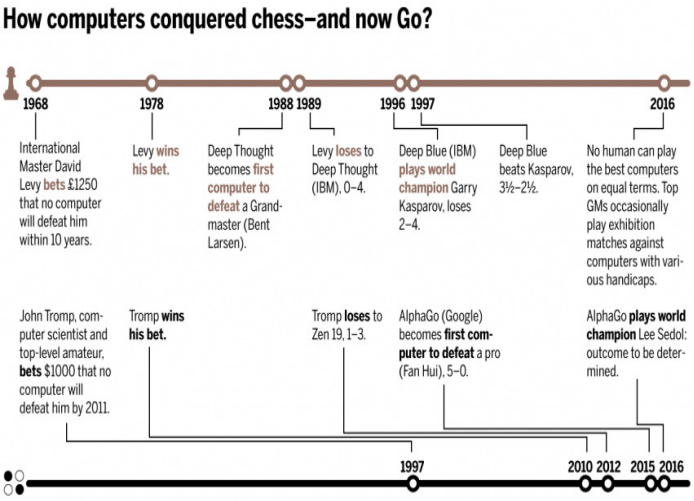

Figure 4. Comparison of computer chess and Go (source Dana Mackenzie).

5. DISCUSSION

Brief history of computer games shows that there were bets and predictions in both ways: computers will or will not win over best humans. Yet, computers have won over best chess players and in 2016 over best Go players. Now, there are bets and predictions whether computers will win over humans in most tasks in another 20 years and that the rise of superintelligence [6] is soon to come.

The Turing remains the best known test of all times and passing it will mark the birth of superintelligence.

Since then, in particular AI society is developing several versions of the Turing test, e.g. those that would provide intelligence in a form of a numeric value, enabling testing of computer progress.

While there are still two major positions:

a) computers will never pass humans in major human properties

b) computers will pass human properties just by raw power due to the Moore's law

it is more or less evident that computers will progress fast and strong and will pass humans in more and more tasks and that they will further stimulate the progress of the human civilization. What is less clear is when and if ever computers will excel in top human performances like awareness and semantics. No doubt it is possible, but no doubt it is a really hard task for computers.

Besides analyses, the Gams version of the Turing test was presented for the first time.

6. REFERENCES

[1] Turing, A. 1950. Computing Machinery and Intelligence. *Mind*, 59, 433-460.

[2] Eugene Goostman, Wikipedia, 2016.

[3] Penrose, R. 2002. *The Emperor's New Mind: Concerning Computers, Minds, and the Laws of Physics*, Oxford.

[4] Gams, M. 2001. *Weak intelligence : through the principle and paradox of multiple knowledge*. Nova Science, 2001.

[5] Marcus, G., Rossi, F., Veloso, M. (eds.) 2016. Beyond the Turing test, Special issue of AI Magazine, Spring 2016.

[6] Bostrom, N. 2014. *Superintelligence – Paths, Dangers, Strategies.* Oxford University Press, Oxford, UK.

Bringing Perception into Action through the Lens of Embodied Cognition

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ABSTRACT

Different areas of cognitive science traditionally perceived the mind as an abstract information processing entity, whose interactions with the outside world should be of small or no relevance at all. However, a recent embodied cognition perspective, view cognitive processes as deeply embedded into the body's interactions with the world. In support of such contention, lots of empirical evidence have been brought and thusly different claims proposed.

In this paper, we present the computer based neurocognitive task of sustained attention, which is a dual task with many characteristics that elegantly mirror some of the above claims. In this regard, we take into consideration both on-line and off-line aspects of the embodied cognition and points out how processing efficiency and attentional functioning are crucial vehicles in bringing perception into effective action (embodied cognition). Furthermore, there is plenty evidence about the bidirectional relationship between the attentional/cognitive functioning and emotion regulation as well.

This rise new possibility in looking at the cognitive bias modification approaches and cognitive training procedures for human beings without perceiving them as disembodied minds or complex machines but instead proactive and physically involved in the real world.

We argue that such cognitive approaches even though at first glance seemed as mere technical and machine oriented procedures, should be regarded as humanistic in its nature, which perfectly reflect the Merleau-Ponty's concept of "embodied subjectivity".

Finally, we explain how such approaches can be successfully combined with the neurobiological accounts and effectively implemented into clinical practice (treatments of ADHD, autism).

Keywords

Embodied Cognition, Attentional Networks, Computer Based Neurocognitive Test, Cognitive Bias Modification, Cognitive Training, Embodied subjectivity.

1. INTRODUCTION

Embodied cognition perspective posits that functional needs of the body dictates the mind to make it function without necessity of the mind involvement in resolving abstract problems [1, 2]. Perceptual and motor systems were many times underestimated and regarded as merely peripheral input and output detectors, without consideration of their interaction with the environment and thusly relevant contributors in crucial cognitive processing.

However in the past decades different opinions about sensorimotor mechanisms evolved from many of diverse cognitive science research fields. These opinions share the common conclusion about their crucial and all-important role in development and maintenance of successful self-regulation behavior and actions within the psychosocial environment.

Because of a great expansion of information communication technologies and artificial intelligence assisted by behavior-based robotics, we live in the information society, where there is plenty of our behavior guided by different routines [3]. These routines helps us efficiently interact with the environment without necessary solving the abstract problems by the strict use of internal representations (Brooks, 1986). As our ancestors possessed neural resources, primarily devoted to perception and motor action processing, it was obvious that their cognitive

activity occurred prevalently in on-line environmental interactive conditions. In other words, because of the survival and fast changing living conditions, there was no time or a very small portion of time dedicated to off-line cognitive processes.
Today**,** there is a growing tendency towards the idea that the mind should be conceptualized and observed through the psychosocial context and in relationship with a physical body that interacts with environment. Many contemporary experts in the field share the opinion that human cognition, instead of being abstract, and strictly separated from peripheral input and output loops, should rather be studied as if its essential components belongs to sensorimotor processing.

In order for embodied cognition to retain a purposeful interpretation of its term, we need a careful observation and analysis of many of diverse opinions. Among the frequently mentioned claims in the literature are: 1. Cognition is situated 2. Cognition is time pressured 3. We off-load cognitive work onto the environment. 4. The environment is part of the cognitive system. 5. Cognition is for action. 6. Off-line cognition is body based.
In the present paper, we will firstly introduce the neurocognitive sustained attention task, which is computer based and explain in details its basic characteristics and features. After that, we will try to analyze it in the light of embodied cognition perspective by verifying how it fits in all of before mentioned claims. Then we will show how specific conditions of the task support those claims through the processing efficiency and performance effectiveness.
We will further discuss the possibility that many of the computer based tasks, with high cognitive load and many repetitions could represent certain cognitive training protocols/cognitive bias modifications that have capacity of creating a new routine by bringing perception into action through attentional processes and self-regulation of emotions. Finally, we outline the affective significance of the psychosocial context [4].

2. VIGILANCE TASK (ANTI-V)

The computer-based neurocognitive task (the ANTI-V task [5]) is used to obtain a direct measure of vigilance in addition to the usual attention network scores (alerting, orienting, executive control).

Instructions present the task as a game. A row of five objects (cars) is presented to participants above or below the fixation point, superimposed on one of two parking lines in the background road. Participants must choose between pressing the left or right button ("c" for the leftward and "m" for the rightward direction of the central car). The row of cars appears for 200ms, but responses are allowed up to 2000ms.

To analyze the functioning of the executive control network, in half (congruent) trials the flanker cars point in the same direction as the target car whereas in the other half trials (incongruent) the flanker cars point in the opposite direction. To manipulate the orienting factor, a 50ms visual cue (an asterisk) appears for 100-ms before the row of cars, either in the same (valid cue) or in the opposite location (invalid cue). In one third of trials, there is no asterisk (no cue condition), so there is a 33% of cue ambiguity.
Alerting is manipulated by the presence or absence of a 50ms warning auditory signal presented 500ms before the target car.
To obtain a direct measure of vigilance, the ANTI-V dual-task paradigm requires participants to detect infrequent stimuli (central car displaced to the left or right), to inhibit the response to the main task ("c" vs. "m" buttons), and to press instead the spacebar.

3. ANTI-V PARADIGM THROUGH THE LENS OF EMBODIED COGNITION PERSPECTIVE

Now that we have a detailed explanation of the task, we are ready to put on the glasses of embodied cognition perspective and look through

its lens of how these claims fit well into the ANTI-V paradigm. The first claim that cognition is situated posits that cognitive processes occurs under the pressures of real-time situation in interaction with sensorimotor mechanisms. Indeed, spatial cognition in particular tends to be situated. ANTI-V task provides context real environment. As it consists of relevant inputs and outputs, which create a cognitive affective significance at the target relevant locations, it guides the cognition through the perception to action demands [6, 7]. The next claim, cognition is time pressured fits well in the ANTI-V paradigm as its basic purpose is to perform as fast and accurate as you can in a time limited and repetitive task conditions.

The task is presented in a form of a videogame and result of performance measures effectiveness of attentional functioning measured through accuracy and reaction times of perceptual-motor activity [8]. The human behavioral research outlines the importance of time pressure as a main principle that creates a situated cognition [9, 3). While off-loading cognitive work onto the environment is a common strategy, this is impossible to do during the on-line ANTI-V task demands because we cannot simply leave information encoding for later time or alter the environment. Perhaps the only off-line strategy available in the ANTI-V task is to try to rely on preloaded representations acquired during the practice block trials of the task (prior learning).

By the claim that environment is part of the cognitive system researchers outline that it is not solely mind guiding the cognition but instead there is an interaction of psychosocial context with the mind, body and environment as a whole [10, 11]. The last but not least claim that cognition is for action was nicely expressed by Glenberg [12] who argued that cognition aroused in order to bring the perception into action in a three-dimensional environment.

Indeed, perception is bringing into action through attentional and cognitive processes. These processes in high cognitive load conditions are modulated by and depend on emotional states and motivational factors [13] even when stimuli are not necessarily emotional in their nature. Some authors brought evidence that there is a possible bidirectional relationship between attentional system and emotions [14]. Furthermore, there are also claims that it is possible to apply attentional processes in emotional regulation as well [15].

4. CONCLUSION

Processing efficiency and attentional functioning seems to be crucial vehicles in bringing perception into effective action. Indeed, there is evidence of bidirectional relationship between attentional-cognitive functioning and emotion regulation as well.
This rise new possibility in looking at the cognitive bias modification approaches and cognitive training procedures for human beings without perceiving them as disembodied minds or complex machines but instead proactive and physically involved in the real world.

We believe that such cognitive approaches even though at first glance seemingly technical and machine oriented, are in fact quite humanistic in their nature. Furthermore, we propose that such approaches, properly combined with the neurobiological accounts are promising steps towards effective implementation into clinical practice (treatments of ADHD, autism).

Let us conclude with the statement of Maurice Merleau-Ponty:"… Man is not an object, locked within his essence like a chair, and, although we may stand out as objects, we also connect to other objects through our consciousness. We are "intentional," directed toward things without being simply reduced to a thing ourselves. Inter-subjectivity is an attempt to understand that we are both, subject and object, in which "the subject is his body, his world, and his situation, by a sort of exchange."[16]

5. REFERENCES

[1] Barrett, L. (2011). *Beyond the Brain: How the Body and the Environment Shape Cognition.* Princeton, NJ: Princeton University Press.

[2] Casasanto, D., and Lupyan, G. (2015). "All concepts are adhoc concepts," in *The Conceptual Mind: New Directions in the Study of Concepts*, eds E. Margolis and S. Laurence Cambridge: MIT Press, 543–566.

[3] Brooks, R. (1991b). New approaches to robotics. *Science*, **253**, 1227-1232.

[4] Gorjup, N. and Gorjup, R. (2014b). Towards Contemporary Neuroethics: Why does it make Sense to Re-define Placebo? *Interdisciplinary Description of Complex Systems*, 12 (4), 334-342.

[5] Roca, J., Castro, C., Lopez-Ramon, M.F., Lupiañez, J. (2011). Measuring Vigilance while assessing the functioning of the three attentional networks: The ANTI-Vigilance task. *Journal of Neuroscience Methods*, Volume 198 (2), 312-324.

[6] Clark, A. (1997). Being there: Putting brain, body, and world together again. Cambridge, MA: MIT Press.

[7] Pfeifer, R., and Scheier, C. (1999). *Understanding intelligence*. Cambridge, MA: MIT Press.

[8] Roca, J., Castro, C., Lopez-Ramon, M.F., Lupiañez, J. (2011). Measuring Vigilance while assessing the functioning of the three attentional networks: The ANTI-Vigilance task. *Journal of Neuroscience Methods*, Volume 198 (2), 312-324.

[9] Kirsh, D. and Maglio, P. (1994). On distinguishing epistemic from pragmatic action. *Cognitive Science*, 18, 513-549. *Science*, 253, 1227-1232.

[10] Wertsch, J. V. (1998). Mediated action. In W. Bechtel & G. Graham (Eds.), *A companion to cognitive science* (pp. 518-525). Malden, MA: Blackwell.

[11] Clark, A. (1998). Embodied, situated, and distributed cognition. In W. Bechtel & G. Graham (Eds.), *A companion to cognitive science* (pp. 506-517). Malden, MA: Blackwell.

[12] Glenberg, A. M. (1997). What memory is for. *Behavioral & Brain Sciences*, 20, 1-55.

[13] Gorjup, R. and Gorjup, N. (2016). Transient Worry Enhance Executive Attentional Functioning and Vigilance Performance: Further Evidence for a New Science of Compassionate Care http://consciousness.arizona.edu/documents/TSC2016_BOOK_of_Abstracts_final.pdf

[14] MacLeod, C., Koster, E. H., and Fox, E. (2009). Whither Cognitive Bias Modification Research? Commentary on the special section articles. *Journal of Abnormal* Psychology, 118 *(1): 89-99.*

[15] Gross, J. J. (1998). The emerging field of emotion regulation. An Integrative Review. *Review of General Psychology*, Vol. 2, No. 3, 271-299.

[16] Merleau-Ponty, M. (1964). The Child's Relations with Others. *In* The Primacy of Perception: And Other Essays on Phenomenological Psychology, the Philosophy of Art, History and Politics. James M. Edie, ed., C. W. Cobb, trans. Pp. 96–155. Evanston, IL: Northwestern, University Press.

Dinamična struktura fenomenologije udejanjenja prepričanj

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POVZETEK

Predstavljena je poskusna teorija, ki opisuje prvoosebni aspekt udejanjanja prepričanj. Opisan je enaktivizem kot konceptualni okvir, na katerem je temeljila raziskava in uporabljena metoda - drugoosebna globinska fenomenološka raziskava. Analiza šestih študij primera je pripeljala do novega razumevanja rekurzivne narave doživljanja udejanjanja prepričanj, pri kateri igrata pomembno vlogo kategoriji *poziv* in *srž. Srž* je občutek, da je vsebina prepričanja na voljo (kljub temu, da še ni refleksivno dostopna), *poziv* pa opisuje konstruktivno vlogo pozornosti pri oblikovanju prepričanja.

Ključne besede

Fenomenologija, prepričanja, drugoosebna globinska fenomenološka raziskava, udejanjanje, enaktivizem.

1. UVOD

Prispevek poroča o delnih rezultatih obširne raziskave, ki poteka v okviru projekta Vpliv komunikacijske situacije na udejanjenje prepričanj. Namen raziskave je poglobljeno razumevanje prvoosebne komponente udejanjenja prepričanj. Prva faza raziskave je zajemala 6 fenomenoloških študij primerov. Analiza rezultatov je pripeljala do štirih poskusnih teorij, od katerih se tri navezujejo na udejanjanje prepričanj, ena pa opisuje nekatere fenomenolške aspekte artikulacije.

V uvodnih poglavjih bosta predstavljena enaktivizem – konceptualni okvir, v katerega smo vpeli raziskavo – in uporabljena tehnika drugoosebnega globinskega fenomenološkega raziskovanja. Prispevek zaokroža opis ene od omenjenih poskusnih teorij – tiste, ki najbolj neposredno opisuje doživljanje udejanjenja prepričanj.

2. KONCEPTUALNI OKVIR

Kljub temu, da ne manjka raziskav in filozofskih razmislekov o tvorbi, spreminjanju in verodostojnosti prepričanj, je zelo malo napisanega o prvoosebni plati fenomena. Navadno se zadovoljimo z definicijo, da imata osebi A in B isto prepričanje, če mislita P. Pa je to res tako?

Vzemimo za primer, da sta osebi A in B na vprašanje »Koliko je vsota kotov trikotnika?« odgovorili »180 stopinj«. Ob tem odgovoru je oseba A doživljala (in kot odgovor ponovila) spomin na stran učbenika, kjer je v črnem okvirju pisalo »Vsota kotov trikotnika je 180 stopinj«. Oseba B pa si je, ko je slišala zastavljeno vprašanje, predstavljala pravokotnik, ugotovila, da je vsota njegovih štirih pravih kotov 90 x 4 = 360 stopinj. Za tem je v mislih potegnila premico med nasprotnima kotoma pravokotnika in ugotovila, da tako dobi dva trikotnika, katerih skupna vsota kotov je 360, posamezna pa 180 stopinj. Prva oseba je torej poročala o spominu, druga pa o posledicah notranjega zemljevida sveta (v tem primeru geometrije). Kljub temu, da A in B mislita P (»vsota je 180 stopinj«), je zelo težko pristati na sklep, da imata obe osebi isto prepričanje.

Težava je v tem, da se večina standardnih okvirjev raziskovanja kognicije ne zanima preveč za prvoosebno komponento. Za raziskovanje doživljajskega procesa je potreben konceptualni okvir, ki upošteva prvoosebni vidik in dopušča konstruktivno, individualno in od konteksta odvisno naravo formacije prepričanj. Temu opisu ustreza enaktivizem - predlog na utelešeni kogniciji temelječe paradigme kognitivne znanosti, ki se skuša oddaljiti od reprezentacionalizma. Pojem udejanjenja je en od centralnih pojmov paradigme enaktivizma. Uvedejo ga Francisco Varela, Evan Thompson in Eleanor Rosch (1991) v kontekstu percepcije. Vprašajo se: "Kaj je bilo prej, svet ali slika?" Predstavijo prevladujoč pogled večine raziskav s področja vidne zaznave – svet tam zunaj ima vnaprej dane lastnosti, ki jih kognitivni sistem razbere – in nasproten pogled – kognitivni sistem projicira svoj svet in kakršnekoli lastnosti tega sveta so le odsev lastnosti kognitivnega sistema. Avtorji v dolgi razpravi o barvi pokažejo, da tako prvi kot drugi pogled ne vzdržita: "V nasprotju z objektivističnim pogledom so barvne kategorije izkustvene; v nasprotju s subjektivističnim pogledom pripadajo barvne kategorije našemu skupnemu biološkemu in kulturnemu svetu" (Varela, Thompson in Rosch, 1991: 172).

Varela, Thompson in Rosch (1991) srednjo pot med realizmom (kognicija služi odkrivanju vnaprej danega zunanjega sveta) in idealizmom (kognicija služi projiciranju vnaprej danega notranjega sveta) poiščejo v tem, da svet in opazovalec drug drugega določata. Obe predstavljeni skrajnosti temeljita na reprezentacijah, na eni strani se z reprezentacijo odkrije, kar je zunanjega, na drugi strani se projicira, kar je notranjega. Avtorji se želijo razmejitvi med notranjim in zunanjim popolnoma izogniti tako, da na kognicijo ne gledajo kot na konstrukcijo, niti kot projiciranje realnega zunanjega sveta. Da bi označili takšno »srednjo pot« avtorji uvedejo pojem udejanjenje (enaction).

Pojem udejanjanja lahko smiselno razširimo (Kordeš 2016) za razumevanje tvorbe prepričanj kot opis srednje poti med priklicem spomina in konstrukcijo povsem novega doživljanja (cf. Bitbol in Petitmengin, 2013). V študiji podobno govorimo o udejanjenju prepričanj – vmesni poti med razumevanjem prepričanj kot nekje zabeleženim in vsakič znova ustvarjenim.

3. METODA

Pri izbiri fenomenološke metode smo morali upoštevati vrsto izzivov pri raziskovanju doživljanja. Mnogo jih reši že metoda eksplikativnega intervjuja (ki jo je uvedel Pierre Vermersch, 1994), dodatno ekološko veljavnost pa smo dosegli z vpeljavo drugoosebnega globinskega fenomenološkega raziskovanja (cf. Lah in Kordeš, 2014). Temelj eksplikativnega intervjuja nadgradimo z raziskovalnim preobratom: Nujno je, da je

vprašanje, ki ga raziskujemo, zanimivo tudi za udeleženca, da se mu posveti, da ga tudi sam prične raziskovati. Če je udeležencu raziskovalno vprašanje dovolj pomembno, da to postane tudi njegovo raziskovalno vprašanje, se preobrazi iz udeleženca v soraziskovalca.

Zgodi se preobrat v raziskovalni dinamiki. Ni več raziskovalec tisti, ki iz udeleženca skuša izvleči podatke. Soraziskovalec raziskuje svoje doživljanje in svoja opažanja deli z raziskovalcem, ki mu pri tem pomaga. Vloga raziskovalca postane vzbujanje zanimanja za raziskovalno vprašanje in odpiranje prostora za soraziskovalčevo samoopazovanje s pomočjo tehnik eksplikativnega intervjuja.

Drugoosebno globinsko fenomenološko raziskovanje je razdeljeno v dve fazi (Slika 1). Prva faza se sestoji iz serije intervjujev, v kateri v našem primeru postavljamo vprašanja iz vnaprej pripravljenega nabora vprašanj. Po vsakem vprašanju vprašamo še po doživljanju procesa odgovarjanja na ta vprašanja. V prvi fazi (trenutno še) udeleženec spoznava tudi raziskovalno vprašanje. Prva faza je selektivna. Udeležence, ki izrazijo zanimanje za raziskovalno vprašanje in način raziskovanja, povabimo k sodelovanju v drugi fazi. Od tu naprej govorimo o sodelovanju med raziskovalcem in soraziskovalcem. V drugi fazi soraziskovalec opazuje svoje doživljanje v vsakdanjem življenju in si v dnevnik zapisuje z raziskovalnim vprašanjem povezana opažanja. Posamezne dnevniške vnose potem raziskovalec in soraziskovalec v intervjujih poglobljeno participatorno raziščeta. V intervjujih pridobljene ugotovitve usmerjajo soraziskovalčevo nadaljnje raziskovanje, kar vzajemno vpliva na raziskovalno dejavnost v sledečih intervjujih.

Slika 1: Fazi drugoosebnega globinskega fenomenološkega raziskovanja

4. POSKUSNA TEORIJA

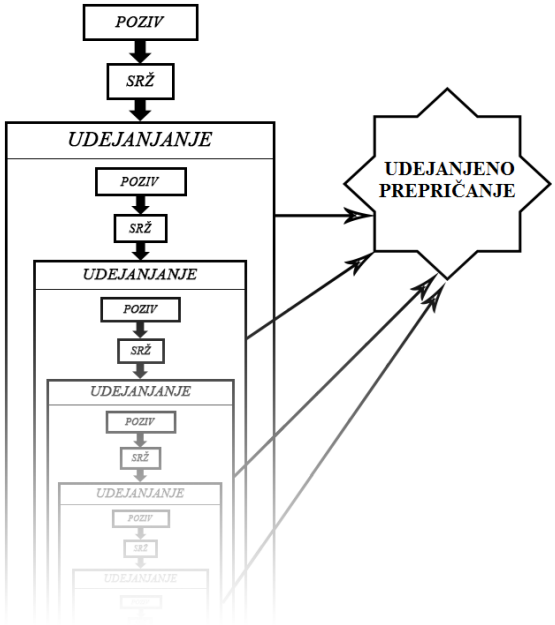
Opise doživljanja iz intervjujev in dnevnikov smo zbrali in kategorizirali glede na skupne značilnosti. Za model, ki ga predstavljamo, sta relevantni kategoriji *poziv* in *srž*.

Poziv zaznamuje opise doživljanja zahteve po prepričanju. Ta zahteva se lahko posredno manifestira kot želja, pričakovanje ali direkten začetek poglabljanja ali razmišljanja o neki stvari, o kateri je prepričanje zahtevano. Sledi primer opisa *poziva* iz dnevniškega zapisa enega od soraziskovalcev (označenega s šifro F01): "Sprva ne prepoznam predmeta (vem le, da se imenuje 'goba'), čutim rahlo nelagodje, da predmeta 'ne razumem', se z mislimi vanj 'poglobim',[…]" (F01, dnevnik, poudarek je avtorjev)

Srž opisuje izražanje občutka, da "lahko odgovorim" oziroma, da "imam prepričanje na voljo". To še ni udejanjenje prepričanja v zavesti, temveč občutek zmožnosti, da oseba prepričanje lahko udejanji (ne glede na to, ali ga pozneje res (lahko) udejanji). *Srž* ilustrira primer iz dnevniškega vnosa soraziskovalca F01: "[…] in občutek, da če vztrajam pri tej predstavi, da se bom prej ali slej spomnil, kaj sem jedel." (F01, dnevnik)

Kategorija *poziv* je nastala po konceptu, ki ga Daniel Dennett imenuje *probe* (slovensko: sonda) – dogodek v možganih, ki kaj prinese v ospredje pozornosti. Dennett sam meni, da je edin način, kako spoznamo kakršnakoli dejstva o zavesti, preko sondiranja – oziroma angleško: probing (Dennett, 1991). Podobno Susan Blackmore (2002) povzema ugotovitve Daniela Simonsa in Daniela Levina (1998, v Blackmore 2002) v kontekstu vizualne percepcije. V vsakem trenutku sicer doživljamo podrobno sliko sveta pred seboj, a iz znanstvenih ugotovitev vemo, da je nemogoče, da zares vidimo celotno sliko z vsemi podrobnostmi. Kar imamo, tako Blackmoreova (2002), je občutek, da so vse podrobnosti prisotne (kar imenuje gist). Kordeš in Demšar (2016) izraz gist uporabljata kot "občutek, da lahko odgovorim" – občutek, da sem odgovor našel, in čutenje njegove esence, čeprav še ni bil natančno formuliran. Na podoben način tu predstavljen model opisuje dinamično strukturo udejanjenja prepričanj: prepričanje ne obstaja, dokler po njem ne pozivamo (oziroma izvedemo probe), nakar dobimo občutek, da je prepričanje prisotno – *srž* (oziroma gist).
Model dinamične strukture fenomenologije udejanjenja prepričanj opisuje, da se vsako udejanjenje prepričanja prične s *pozivom* po prepričanju. Temu sledi doživljanje *srži*, torej občutka, da je to prepričanje na voljo. Tu se proces lahko zaključi in ponavadi se res. Na primer: ko kolega pride z ustnega izpita (jaz pa še čakam pred kabinetom), pove vprašanja, ki jih je dobil. Za vsakega samo najdem *srž* – občutek, da imam odgovor na voljo. V raziskavi smo se primerom, ko oseba ne ve oziroma nima občutka, da ve, izogibali. Model opisuje samo primere, ko se *srž* pojavi.

V primeru poglabljanja – torej dejanskemu vztrajanju pri občutku *srži*, se sproži proces *udejanjanja*. To je sestavljen proces, ki privede do pojavitve prepričanja. Ko se pojavi *srž*, da je prepričanje tam, je del tega občutka tudi védenje: če vztrajam pri tem še-ne-čisto-prepričanju, bom prišel do prepričanja, ki ga iščem. To vztrajanje je nov *poziv*, ki zahteva prepričanje. Po tem se pojavi *srž* bolj dodelane oblike prepričanja, ki ga iščem. Kar nam preostane, je le še *udejanjanje* prepričanja iz te nove *srži* – in rekurzivni proces je v teku. Izhodni pogoj tega procesa je, če mi zmanjka *srži* – občutka, da je tam še kanček prepričanja, ki bi ga lahko s *pozivom* pridobil. Alternativna možnost je voljna prekinitev tega procesa oziroma preusmeritev pozornosti z *udejanjanja* na kaj drugega (na primer na artikulacijo odgovora). Pri vsaki iteraciji se izlušči več in več kančkov prepričanja, ki se skozi proces naberejo v celoto udejanjenega prepričanja (Slika 2).



Slika 2: Model dinamične strukture fenomenologije udejanjenja prepričani

Ta model lahko na zelo grob način ilustrira proces udejanjanja pri soraziskovalki V01 iz primera:

"Občutek […] imam, da Sokrat ni pravi odgovor in rečem ne. Nato se spet poskušam "spomniti" […], kot da si poskušam priklicati neko zgodbo. Iz črnega prostora se mi pojavi slika Diogenesa, vendar tej sliki takoj sledi zavrnitev - občutek, da to ni to. Spremeni se v sliko kipa (Aristotel) in s to sliko se pojavi občutek/intuicija, da je to pravilen odgovor." (V01, dnevnik)

Udejanjanje prepričanja se je pričelo z vprašanjem: "Kdo je bil učitelj Aleksandra Velikega?" (V01, dnevnik). To je v soraziskovalki sprožilo poziv. Temu pozivu sledi srž, da je prepričanje na voljo. Iz udejanjanja tega prepričanja pride že kanček prepričanja oziroma "občutek […], da Sokrat ni pravi odgovor" (V01, dnevnik). Temu sledi nov poziv – "Nato se spet poskušam 'spomniti'" (V01, dnevnik) – in nov občutek, da je prepričanje na voljo. Drugi krog udejanjanja vrne prepričanje, da Diogenes tudi ni pravi odgovor. Tretji krog pa prepričanje oziroma občutek, da je odgovor "Aristotel".

Na podoben način bi lahko razložili tudi opis doživljanja, ki ga podaja soraziskovalec T02:

"Tako da sem dobil občutek, kot da je to nek pool of knowledge moj, ki bi ga lahko uporabil za to nalogo. […] Dejansko sem lahko približal to sliko in ko sem jo približal, sem dobil občutek kakor pri neki besedi, ki jo imaš na koncu jezika, pa si vedno bližji – kot da bi bil vedno bližji znanju. Samo nisem prišel na koncu do njega – do odgovora." (T02-3-1, 00:05:17)

Približevanje slike, kot ga je omenil soraziskovalec T02, bi lahko razumeli kot serijo novih pozivov po prepričanju – srži ("občutek, kakor pri neki besedi, ki jo imaš na koncu jezika") in udejanjanja – nadaljnjega bližanja. Soraziskovalec T02 nato poroča, da na koncu ni dobil odgovora, ker je prišel do blokade, ki jo opiše kot: "Nisem mogel večat bolj slike, in nisem … in tudi ta občutek je pač se ustavil na tisti točki" (T02-3-1, 00:06:30) To bi lahko interpretirali kot, da mu je zmanjkalo srži.

5. ZAKLJUČEK

Pri tem modelu ostaja še vrsta neodgovorjenih vprašanj, kot so: ali je tak potek splošen – torej neodvisen od drugih faktorjev, kot sta morda občutek vsebine in občutek odnosa? Ali je udejanjanje možno tudi brez srži? Med raziskavo smo prišli do veliko primerov, ko oseba ni mogla zanesljivo trditi, ali je na začetku čutila srž ali ne, a vseeno je potem podala opis udejanjanja. Zanimivo bi bilo ugotoviti, ali v kakšnem od takih primerov zagotovo ni prišlo do srži.

Uporabljena metoda drugoosebnega globinskega fenomenološkega raziskovanja je omogočila dokaj visoko stopnjo ekološke veljavnosti, saj so soraziskovalci v drugi fazi samostojno in z zanimanjem opazovali svoje doživljanje v vsakodnevnih situacijah – torej izven situacije intervjuja. A hkrati je potreba po tako globokem zanimanju veljavnost raziskave omejila, saj nam je tako zožila nabor oseb, ki bi bili pripravljeni v raziskavi sodelovati. Težko je najti nekoga, ki ga zanima dano raziskovalno vprašanje ter daljše, temeljitejše samoraziskovanje. Lahko se zgodi, da soraziskovalec tekom raziskave ugotovi, da ga dano vprašanje le ne zanima tako zelo, in se želi iz raziskave umakniti. Obratno pa nikoli ne spoznamo ljudi, ki jih na začetku raziskava ne zanima, s poglobljenim vpogledom pa bi se razvilo zanimanje. Tako smo že od samega začetka omejeni na preučevanje oseb, ki jih dano vprašanje in samoraziskovanje res zanima in ki so se pripravljeni spustiti v ta težak in dolgotrajen postopek (sodelovanje soraziskovalca v raziskavi praviloma traja vsaj nekaj mesecev).

6. ZAHVALA

Zahvaljujemo se Fakulteti za psihoterapevtsko znanost Univerze Sigmunda Freuda v Ljubljani, ki projekt omogoča, prispeva materialna sredstva in nudi prostore za izvedbo intervjujev in srečanj. Prav tako se zahvaljujemo soraziskovalcem za prijetno in produktivno sodelovanje.

7. VIRI

[1] Bitbol, M. in Petitmengin, C. 2013. On the possibility and reality of introspection. *Kairos. Revista de Filosofia in Ciência*, 6, 173-198.

[2] Blackmore, S. 2002. There is no stream of consciousness. *Journal of Consciousness Studies*, 9(5-6), 17-28.

[3] Dennett, D. 1991. *Consciousness explained*. Boston, MA: Little Brown.

[4] Kordeš, U. 2016. Going Beyond Theory, Constructivism and Empirical Phenomenology. *Constructivist Foundations*, 11(2), 202-233.

[5] Lah, A. in Kordeš, U. 2014. One cannot „just ask“ about experience. V: Markič O., Strle T., Kordeš u. & Gams M. (eds.) Kognitivna znanost/Cognitive Sciences. Proceedings of the 17th international multiconference “Information Society – IS 2014.” volume C. Inštitut Jožef Štefan, Ljubljana: 36–39.

[6] Petimengin, C. 2006. Describing one’s subjective experience in the second person: An interview method for the science of consciousness. *Phenomenology and the Cognitive Sciences*, *5*(3-4), 229-269.

[7] Simons, D. J. in Levin, D. T. 1998. Failure to detect changes to people during a real-world interaction. *Psychonomic Bulletin in Review*, 5(4), 644-649.

[8] Varela, F. J., Thompson, E. in Rosch, E. 1991. *The embodied mind: cognitive science and human experience*. Cambridge, MA, MIT Press.

[9] Vermersch, P. 1994. *L'entretien d'explicitation*. Paris: ESF.

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Embodied Cognitive Robotics, the Question of Meaning and the Necessity of Non-Trivial Autonomy

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ABSTRACT
Embodied cognitive robotics has made remarkable advances in modelling natural cognitive processes and thus speculating about the content of the black box of the mind. The field's tackling of one of the biggest questions in cognitive science, the question of meaning, has been met with considerable acclaim. The latter was gained by modelling the grounding of meaning through an agent's use of language as a cognitive tool in its active interaction with the environment via sensorimotor behavior. Many different approaches with such an agent have been labelled as successful in modelling meaning comprehension, which begs the question of what natural understanding and meaning really are. This points to such embodied cognitive models lacking – their grounding is neither meaningful nor significant to them, and it is not internally necessary, but is rather forced onto them by externally programmed fundamental goals. What is missing is a non-trivial, constitutive autonomy, which would make robots create their own goals in order to self-regulate and preserve their internal organization; in order to survive. Only then can meaning truly be assigned.

Keywords
embodied cognitive robotics, symbol grounding, language, meaning, autonomy

1. INTRODUCTION
Embodied cognitive robotics has been on a rise since the early '90s, making progress in many respects [1, 2]. It has been tackling various problems of cognition left over from computationalism, such as symbol grounding and the frame problem, and shining a new light on existing puzzles, especially low-level cognition [3]. It presents a new approach to modelling natural cognitive processes and thus speculating about the content of the black box of the mind, claiming that "thought is expressed not as a symbol manipulation, but as an inner simulation drawing on lower-level capacities of the sensorimotor cognition" [4, p. 1]. It views cognition as embodied, situated, grounded, sub-symbolic, dynamic and distributed in practical activity [1, 2, 5–7]. A considerable number of empirical evidence speaks for such a position: from neurocomputational accounts (e.g., in order to develop communication skills, sensorimotor actions and understanding the actions of others are needed and have to act in accord [8]), through neuroimaging findings (e.g., conceptual knowledge about objects happens through simulations of the motor cortices [9]), to cognitive neuropharmacology (e.g., constraining the body in some way (like the movement of lips) affects emotional responses, judgement and comprehension [6]). Embodied cognitive robotics has especially prided itself on having made a breakthrough [1, 4, 8, 10, 11] or even completely solving [12] one of the foremost problems in cognitive science: the symbol grounding problem, or how symbols get meaning. However, the questions of what meaning and understanding really are, and how both are connected to conscious mental states, remain unanswered [13]. Consequently, the recent claims about solving the symbol grounding problem must also be called into question.

The current state of debate in embodied cognitive robotics on how meaning arises largely leans towards the idea that this happens through an agent's use of language as a cognitive tool in its active interaction with the environment via sensorimotor behavior [1, 4, 8, 10, 11]. The use of language to accomplish this is based on Vygotsky's claim that language is responsible for the development of abstraction, reasoning, categorization and memory [1]. By placing an agent (with performable actions like moving limbs, grasping, pointing, touching, etc.) into an interactive environment, robotics warrants a viable method for researching meaning comprehension.

2. HOW MEANINGFUL IS THE FIELD'S WORK? A PRESENTATION OF VARIOUS TRENDS
The field is bursting with different means for achieving the grounding of meaning. The models are based on very diverse pickings of different psychological and neuroscientific findings. This exorbitant pool of evidence that links language and action to meaning comprehension consists of specific phenomena as well as of general theories. For instance, one of the latter claims that action, interaction and language develop simultaneously, intertwine and influence each other in leading cognitive development [14].

Modelling researchers have been aptly gathering such efforts and applying them in their work. An approach from Cangelosi et al. [10] incorporates findings from developmental psychology of how a child mimics people. It employs two robots and is based on a teacher-learner relationship. The learner acquires the actions by mimicking actions of the teacher through observation. It is also based on a theory that symbols are grounded in categorical representations of the agents and maintain relationship with other symbols. The model therefore produces grounding transfer, as the learner robot creates higher level actions through learning and naming basic actions (linguistic combination of two basic action names results in a new, composite action).

Another approach from Farkaš et al. [4] includes neuroscientific studies that have shown that simple action verbs strongly activate the correlating homuncular motor areas (e.g., the word "kick" activates the "leg" area) [15] and that action-language learning is not synchronous, as pre-linguistic children still learn object-related actions. Farkaš et al.'s robot learns certain motoric actions and develops an ability to produce a linguistic comment about them.

A clever twist was made by Lallee et al. [11], who expand the understanding of an action in their model. They focus not on action alone, but on the relations between the starting and the resulting states caused by an action. This is consistent with research showing that humans relate actions to their goals – which is represented by the resulting state of an action – and that the same action can have different ending states (in monkeys – grasping for eating and grasping for placing) [11]. The model parses individual actions (e.g., give, take, touch and push) in a way that it learns causal relations between the objects. This happens through linguistic use of "if-then" and "because", and possession verbs such as "has", which are used as subparts of an action. The model also incorporates developmental psychology observations that a child questions the human in their environment about an unknown action, goal or purpose; when the robot encounters an action it does not understand, which means that the ending state is unknown, it questions the human next to them about it [11].

Despite shortcomings – Cangelosi et al.'s model has biologically questionable technical groundwork and the learning method where the learner robot is forced to automatically mimic (and not learn to mimic or adjust accordingly) the teacher robot, Farkaš et al.'s model has to perform an action in order to comment on it, Lallee et al.'s model has an innate vocabulary and is not pre-linguistic – these and alike models are being described as promising and even successful in accurately modelling natural cognition and assigning of meaning [1, 2, 4, 8, 10, 11], even though they demonstrate a different representation of it. This raises an important question: how can different approaches all accurately model human understanding? Even by sharing a seemingly common goal, ascribing them human-like creation of meaning seems superficial, especially with meaning being left so undefined. The fact that they used different approaches in accomplishing the grounding itself, the models' understanding has to be different (if it can even be categorized as understanding). Do they really understand? Was meaning really created? Was the whole process of an action and related linguistic signals intimately and intrinsically meaningful and significant to the robots themselves, as it is to us[1]? One could argue that it was, in the robots' own limited scope and nature (and simply sweeping the question of meaning under the rug). But in that case, it does not seem to be human-like [2], which is what they attempt to model, or have human-like significance. Something is therefore missing.

3. UNDERSTANDING MEANING

These questions are not the first of their kind. They have been similarly posed by one of the most relevant critics of AI (from GOFAI (Good Old-Fashioned Artificial Intelligence) to the embodied AI), Hubert Dreyfus. In [17], he specifically addresses the problem of meaning in artificial intelligence. He draws from Merleau-Ponty and Freeman to point out that embodied models simply do not create meanings, do not "directly pick up significance and improve […] sensitivity to relevance", "responding to what is significant" in terms of "needs, body size, ways of moving, and so forth" [17, p. 265]. There are many moments that bring such a conclusion.

The problem of agency is the first to be considered – who is really creating the meaning and grounding it? If the robot is programmed to have such a need, to ascribe meanings, the grounding that supposedly occurs can only be significant for the programmer and not the robot. If "meaning is only attributed by an external observer" [2, p. 472], if grounding is forced by a creator, then there can be no "grounding of grounding". The robot neither understands nor produces its needs – it is not choosing what and how to ground to satisfy internally produced wants (as children do [18]). Everything it does, its every move and process is to satisfy an externally implemented program written by its creators, whose needs are really reflected in it. The produced meaning is therefore meaningful for the creator, not for the robot. The concept of grounding itself is therefore uncertain as well. If it is devoid of the supposed agent's significance, it stands to say that it is simply mapping, in most cases, actions to linguistic signals. Saying that meaning is therefore indifferent and intrinsically unmotivated (and unneeded) mapping is dubious at best, and GOFAI and computationalism disguised as embodied cognition at worst [5, 19].

What seems to be missing is an internal organization of the robot that would spawn its own goals and needs to give meaning to something in order to "keep itself going". Only then will it really be significant and meaningful to the robot. Its internal organization therefore needs to be set up in a way that it does not reflect its creator's goals, and the grounding has to occur so that it sustains the internal organization – it has to be teleological exclusively for the model. This arising significance can only then truly create the meaning itself. The robot therefore needs to be autonomous.

4. AUTONOMY

Autonomy has been a huge buzzword in the embodied robotics circles. Widely used [4, 5, 8, 10, 19], it mostly describes characteristics of a robot that is autonomous, if not trivially, only behaviorally. These characteristics mostly adhere to the following categories: "the robot is engineered so as to be able to interact with its environment without requiring ongoing human intervention", "any embodied system designed to satisfy internal or external goals by its own actions while in continuous long-term interaction with the environment in which it is situated", and in rare cases to "autonomous systems are expected to survive in unknown and partially unpredictable environments by devising their own goals and finding out solutions to challenges that may arise" [20, p. 456–7]. What therefore lacks is a constitutive [20] autonomy, autonomy that is not trivial, superficial, depicting more than just the fact that a robot and its creator have two separate physical bodies.

The most important part of such autonomy in the case of robots is the capability of an agent to internally produce its own goals. The agent has to determine its own rules of the "game" that is played, that is, the rules must not be forced on the agent by its own programmed design, its only option to adhere to them. Only then arises the intrinsic "creation and appreciation of meaning" [21, p.

[1] This can be evidenced through our lived experience [16].

488]. Only then ecologically and evolutionary sensible generation of meaning can take place, when the agent has to create meanings in order to survive, in order to keep its identity in the always "precarious network of dynamical processes" [19, p. 40]. Creation of meaning then becomes a part of the robot's self-regulation and self-governance, always a necessary step in the robot's endless process of maintaining an identity that arises from such processes themselves. Meaning becomes infinitely more crucial, significant and essential for the agent.

There are few, if any accounts of how constitutive autonomy could be potentially modelled, especially because such autonomy has been always before in the domain of living systems. There have been computational accounts of simulating living systems as such, especially in regard to the principle of autopoiesis or self-production, of which constitutive autonomy is a fundamental feature [7]. However, this differs from separating constitutive autonomy from autopoiesis and remaking it to apply not only to living, but also to artificial and social systems [20]. For this to be possible, a set of design principles needs to be discerned, which are akin to those of living systems, but formed in terms of "identity" rather than "life" or "metabolism". Froese and Ziemke have made an attempt at that [2]. They identified the most basic and crucial design principle, absolutely necessary for modelling a system with constitutive autonomy: "The system must be capable of generating its own systemic identity at some level of description." [2, p. 485] This follows from the idea that only "systems with a self-generated identity can be said to genuinely own and enact their own goals" [2, p. 485]. This self-generated identity signifies the constitutive autonomy. The ability of the system to become something different at any given time is crucial – living systems stop being themselves (especially living), when they stop their internal operations. In contrast, whether "a robot is switched on and engaged in its operations or switched off, it remains to be the same system in both cases" [2, p. 485]. To be able to model such a principle, a paradigm-like shift needs to happen. Direct engineering of an agent needs to become engineering of a suitable environment, which would produce an agent, whose constitutive autonomy would emerge when coupled with such an environment. However, as identified by Froese and Ziemke, turning this idea into a model presents a unique problem, aptly named "the problem of engineering second-order emergence" [2, p. 487].

5. CONCLUSION

Even by determining that (constitutive) autonomy is needed for intrinsically relevant meaning to arise, it does not seem that the question of what meaning is has been solved. GOFAI, based on computationalism, and embodied AI, relying on embodied principles, have been found lacking, which gives way to alternative contemporary paradigms to contribute to the open problem of understanding. This especially holds true for enactivism, whose canon introduced autonomy. When describing meaning, it may therefore be proper to start thinking in terms of another enactivist concept, sense-making. However, making such a paradigm shift in modelling comes with its own unique problems, like the problem of engineering second-order emergence. Attention should also be lent to other biologically inspired fields, like biosemiotics, which may offer additional insights.

6. REFERENCES

[1] Mirolli, M. and Parisi, D. 2011. Towards a Vygotskyan Cognitive Robotics: The Role of Language as a Cognitive Tool. *New Ideas Psychol*. 29, 3 (2011), 298–311. DOI=dx.doi.org/10.1016/j.newideapsych.2009.07.001

[2] Froese, T. and Ziemke, T. 2009. Enactive artificial intelligence: Investigating the systemic organization of life and mind. *Artif. Intell*. 173, 3–4 (2009), 466–500. DOI=10.1016/j.artint.2008.12.001

[3] Froese, T. 2007. On the Role of AI in the Ongoing Paradigm Shift within the Cognitive Sciences. In *50 years of artificial intelligence: Essays dedicated to the 50th anniversary of artificial intelligence*, M. Lungarella, F. Iida, J. Bongard and R. Pfeifer, Eds. Springer-Verlag, Berlin, 63–75. DOI=10.1007/978-3-540-77296-5_7

[4] Farkaš, I., Malík, T., and Rebrová, K. 2012. Grounding the meanings in sensorimotor behavior using reinforcement learning. *Front. Neurorobot*. 6, 1 (2012), 1–13. DOI=10.3389/fnbot.2012.00001

[5] Ong, K. Y. C. 2006. *Philosophical Robotics*. The Old Inn Publishing, Lewes, England.

[6] Guckelsberger, C. and Salge, C. 2016. Does Empowerment Maximisation Allow for Enactive Artificial Agents? In *Proc. 15th Conf. ALIFE* (Cancun, Mexico, July 04 - 08, 2016), C. Gershenson, T. Froese, J. M. Siqueiros, W. Aguilar, E. J. Izquierdo and H. Sayama, Eds. The MIT Press, Cambridge, MA, 704–711.

[7] Varela, F. J., Thompson, E., and Rosch, E. 1991. *The Embodied Mind: Cognitive Science and Human Experience*. The MIT Press, Cambridge, MA.

[8] Cangelosi, A. et al. 2010. Integration of Action and Language Knowledge: A Roadmap for Developmental Robotics. *IEEE Trans. Auton. Ment. Dev*. 2, 3 (2010), 167–195. DOI=10.1109/TAMD.2010.2053034

[9] Barsalou, L. W. 2008. Grounded cognition. *Annu. Rev. Psychol*. 59 (2008), 617–645. DOI=10.1146/annurev.psych.59.103006.093639

[10] Cangelosi, A., Tikhanoff, V., Fontanari, J., and Hourdakis, E. 2007. Integrating language and cognition: a cognitive robotics approach. *IEEE Comput. Intell. Mag*. 2, 3 (2007), 65–70. DOI=10.1109/MCI.2007.385366

[11] Lallee, S., Madden, C., Hoen, M., and Dominey, P. F. 2010. Linking language with embodied and teleological representations of action for humanoid cognition. *Front. Neurorobot*. 4, 8 (2010), 1–12. DOI=dx.doi.org/10.3389/fnbot.2010.00008

[12] Steels, L. 2007. The Symbol Grounding Problem has been solved. So what's next? In *Symbols and embodiment: Debates on meaning and cognition*, M. de Vega, Ed. Oxford University Press. Oxford, 223–244. DOI=10.1093/acprof:oso/9780199217274.003.0012

[13] Harnad, S. 2000. Minds, Machines and Turing. *J. Logic Lang. Inform*. 9 (2000), 425–445. DOI=10.1023/A:1008315308862

[14] Rizzolatti G. and Arbib M. A. 1998. Language within our grasp. *Trends Neurosci*. 21 (1998), 188–194. DOI=dx.doi.org/10.1016/S0166-2236(98)01260-0

[15] Pulvermüller, F. 2013. How neurons make meaning: brain mechanisms for embodied and abstract-symbolic semantics. *Trends. Cogn. Sci*. 17, 9 (2013), 458–470. DOI=dx.doi.org/10.1016/j.tics.2013.06.004

[16] Weber, A. and Varela, F. J. 2002. Life after Kant: Natural purposes and the autopoietic foundations of biological individuality. *Phenomenol. Cogn. Sci*. 1, 2 (2002), 97–125. DOI=10.1023/A:1020368120174

[17] Dreyfus, H. L. 2007. Why Heideggerian AI Failed and How Fixing it Would Require Making it More Heideggerian. *Philos. Psychol*. 20, 2 (2007), 247–268. DOI=10.1080/09515080701239510

[18] Cowley, S. J. 2007. How human infants deal with symbol grounding. *Interact. Stud*. 8, 1 (2007), 81–104. DOI=dx.doi.org/10.1075/is.8.1.06cow

[19] Di Paolo, E., Rohde, M., and De Jaegher, H. 2010. Horizons for the Enactive Mind: Values, Social Interaction, and Play. In *Enaction: Towards a New Paradigm for Cognitive Science*, J. Stewart, O. Gapenne and E. Di Paolo, Eds. The MIT Press. Cambridge, MA, 33–88. DOI=10.7551/mitpress/9780262014601.001.0001

[20] Froese, T., Virgo, N., and Izquierdo, E. 2007. Autonomy: A Review and a Reappraisal. In *Proceedings of the 9th European Conference on Artificial Life: Advances in Artificial Life* (Lisbon, Portugal, September 10 - 14, 2007), F. Almeida e Costa, L. M. Rocha, E. Costa, I. Harvey, and A. Coutinho, Eds. Springer, Lisbon, 455–464. DOI=10.1007/978-3-540-74913-4_46

[21] De Jaegher, H. and Di Paolo, E. 2007. Participatory sense-making: An enactive approach to social cognition. *Phenomenol. Cogn. Sci*. 6, 4 (2007), 485–507.

[22] Harnad, S. 1990. The symbol grounding problem. *Physica D*. 42, 1–3 (1990), 335–346. DOI=10.1016/0167-2789(90)90087-6

Multidisciplinarna Obravnava Bolnika

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POVZETEK

Prispevek na kratko predstavlja multidisciplinarni pristop k obravnavi pacientov z nevrodegenerativnimi boleznimi. Predstavljene so prednosti in tudi pomanjkljivosti take obravnave, in celoten učinek, ki vodi do izboljšane kvalitete življenja. Sestava z optimalno kombinacijo specialistov in drugih deležnikov znotraj multidisciplinarnega tima še ni bila določena in je verjetno odvisna od posameznega primera in tipa bolezni.

Ključne besede

Multidisciplinarna obravnava, nevrodegenerativne bolezni, zdravstveni tim

1. UVOD

Z daljšo življenjsko dobo in manjšim naravnim prirastkom družba pritiska na aktiviranje starejšega prebivalstva. Soočamo se s trendi da bi podaljšali delovno aktivnost starejših s podaljševanjem normativno potrebne delovne dobe za upokojitev in splošnim pričakovanjem, da bi bili starejši dalj časa samostojni, aktivni in neodvisni. Spremenjen odnos družbe do starejših predstavlja velik pritisk na to skupino ljudi, ki je pogosto indirektno prikazana kot breme družbe. Slednje je toliko večje v primerih bolnikov z nevrodegenerativnimi boleznimi. Z napredovanjem bolezni se pojavljajo spremembe v kognitivnih in gibalnih funkcijah, socialni vlogi posameznika, pri dnevnih aktivnostih in drugje. Multidisciplinarna obravnava bolnika omogoča zadostitev specifičnih potreb vsakega posameznika (Marck in Boon, 2014).

Pri multidisciplinarni obravnavi je za vsak vidik bolezni načeloma zadolžena ena izmed disciplin, ki skupaj pokrivajo celoten spekter znakov bolezni. Multidisciplinarna obravnava je znana in uspešen pristop h kvalitetni obravnavi bolnikov, ki se je doslej izkazala za uspešno že na več področjih medicine, npr: pri onkologiji, Aidsu in imunskih boleznih kot je revmatoidni artritis (Rolland et al., 2013). Na področju motenj v delovanju možganov so rezultati mešani, vendar prevladuje mnenje, da ima multidisciplinarna obravnava večji doprinos h kvaliteti življenja bolnika in hkrati predstavlja dolgoročno cenovno ugodnejši pristop od monodisciplinarne obravnave.

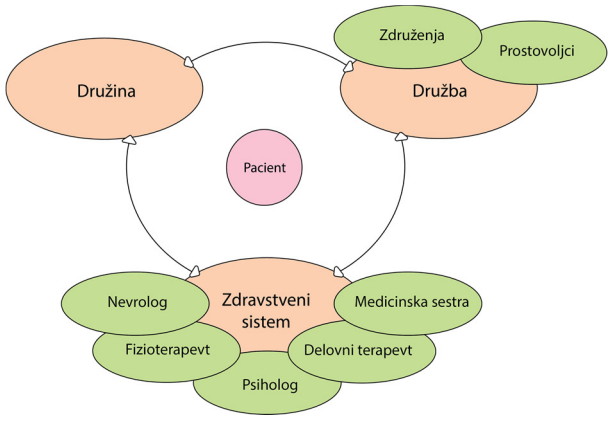
2. NEVRODEGENERATIVNE BOLEZNI

Multidisciplinaren prostop k obravnavi bolnika se uspešno uvaja v zdravljenje nevrodegenerativnih bolezni. Med nevrodegenerativnimi boleznimi sta demenca in Parkinsonova bolezen zaradi različnih podtipov bolezni in različnih področji človekovega delovanja, ki jih prizadeneta, posebno primerni za multidisciplinarni prostop. Demenca je sindrom napredujočega propada kognitivnih sposobnosi in dnevnih aktivnosti. Kvalitetna obravnava bolnika z demenco je ključnega pomena za ohranjanje njegove samostojnosti in neodvisnosti pri vsakodnevnih opravilih. Več kot pri polovici primerov vseh bolnikov z demenco gre za t.i. Alzheimerjevo bolezen, ki napreduje počasi v nekaj letih, kljub temu pa je pomembno, da je ustrezna in verjetna diagnoza zastavljena že v obdobju blagega kognitivnega upada. Zgodnja diagnoza predstavlja ugodno izhodišče za kakovostno obravnavo tekom bolezenskega procesa in prognostična pričakovanja. S staranjem prebivalstva se incidenca AD povečuje in napovedi kažejo, da bo število dementnih v naslednjih 20 letih podvojilo.

Parkinsonova bolezen (PB) je za Alzheimerjevo boleznijo druga najpogostejša nevrodegenerativna bolezen. Pri PB je najbolj prizadeto bolnikovo gibanje. Sekundarni simptomi kot so motnje v zaznavanju, čustvovanju, motnje spanja in psihiatrične motnje , ki ključno vplivajo na kvaliteto življenja. Farmakološke terapije lajšajo simptome te bolezni (bradikineza, diskinezije, itd.) a žal nimajo učinka pri atipičnih parkinsonizmih. Pri slednjih je toliko pomembnejše zgodnje prepoznavanje in prava diagnoza, saj v teh okoliščinah pride v upoštev predvsem zdravljenje nemotoričnih simptomov. V vseh primerih je pomoč družine in bližnjih ključna za kvalitetno življenje pacienta.

3. SESTAVA TIMA

Najboljša sestava zdravstvenega multidisciplinarnega tima še ni bila določena in ni znano, kakšna kombinacija predstavnikov različnih disciplin, bi največ doprinesla k odkrivanju diagnoze in optimalnemu zdravljenju bolnika z nevrodegenerativno boleznijo.



Primer multidisciplinarnega tima:

Pomembno vlogo ali doprinos pri obravnavi bolnika s Parkinsonovo boleznijo imajo naslednje discipline: specialisti (nevrologi, psihiatri), specializirane medicinske sestre, sorodni zdravstveni delavci (psihoterapevti, delovni terapevti, terapevti za govor in jezik, dietetiki, socialni delavci, seksologi, nevropsihologi. Pri dementnih bolnikih multidisciplinarna obravnava vpliva tako na diagnozo (učinkovitejše ugotavljanje vzroka demence in tipa bolezni), kakor tudi terapijo (Olanrewaju et al., 2015, Wolfs et al., 2006).

3.1. Multidisciplinarni timi na Nevrološki kliniki

Kognitivni tim in tim za motnje gibanja ("ekstrapiramidni tim") enkrat tedensko obravnavata bolnike, ki obiščejo Klinični oddelek za bolezni živčevja na Nevrološki kliniki v Ljubljani. Kognitivni tim strokovnjakov obravnava bolnike s kognitivnimi motnjami. Med njimi so najpogosteje bolniki z demenco, ki je večinoma posledica Alzheimerjeve bolezni in redkeje rezultat drugih oblik. V prvi vrsti se strokovni tim posvetuje glede diagnoze, nato pa se posvetijo posameznikovim potrebam in šibkostim, ki spremljajo bolezensko stanje. Tim za motnje gibanja obravnava paciente s Parkinsonovo boleznijo in tiste z drugimi nevrodegenerativnimi boleznimi, ki prizadenejo bolnikove gibalne zmožnosti. Poleg težkih motoričnih preprek (rigidnost, tremor, diskinezije) imajo taki bolniki več težav tudi z nemotoričnimi simpotmi, ki občutno vplivajo na kakovost njihovega vsakdanjega življenja. Motnje spanja, depresija, motnje v prebavi, poleg neprestanega nihanja kliničnih simptomov sindroma Parkinsonove bolezni predstavljajo posebne prepreke tako za bolnika in družinske člane kot tudi za samo zdravstveno osebje.

4. PREDNOSTI IN SLABOSTI MULTIDISCIPLINARNE OBRAVNAVE

Obravnave in pomoči tima strokovnjakov je bolnik deležen na enem samem kraju. Nevrodegenerativne bolezni, kot je Parkinsonova bolezen ali demenca, spremljajo raznoliki simptomi. Kompleksnost simpotomov lahko nadzoruje le raznolik tim strokovnjakov. Tim strokovnjakov je izredno prilagodljiv in se lahko preoblikuje glede na potrebe posameznika in glede na stopnjo njegove bolezni. Raziskave poročajo o občutnih razlikah v kvaliteti življenja bolnikov, ki so bili deležni multidisciplinarne obravnave v primerjavi z bolniki, ki so bili obravnavani s strani enega specialista (van der Marck, 2013).

Čeprav kratkoročno dražji pristop, lahko z multidisciplinarno obravnavo zdravstveni sistem privarčuje na dolgi rok. S celostno obravnavo se izboljšuje kvaliteta pacientovega življenja, ki posledično vodi do podaljšanja samostojnega načina življenja. Z večjo neodvisnostjo bolnikov so svojci manj obremenjeni z oskrbo in so hkrati tudi manj odsotni z delovnega mesta. V poznejših obdobjih bolezni se zamakne in skrajša tudi čas institucionalizacije, saj bolniki lahko dalj časa uspešno ter samostojno delujejo v domačem okolju.

Za posamezne primere je potovanje do Nevrološke klinike lahko naporno, posebno kadar ti živijo v oddaljenih krajih. Po obravnavi ali hospitalizaciji se pojavlja vprašanje, kako uspešno bodo izboljšano zdravstveno stanje bolniki lahko sami vzdrževali doma. Raziskave, ki poročajo o prednostih multidisciplinarne obravnave večinoma poudarjajo napredke na področju rehabilitacije po diagnozi (Olanrewaju et al., 2015, Wolfs et al., 2006). Specialisti navadno nimajo dobrega vpogleda v delo strokovnjakov drugih podoročij, kar vodi do nerazumevanja in nepoznavanja doprinosa in prednosti sodelovanja. Bolniki na lastno pobudo in s pomočjo svojcev iščejo obravnavo pri strokovnjakih različnih disciplin, kar zaradi dolgih čakalnih vrst poteka počasneje. V vmesnem času se stanje bolnika lahko že spremeni.

5. ZAKLJUČEK

Metoda multidisciplinarne obravnave ne predstavlja le načina hitrega postavljanja natančne diagnoze temveč sega na področje dolgoročnega spremljanja bolnikovega stanja, njegove bolezni glede na rezultate programa. Poleg multidisciplinarne obravnave sta pomembni še interdisciplinarna ter integrativna obravnava (van der Marck et al., 2014; Boon et al., 2004). Pri interdisciplinarni obravnavi člani tima na sestankih sodelujejo in sprejemajo skupinske odločitve. Integrativna obravnava pa dodatno kot enakopravnega člana tima sprejme in aktivira še bolnika samega. Z vsako naslednjo stopnjo pa sistem ne pridobi nujno na kakovosti. Pri velikem številu članov in časovni stiski v zdravstvenem sistemu integrativni pristop ne predstavlja nujno najbolj optimelnega sistema. Seveda so možne izboljšave obstoječih zasnov multidisciplinarne obravnave. S poglobljeno in natančnejšo komunikacijo med različnimi strokovnjaki, ki jih pacient obišče tekom postavljanja diagnoze, lahko zmanjšamo število podvojenih testov in storitev. Odprt dostop vsem zdravnikov do rezultatov preiskav posameznika v obliki registra ali podobno bi tudi vodil h krajšim preglednim postopkom in hitrejši diagnozi.

6. REFERENCE

1. Boon, H., Verhoef, M., O'Hara, D., & Findlay, B. (2004). From parallel practice to integrative health care: a conceptual framework. *BMC Health Services Research*, 4(1), 4-15. http://doi.org/10.1186/1472-6963-4-15
2. Grand, J. H. G., Caspar, S., & MacDonald, S. W. S. (2011). *Clinical features and multidisciplinary approaches to dementia care. Journal of Multidisciplinary Healthcare,* 4, 125–147. http://doi.org/10.2147/JMDH.S17773
3. van der Marck, M. A., Bloem, B. R., Borm, G. F., Overeem, S., Munneke, M., & Guttman, M. (2013). Effectiveness of multidisciplinary care for Parkinson's disease: A randomized, controlled trial. *Movement Disorders,* 28(5), 605–611. http://doi.org/10.1002/mds.25194
4. van der Marck, M. A., & Bloem, B. R. (2014). How to organize multispecialty care for patients with Parkinson's disease. *Parkinsonism & Related Disorders,* 20 Suppl 1, S167–173. http://doi.org/10.1016/S1353-8020(13)70040-3
5. Olanrewaju, O., Clare, L., Barnes, L., & Brayne, C. (2015). A multimodal approach to dementia prevention: A report from the Cambridge Institute of Public Health. *Alzheimer's and Dementia: Translational Research and Clinical Interventions,* 1(3), 151–156. http://doi.org/10.1016/j.trci.2015.08.003
6. Rolland, Y., Tavassoli, N., Gillette-Guyonnet, S., Perrin, A., Hermabessiere, S., Ousset, P. J., … Vellas, B. (2013). Multidisciplinary team meetings (MDTM) in detection of Alzheimer'Bowman, M., Debray, S. K., and Peterson, L. L. 1993. Reasoning about naming systems. *ACM Trans. Program. Lang. Syst.* 15, 5 (Nov. 1993), 795-825. DOI= http://doi.acm.org/10.1145/161468.16147
7. Wolfs, C. A. G., Dirksen, C. D., Severens, J. L., & Verhey, F. R. J. (2006). The added value of a multidisciplinary approach in diagnosing dementia: A review. *International Journal of Geriatric Psychiatry,* 21(3), 223–232. http://doi.org/10.1002/gps.1454

A Better Scientific Understanding of Pain and Kripke's Rejection of the Mind-Brain Identity Theory

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ABSTRACT

In this paper, I consider the implications of a better scientific understanding of pain for Kripke's argument against the mind-brain identity theory. Kripke as well as the mind-brain identity theorists did not pay much attention to the phenomenon of pain as such, but from what they say, it can be deduced that they considered it a simple and homogeneous experience. Pain science has made considerable progress in the last couple of decades, and today we know that pain is a quite complex phenomenon and have a better understanding of the underlying mechanisms. This brings out failings of the identity theory as well as of Kripke's argument.

Keywords

mind-body problem, mind-brain identity, Kripke, necessary a posteriori truth, pain science

1. INTRODUCTION

The mind-body problem is a philosophical question *par excellence*, with which philosophers have grappled since the Antiquity. Throughout history the prevalent view was dualism according to which mind and body are radically different kinds of thing.[1] But with the birth of natural sciences, materialism or physicalism gained respectability, so much so that in the second half of the 20th century it became the dominant view.[2]

However, if everything is physical, then we need to explain how the mind fits in this physical world, because humans, at least at first sight, clearly possess two different kinds of properties. Physical properties, such as weight, size or color, are properties that natural sciences attribute to various objects, while mental properties, such as being conscious of, being sad, being in pain or having a belief, are typically attributed only to humans (and certain animals). While physical properties are public, i.e. in principle observable by anyone, mental properties are private to the subject that possesses them. For example, I can feel my pain, while everybody else can only infer from my behavior that I am in pain, but cannot feel it themselves.

Physicalists must insist that this difference is only apparent and that mental states are just physical states. However, there are many strategies that tie the mental to the physical. One materialist view – quite popular in the 1960s – is the mind-brain identity theory which maintains that mental states are identical to brain states.[3] For example, identity theorists claim that an experience of pain is merely a brain process.

In "Naming and Necessity,"[4] Saul Kripke attacks the mind-brain identity theories and devises an argument in which he purports to show that the mind-brain identity claims differ from the theoretical identifications and are therefore false and should be rejected. He develops his argument by comparing the particular mind-brain identity – the identity of pain with C-fiber stimulation –, with the particular theoretical one – the identity of water with H_2O.

Both sides in this debate, which used pain as an example, did not spend much time on the nature of pain itself. Identity theorists proclaimed that the sensation of pain is just C-fibers firing; while Kripke insisted that there is nothing more to pain that the immediate phenomenal quality, the feeling of pain, which made it impossible to identify it with C-fibers firing. In the decades since this debate took place, the science of pain has progressed considerably. In this paper I analyze Kripke's argument with this enriched understanding of the nature of pain in mind.[5]

2. MIND-BRAIN IDENTITY THEORY AND KRIPKE'S ARGUMENT AGAINST IT

The identity theory holds that mental states and processes are identical to brain states and processes. These identities are not necessary, but contingent. We need to find out that a particular identity holds, or more specifically, it is the task of science to discover them. And their contingent nature is the very reason for the appearance that there are two distinct states and not only one.

At the time it was typical to understand necessity linguistically: a sentence is necessary if its truth is determined solely based on the meaning of the words it contains. For example, a sentence "Bachelors are unmarried men" is necessarily true, because the meaning of the word "bachelor" is "an unmarried man." Accordingly, in the case of necessary identities, their truth is known *a priori*, one only needs to know the meanings of the

[1] For further details on the varieties of dualism, see Robinson, 2016.

[2] Although in the last couple of decades dualism has regained support.

[3] See, for example, Place, 1956; Feigel, 1958; Smart, 1959; Armstrong, 1968; Lewis, 1966; for an overview of the theory, see Smart, 2007.

[4] In 1970 Kripke delivered three lectures at Princeton University, which were published as "Naming in Necessity" in 1972. A corrected and expended version with a new preface was published in 1980. The identity theory is discussed at the end of the third lecture (1980: 144–155).

[5] Focus here is on physical pains, namely pains that are felt in bodily locations, and not broader notion which includes also emotional suffering, for example, grief.

relevant words. However, in the case of contingent identities, their truth cannot be ascertained from linguistic meanings, but only discovered *a posteriori*. For example, the truth of the sentence "Lightning is a motion of electric charges" cannot be determined based on meanings, since "lightning" does not mean the same as "motion of electric charges." The fact that the perceived lightning is an electric discharge was discovered by scientists based on theory and experiments. Consequently, the way we talk suggests we are dealing with two distinct things, but science tells us it is one and the same thing we refer to with two distinct words. And the same applies to the case of mental states. "Having a pain" does not mean the same as "C-fibers firing," but scientific findings tell us otherwise. The apparent difference is therefore the consequence of words having different meaning, but nonetheless both refer, in fact, to the same thing.

The contingent nature of the identity statements also makes it possible to maintain that in some other circumstances a mental state could be identified with some other physical state. In this way, Lewis, who defines the concept of pain as the concept of a state that occupies a certain causal role,[6] can claim that, in the case of human pain, this state is that of C-fibers firing, while in the case of Martian pain, it is some other state, which occupies the relevant causal role.

But Kripke forcefully rejects the idea of contingent identities. His famous example is about the identity statements involving proper names, which are according to him rigid designators. That means that a name in every possible world designates the same object. Take the example of Hesperus and Phosphorus. Ancients named the brightest star in the evening Hesperus and the brightest star in the morning Phosphorus, but they later discovered that they are actually one and the same celestial body, namely Venus. Accordingly, the identity statement "Hesperus is Phosphorus" is true. But since this identity was discovered by astronomers empirically, it is an *a posteriori* truth. However, it is not contingent, as identity theorists would have it. "Hesperus" and "Phosphorus" are names that refer in this world and consequently in every possible world to planet Venus. Therefore, identity statements between names, when true at all, are necessarily true.

Kripke uses the same strategy in the discussion on names of natural kinds, by which he means terms for natural kinds of stuff, such as water and gold, terms for natural kinds of things, such as the tiger, and for terms for natural phenomena, such as heat or lightning. These terms are rigid designators, too. Relevant for this discussion is his treatment of theoretical identifications, such as "Lightning is an electrical discharge" and "Water is H_2O." Such identity statements are not known *a priori* since, for example, it is not part of the meaning of "water" that water is composed of H_2O. Originally, we identified water, or fixed the term's reference, by its phenomenal properties, such as its characteristic feel, appearance, and so forth. As Kripke says, we identified it with the help of its contingent properties. But later scientists discovered water's chemical composition, thus discovering its essential property.[7] Now, while in some other possible world water will lack all phenomenal properties we initially identified it by, there will be no possible world in which water is not composed of H_2O. Scientists discovered water's essence and therefore "Water is H_2O" expresses an *a posteriori* necessary truth.

The same is true of the "Lightning is a motion of electric charges." If it is in fact true that lightning is a motion of electric charges, then it is necessarily true. In general, theoretical identifications are necessary, if true, and science is discovering the true essences of natural phenomena, substances and species.

If Kripke's analysis is correct, then identity theorists cannot claim that pain is contingently identical with C-fibers firing, and the only path open to them is to maintain that the identity is necessary. But Kripke further argues that mental-physical identities cannot be explained in the same way as other theoretical identifications.

Identity theorists differentiate between at least two kinds of identifications, namely between two particular states and two types of states in general. In the first case we speak of token–token identity and in the second case of type–type identity. Suppose that I am having a pain in my right shoulder at this moment. A token–token identity theorist would maintain that this particular sensation of pain I am experiencing is identical to a particular physical state occurring inside me, while a type–type theorist would make a more general claim, proclaiming the identity between the two state-types, namely between a mental state of having pain and a physical state of C-fibers firing. Kripke considers both versions, but he mainly focuses on the type–type identity theses, since they best correspond with the theoretical identifications discussed above.

While these identifications are necessary, the fact that they are knowable only *a posteriori* gives them an appearance of contingency. One way to explain this illusion is by noting that we usually fix the reference of the term by some contingent marks of the object or phenomenon. In the case of water, we proclaim that water is transparent, an odorless liquid found in rivers and lakes around here which quenches thirst. Since nowhere in this definition its chemical composition is mentioned, it is easy to come to the wrong conclusion that water could have been composed, say, of XYZ. This explains why necessary *a posteriori* truths on the surface appear to us contingent. Only when we note that they express identities of objects ("Hesperus" and "Phosphorus" are both names of planet Venus), the very nature of substances (water is composed of H_2O) or phenomena (lightning is a motion of electric charges), do we realize that they are necessary and that it is not the case that Hesperus could not have been Phosphorus, water could not have been composed of H_2O, and lightning could not have been a motion of electric charges.

However, the type-type identity theorist cannot in such a way dispel the supposed illusion of contingency. In the case of the identity of pain with C-fibers stimulation, we would need to show that the reference of pain is fixed by some of its accidental properties, which makes it possible for us to miss the fact that it is essentially C-fibers stimulation. However, Kripke continues, pain

[6] More specifically, it is "a concept of a state apt for being caused in certain ways by stimuli plus other mental states and apt for combining with certain other mental states to jointly cause certain behavior" (Lewis, 1983: 124).

[7] That composition is essential to substances, or "stuffs," is an essentialist thesis, which we come to know by philosophical analysis and is therefore known *a priori* (Kripke, 1980: 109). Kripke often states his argument only in terms of the rigid designators, omitting essentialist implications, but Salmon (1979) clearly shows that the argument presupposes essentialist thesis.

"is not picked out by one of its accidental properties; rather it is picked out by the property of being pain itself, by its immediate phenomenological quality" (Kripke, 1980: 152). Therefore, if we can imagine a situation in which pain is being felt without a stimulation of C-fibers, or a situation in which a stimulation of C-fibers exists without being felt as pain, then we must conclude that pain and C-fiber stimulation are two distinct things and that the identity thesis should be rejected.

The focus of this paper is not the analysis of Kripke's argument as such,[8] but to determine the ways in which, if at all, a better scientific understanding of pain affects this debate.

3. RELEVANT SCIENTIFIC FINDINGS ON PAIN

The International Association for the Study of Pain defines pain as "[a]n unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage" (IASP Taxonomy, 2012).

Pain is a sensory experience since it is a sensation in a part or parts of the body, namely we perceive a tissue damage or potentially damaging condition. But it is also an emotional experience since it is always unpleasant. Pain scientists go on to point out that they do not want to tie pain to the stimulus. As they say, "activity induced in the nociceptor and nociceptive pathways by a noxious stimulus is not pain, which is always a psychological state, even though we may well appreciate that pain most often has a proximate physical cause" (ibid.)

The emphasis is therefore on the subjectivity of experience and not on its supposed physical causes. Moreover, the experience is recognized to be multidimensional. Scientists recognize sensory, affective (emotional) as well as cognitive aspects in pain experience.

Traditionally it was thought that pain is an injury-produced response. First, injury or some other somatic pathology activates pain receptors, and then the message is conveyed via specialized fibers directly up the spinal cord to the pain center in the brain. As Aydede notes (Aydede, 2005: 30), this so-called specificity theory of pain was dominant until 1965 when Melzack and Wall proposed the gate-control theory. According to this view, noxious stimuli are modulated in the gate in the spinal cord, and the brain plays an important inhibitory role in this. The theory is able to explain the high variability in the connection between nociceptive stimuli and the pain experience, which the traditional theory could not.

Another unexplainable data came from the dissociation effects, which were exhibited, for example, by patients who underwent prefrontal lobotomy, or cingulotomy. These patients reported that they were in pain; they could recognize its location, intensity and so on, but they were not bothered by it and did not behave like people normally do when in pain. In other words, the unpleasantness of pain was removed or reduced, while the sensory-discriminative aspect of pain remained intact. This suggests that phenomenological components of pain experience can come apart, which is difficult to explain when pain is connected with a simple, straightforward transmission from the place of injury to the brain.

[8] There is rich literature on this issue. See, for example, Hughes, 2004; Noonan, 2013, where you can find further references.

In 1986 Melzack and Casey accommodated these observed data within the gate-control theory by postulating multiple parallel central processing systems, which are selectively associated with the sensory-discriminative, affective-motivational, and cognitive-evaluative aspects of pain experience.

In this new model, pain is allowed to be a subjective experience and is no longer explained in terms of behavioral responses to noxious stimuli. And the key role in this model is given to the brain which, as Melzack nicely puts it, creatively transforms "patterns of nerve impulses into the perceptual qualities, emotions, and meanings that compose the stream of subjective experience" (Melzack and Wall, 2003: 3).

4. IMPLICATIONS FOR THE MIND-BRAIN IDENTITY THEORY AND KRIPKE'S ARGUMEMENT AGAINST IT

First thing worth noticing is the complexity of underlying mechanisms that accompany the subjective experience of pain. On the other hand, philosophers discussing the mind-body problem, not only identity theorists and Kripke, mostly just talk about C-fibers firing or C-fibers stimulation. As we know, C-fibers are not the only fibers that respond to noxious stimuli. So this is the first simplification, next is the complete absence of any mention of other mechanisms that participate in the processing of noxious stimuli. The identity theorists' talk of C-fibers firing seems even funnier. They claim that mental states are identical with brain states, but then identify pain with C-fibers which are not part of the brain.

Many find this simplistic talk as offensive to science. For example, Nikola Grahek in his book (Grahek, 2007), which mainly focuses on pain asymbolia and what lessons we can learn from the complete dissociation of the sensory-discriminative dimension of pain from its other components, finds philosophers' treatment of C-fibers appalling. First, he claims that they were uncritically introduced, with complete disregard for their distinctive properties, and then uncritically rejected. Perhaps he has identity theorists in mind when he complains that "[s]ome philosophers have 'located' these quasi-mythical peripheral afferent fibers in the *brain*(!)" (Grahek, 2007: 142).

In my opinion, Grahek and other critics are too harsh on philosophers of mind here. They are not being condescending to science, but rather trying to give it space to do its job. Accordingly, as Aydede nicely puts it, the role of C-fibers is to be "a sort of stand-in or proxy for whatever the ultimate physical structure is to be identified with pain experience (in case the Identity Theory is your game) or for whatever it is that turns out to be the occupant of the functional role of pains (if Functionalism is your preferred game)" (Aydede, 2008).

However, the simplistic view on the nature of pain undoubtedly influences what philosophers take to be plausible and what position they consequently take. For example, one wonders, if identity theorists were aware of the complex serial and parallel processing that goes on when we are experiencing pain, would they still support the identity theory or they would rather explain subjective experience as a by-product of this complexity?

The next point concerns the subjective experience of pain itself. In his objection to the identification of pain with C-fibers stimulation, Kripke argues that identity theorists cannot defend the necessary identity of pain with C-fiber stimulation, since the reference of "pain" is determined by pain's essential property,

namely that of being pain, or, as he explains, by its immediate phenomenological quality. However, Kripke understands the sensation of pain to be simple, and by the phenomenological quality he probably means the sensory aspect of pain experience. However, if pain experience is complex, and has besides the sensory-discriminative also affective-motivational and cognitive-evaluative aspects, we must ask ourselves if all three aspects are essential for something to count as pain experience.

Let's say that negative affective quality, unpleasantness, is only a contingent property of pain and that it is by this that we establish the reference for pain. Then we could imagine a situation in which pain, namely an unpleasant, hurtful experience, would have been felt without C-fibers stimulation. Of course, the identity theorist would insist that this experience is not really pain since unpleasantness is not essential to pain. But sensory quality is essential and this is identical with C-fibers stimulation, so pain is necessarily identical with C-fibers stimulation. Thus, it is only before we know pain's true nature that we are able to imagine it to exist without C-fibers stimulation, but afterwards we recognize our mistake.

The same is true for the possibility of imagining a situation in which C-fibers stimulation is not felt as pain. Here we would not even have to imagine some counteractual situation, since a patient suffering from pain asymbolia is a perfect example for this. She proclaims to feel pain, she is able to localize it, to determine its intensity and qualitative character, yet she is simply not bothered by it and does not exhibit any typical pain behavior. If we establish the reference for "pain" according to its hurtful character, then we will first maintain that asymbolic is not experiencing pain. However, after some consideration and ascertaining that the true nature of pain is captured by its sensory quality, we would realize that patient suffering from pain asymbolia is experiencing pain and that stimulation of C-fibers is after all felt as pain.

I do not propose here to determine the true nature of pain, whether it is essentially hurtful or not. But these considerations bring out an important weakness in Kripke's modal argument against the mind-brain identity theory. In the case of water we are able to determine what is possible and what is not, because science has already determined water's true nature, its essence. However, in the case of pain, science is still searching for the right answers, so we are not properly equipped to determine what is possible and what is not concerning pain. Perhaps pain experience is distinct from the physical mechanism, but perhaps it is not.

5. CONCLUSION

To conclude, the main lesson learned from the better scientific understanding of pain for philosophical accounts of the relationship between the mind and the physical is that we need to be weary of drawing definite conclusions and of developing all-encompassing theories. In general, it would probably be better to wait until we gain deeper knowledge regarding the workings of the brain and to content ourselves, for the time being, with more modest proposals.

6. REFERENCES

Armstrong, D. M. (1968). *A materialist Theory of the Mind*. London: Routledge.

Aydede, M. (2005). "Introduction: A Critical and Quasi-Historical Essay on Theoreis of Pain." In Aydede, M. (ed.), *Pain: New Essays on Its Nature and the Methodology of Its Study*. Cambridge, Mass., and London: The MIT Press

Aydede, M. (2008). "Review of Nikola Grahek: *Feeling Pain and Being in Pain*." Notre Dame Philosophical Reviews. URL = <http://ndpr.nd.edu/news/23288-feeling-pain-and-being-in-pain/>.

Feigel (1958). "The 'Mental' and the 'Physical'." In Feigl, H., M. Scriven and G. Maxwell (eds), *Concepts, Theories and the Mind-Body Problem*. Minneapolis: University of Minnesota Press.

Grahek, N. (2007). *Feeling Pain and Being in Pain* (2nd edition). Cambridge, Mass., and London: The MIT Press.

Hughes, Ch. (2014). *Kripke: Names, Necessity, and Identity*. Oxford: Clarendon Press.

International Association for the Study of Pain (2012). "IASP Taxonomy." URL = <http://www.iasp-pain.org/Taxonomy#Pain>.

Kripke, S. (1972). "Naming and Necessity." In Davidson, D., and G. Harman (eds.), *Semantics of Natural Language*. Dordrecht: Reidel.

Kripke, S. (1980). *Naming and Necessity*. Cambridge, Mass.: Harvard University Press.

Lewis, D. (1966). "An Argument for the Identity Theory." *The Journal of Philosophy*, 63: 17–25.

Lewis, D. (1983). "Mad Pain and Martian Pain" with "Postscript." In D. Lewis, *Philosophical Papers*, *Vol. 1*. Oxford: Oxford University Press.

Melzack, R., and P. D. Wall (eds.) (2003). *Handbook of Pain Management*. China: Churchill Livingstone.

Noonan, H. (2013). *Routledge Philosophy Guidebook to Kripke and* Naming and Necessity. Abingdon: Routledge.

Place, U. T. (1956). "Is Consciousness a Brain Process?" *British Journal of Psychology*, 47: 44–50.

Robinson, H. (2016). "Dualism." In Edward N. Zalta (ed.), *The Stanford Encyclopedia of Philosophy* (Spring 2016 Edition), URL = <http://plato.stanford.edu/archives/spr2016/entries/dualism/>.

Salmon, N. (1997). "How not to Derive Essentialism from the Theory of Reference." *The Journal of Philosophy*, 76: 703–725.

Smart, J. J. C. (1959). "Sensations and Brain Processes." *Philosophical Review*, 68: 141–156.

Smart, J. J. C. (2007). "The Mind/Brain Identity Theory". In Edward N. Zalta (ed.), *The Stanford Encyclopedia of Philosophy* (Winter 2014 Edition), URL = <http://plato.stanford.edu/archives/win2014/entries/mind-identity/>

Transitions Between Words

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ABSTRACT
Understanding the associative neuronal mechanisms that underlie language processing remains a research challenge. To address this issue, we have developed a novel ERP paradigm in order to distinguish among the brain signatures of different types of transitions between words; these have been previously hypothesised to reflect transitions between discrete brain states, and described with models of latching dynamics. In this abstract, we present results from a behavioural experiment, designed to test the validity of the novel task, and results from a pilot ERP study, measuring brain responses to seven different transitions between words.

Categories and Subject Descriptors
I.2.7. [**Artificial Intelligence**]: Natural language processing – language models, language parsing and understanding.

General Terms
Experimentation, Languages, Theory.

Keywords
Language comprehension, syntactic and semantic violation, ERPs, everyday-like reading task, transitions between words.

1. INTRODUCTION
Understanding the neural mechanisms underlying language processing is challenging. So far, most studies that address this issue measure responses to semantic/syntactic violations (e.g., Barber & Carreiras, 2005; Kutas & Hillyard, 1980; 1984) or involve unnatural rapid serial stimuli presentation (e.g., Camblin et al. 2007). However, we believe that these methodologies may not be adequate to describe language processing during normal comprehension. We are thus aiming towards developing novel tasks, which include only everyday-like stimuli, enable self-paced reading and do not introduce violations or word-by-word manner of stimuli presentation.

Thus, we have designed a new paradigm in order to advance our understanding of the associative neuronal mechanisms that underlie language processing, which have previously been described with models of latching dynamics (Lerner et al., 2013; Pirmoradian & Treves, 2013; Russo et al. 2008). In order to address this issue, we attempt contrasting the brain signatures of different types of transitions between words. These have been hypothesized to reflect transitions between discrete brain states (Pirmoradian & Treves, 2013; Russo et al. 2008), but have thus far not been addressed in an everyday-like experimental setup.

We conducted two experiments, a behavioural one and an ERP experiment. The behavioural experiment was designed to test the validity of the novel task described below. We then designed an ERP pilot study, which is currently ongoing. We present here qualitative results from this pilot study.

2. ERP SIGNATURES OF LANGUAGE PROCESSING
In order to study the neuronal mechanisms that underlie language processing most ERP studies adopt violation paradigms in which the stimuli are presented in the manner of rapid serial stimuli presentation. In these paradigms, non-grammatical sentences are usually compared with grammatically correct sentences, which are in all other aspects identical to the violation stimuli. These kind of studies assume that when all other linguistic variables are held constant, the brain response to the target stimulus, compared to the control stimulus, reflects processes which are related to the grammatical rule in question.

Traditionally, these studies report several ERP signatures which are related to sentence processing (for a recent review see Caffarra et al. 2015), i.e., **the early left anterior negativity (ELAN)** which peaks in response to violations of an obligatory phrase structure (e.g., Friederici & Weissenborn, 2007; Hahne & Friederici, 1999; Steinhauer & Drury, 2012), **the left anterior negativity (LAN)** in response to morphosyntactic violations (e.g., Molinaro, Barber & Carreiras, 2011; Molinaro, Vespignani, Zamparelli, & Job, 2011) **N400** in response to lexical-semantic anomalies (e.g., Federmeier, 2007; Hagoort, 2003; Kutas & Federmeier 2000;2011; Van de Meerendonk, 2010) and **P600** in response to various violations of syntactic and morphosyntactic features (e.g., Carreiras et al. 2004; Friederici et al., 1993; Molinaro, Barber & Carreiras, 2011).

However, we believe that this methodology may not be adequate to describe language processing during normal, everyday-like comprehension, when typically no violations of the kind described above are present. Thus, we are aiming towards developing novel paradigms to address the issue of language processing during normal comprehension.

3. METHOD
3.1 Participants
The participants in our study were native Italian speakers. All the participants were right-handed and aged between 22 and 30. In the behavioural experiment, 10 participants have taken part. In the ongoing ERP experiment, 10 participants have participated so far, who did not take part in the behavioural experiment.

3.2 Stimuli
Our stimulus set comprised 336 different words, which latch on one another through one of 7 different types of transition: letter-

addition (e.g., *auto – avuto*), -omission (e.g., *scorretti – sorretti*), -change (e.g., *gira – gara*), anagram (e.g., *cromate – mercato*), antonym (e.g., *selvatico – domestico*), synonym (e.g., *maniero – castello*), and semantic relation (e.g., *galline – uova*).

3.3 Design and procedure

We developed a novel task for ERP studies which enables to distinguish between different types of transitions between words in self-paced reading without rapid serial stimuli presentation. Furthermore, our task did not introduce any kind of violations of semantic expectations.

Additionally, the design of the task itself was not our invention, but rather brings into laboratory an old and popular Italian enigmatic game named Il Bersaglio (see Figure 1), with which native Italian speakers are very well-acquainted.

Figure 1: The game "Il Bersaglio" as it appears in an Italian printed magazine *La Settimana Enigmistica*.

During the task in our experimental setup, the participants were presented with target words, which were displayed in the form of 12 rounds of a simple computer game. Each game included 28 different Italian words, displayed in a 7x4 grid (see Figure 2). Each game started from the word, indicated in green colour. The participants had to click on the consecutive word, which corresponded to one of the seven types of transitions, described above. If they have selected the correct word, i.e. the correct transition type, the selected word turned green. If their selected word was wrong, they received a feedback in red colour to indicate their mistake. The goal of the game was to find the (only) correct sequence in the entire grid, and to move quickly to the next round.

Two experiments were conducted, a pilot behavioural one in order to test the validity of the task and an ERP one, which is currently ongoing.

Figure 2: A round of a computer game, with indicated the starting word in green (bottom-right) and the correctly selected consecutive word, which latches to the starting word through a letter-omission transition.

3.4 EEG recording

The EEG was continuously recorded using the ActiveTwo BioSemi system (BioSemi V.O.F., Amsterdam, Netherlands) with 128 channels covering the entire scalp. EEG signals were sampled at a rate of 1000 Hz and average reference was used. The vertical electrooculogram (VEOG) was recorded from above and under the left eye.

3.5 Data analysis

The acquired event related EEG was analysed using EEGLAB, open source MATLAB (The Matworks, Natick, MA) toolbox for EEG processing. Data was high-pass filtered at 0.15 Hz and low-pass filtered at 30 Hz, and re-referenced to the average reference. Data segmentation followed, from 1500 ms before to 200 ms after the participant's mouse clicks to selected words. A baseline correction was performed (from 1500 ms to 1000 ms before the mouse click) before all segments were visually inspected in order to remove those containing artifacts. Before extraction of the epochs of the 7 different conditions (i.e. letter-addition, -omission, -change, anagram, antonym, synonym, and semantic relation) the data was pre-processed and artefacts were omitted using independent component analysis (ICA).

4. RESULTS

4.1 Behavioural experiment

Prior to the EEG experiment, we conducted a behavioral, reaction time (RT) experiment in order to test the validity of the task. Figure 3 presents results for 19 participants and shows the considerable variability in the mean reaction times among seven different types of transitions, also among semantic and word-form subtypes taken separately. There is a factor of 2 between the mean time required for the fastest (letter-omission, ca. 4s) and for the slowest (anagram, ca. 8s) type of latching.

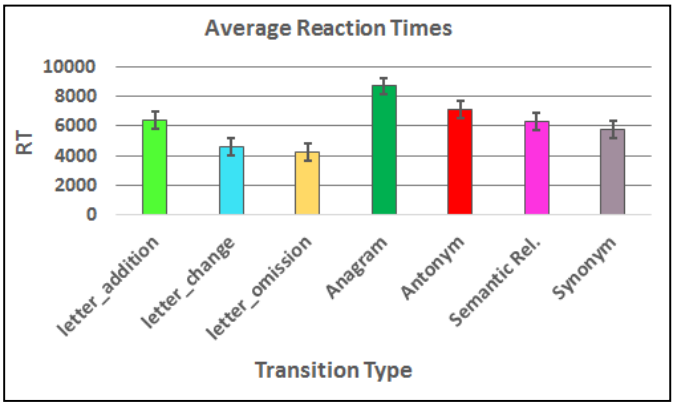

Figure 3: Results of the behavioural part of the experiment, showing participants' RTs when dealing with specific types of transitions (N=19).

We ran a paired samples test with the two different transition classes, semantic (i.e. antonym, semantic relation and synonym) and word-form (i.e. letter-addition, -change, -omission). Results confirm that the reaction times are significantly faster in the word-form transition class ($t(18) = -2.957$, $p = .008$).

4.2 ERP experiment

Since the ERP experiment is currently ongoing, we present results from our pilot study, which indicate different ERP signatures for the seven different types of transitions. Figures 4 and 5 present the data visualisation for nine subjects on a single electrode (D13) in the period from 1000 ms before and 200 ms after the mouse click.

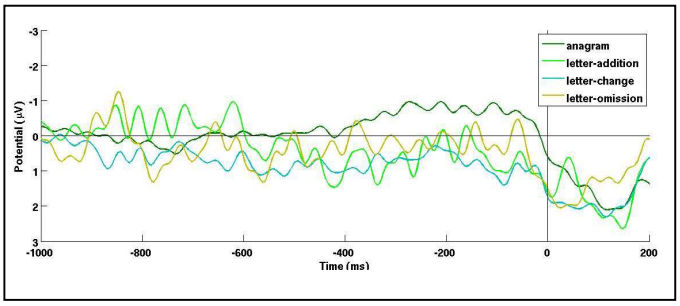

Figure 4: The ERP signatures of the word-form types of transitions (N=9).

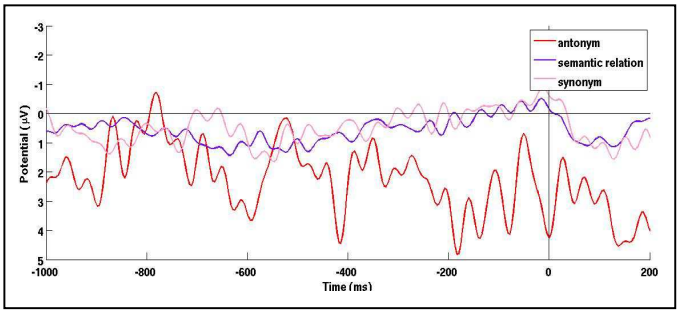

Figure 5: The ERP signatures of the semantic types of transitions (N=9).

5. SUMMARY AND DISCUSSION

In this study, we present a novel paradigm to disentangle distinct associative mechanisms that contribute to language processing. The new paradigm avoids the use of syntactic or semantic violations and rapid serial stimuli presentation, but rather focuses on self-paced reading of grammatically correct stimuli within a natural and highly engaging game environment.

The results of the behavioural experiment suggest that there is a difference in the processing of different types of transitions, which can be observed at least in the different reaction times. We were thus able to verify the basic viability of the novel paradigm before engaging in the main, ERP experiment, which is currently ongoing. Nevertheless, the first ERP data visualisation suggests distinct differences in the EEG signatures of different types of transitions, and thus sheds promising light to our future goal of relating different brain signatures to distinct associative mechanisms that underlie semantic and word-form processing in the brain.

6. REFERENCES

[1] Barber, H., & Carreiras, M. 2005. Grammatical gender and number agreement in Spanish: An ERP comparison. J of Cognitive Neuroscience, 17(1), 137–153. DOI=10.1162/0898929052880101.

[2] Caffarra, S., Molinaro, N., Davidson, D., & Carreiras, M. 2015. Second language syntactic processing revealed through event-related potentials: an empirical review. Neurosci. & Biobehavioral Rev., 01/2015; 2015(51C):31-47. DOI=10.1016/j.neubiorev.2015.01.010.

[3] Camblin C.C., Gordon P.C., Swaab T.Y. 2007. The interplay of discourse congruence and lexical association during sentence processing: Evidence from ERPs and eye tracking. J Mem Lang., 56(1), 103-128. DOI0=10.1016/j.jml.2006.07.005.

[4] Carreiras, M., Salillas, E., & Barber, H. 2004. Event-related potentials elicited during parsing of ambiguous relative clauses in Spanish. Cognitive Brain Research, 20(1), 98–105. DOI=10.1016/S0926-6410(04)00041-2.

[5] Federmeier, A. D. 2007. Thinking ahead: The role and roots of prediction in language comprehension. Psychophysiology, 44(4), 491–505. DOI=10.1111/j.1469-8986.2007.00531.x.

[6] Friederici, A. D., & Weissenborn, J. 2007. Mapping sentence form onto meaning: The syntax–semantic interface. Brain research, 1146, 50–58. DOI= 10.1016/j.brainres.2006.08.038.

[7] Friederici, A. D., Pfeifer, E., & Hahne, A. 1993. Event-related brain potentials during natural speech processing: Effects of semantic, morphological and syntactic violations. Cognitive brain research, 1(3), 183–192. DOI=10.1016/0926-6410(93)90026-2.

[8] Hagoort, P. 2003. Interplay between syntax and semantics during sentence comprehension: ERP effects of combining syntactic and semantic violations. J. of Cognitive Neurosci., 15(6), 883–899. DOI= 10.1162/089892903322370807.

[9] Hahne, A., & Friederici, A. D. 1999. Electrophysiological evidence for two steps in syntactic analysis: Early automatic and late controlled processes. J. of Cognitive Neurosci., 11(2), 194–205. DOI= 10.1162/089892999563328.

[10] Kutas, M., & Hillyard, S. A. 1980. Reading senseless sentences: Brain potentials reflect semantic incongruity. Science, 207(4427), 203–205. DOI= 0.1126/science.7350657.

[11] Kutas, M., & Hillyard, S. A. 1984. Brain potentials during reading reflect word expectancy and semantic association. Nature (307), 161-3. DOI=10.1038/307161a0.

[12] Kutas, M., & Federmeier, K. D. 2000. Electrophysiology reveals semantic memory use in language comprehension. Trends in cognitive sci., 4(12), 463–470. DOI= 10.1016/S1364-6613(00)01560-6.

[13] Kutas, M., & Federmeier, K. D. 2011. Thirty years and counting: Finding meaning in the N400 component of the event-related brain potential (ERP). Annual rev. of psychology, 62, 621. DOI= 10.1146/annurev.psych.093008.131123.

[14] Lerner, I., Bentin, S., Shriki, O. 2013. Spreading activation in an attractor network with latching dynamics: automatic semantic priming revisited. Cogn Sci., 36(8):1339-82. DOI=10.1111/cogs.12007.

[15] Molinaro, N., Barber, H. A., & Carreiras, M. 2011. Grammatical agreement processing in reading: ERP findings and future directions. Cortex, 47(8), 908–930. DOI= 10.1016/j.cortex.2011.02.019.

[16] Molinaro, N., Vespignani, F., Zamparelli, R., & Job, R. 2011. Why brother and sister are not just siblings: Repair processes in agreement computation. J. of Memory and Language, 64(3), 211–232. DOI=10.1016/j.jml.

[17] Pirmoradian, S., & Treves, A. 2013. Encoding words into a Potts attractor network. In Proceedings of the thirteenth neural computation and psychology workshop (ncpw13) on computational models of cognitive processes, World Scientific press, Singapore (pp. 29–42).

[18] Russo, E., Namboodiri, V. M., Treves, A., & Kropff, E. 2008. Free association transitions in models of cortical latching dynamics. New Journal of Physics, 10(1), 015008. DOI=10.1088/1367-2630/10/1/015008.

[19] Steinhauer, K., & Drury, J. E. 2012. On the early left anterior negativity (ELAN) in syntax studies. Brain and language, 120(2), 135–162. DOI=10.1016/j.bandl.2011.07.001.

[20] Traxler, M., & Gernsbacher, M. A. 2011. Handbook of psycholinguistics. Academic Press.

[21] Van de Meerendonk, N., Kolk, H. H., Vissers, C. T. W., & Chwilla, D. J. 2010. Monitoring in language perception: mild and strong conflicts elicit different ERP patterns. J. of Cognitive Neurosci., 22(1), 67–82. DOI= 10.1162/jocn.2008.2117.

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POVZETEK

V prispevku predstavim tezo o razširjenem umu, kot sta jo leta 1998 predstavila Clark in Chalmers. Temu sledita dva vala razprav, ki temeljita na načelu enakosti (prvi val) in na načelu komplementarnosti (drugi val). V nasprotju s kritiki, ki kognicijo postavljajo v glavo, ideja razširjenega uma upošteva, da telo, artefakti in druge zunanje strukture skupaj z možgani tvorijo kognitivni sistem, ki opravlja različne kognitivne naloge kot so pomnjenje, zaznavanje, jezikovno sporazumevanje, učenje in sklepanje.

Ključne besede

Razširjena kognicija, utelešena kognicija, načelo komplementarnosti, kognitvna znanost

1. UVOD

Andy Clark in David Chalmers sta leta 1998 v reviji *Analysis* objavila članek z naslovom "The Extended Mind" (Clark, Chalmers, 2010). Avtorja s tezo o razširjenem umu[1] zagovarjata stališče, da človekov um ni omejen z mejami svojega telesa, saj okolje predstavlja konstitutivni del kognitivnega procesiranja. S to, za mnoge filozofe kognitivne znanosti precej drzno tezo, sta avtorja vstopila v filozofske razprave, kako razumeti in utemeljevati nov pristop, ki se je uveljavljal pod imeni utelešena, udejanjena in umeščena kognicija (npr. Varela et. al., 1991; Clark, 1997, 2008; Gibbs, 2006; Wilson, 2004; Wilson M., 2002). Njun članek je takoj spodbudil živahno razpravo, ki se do dandanes še ni izčrpala. V tem prispevku bom predstavila njuno idejo in razloge, ki jih navajata v podporo svojemu stališču. Nato bom izpostavila najpogostejše ugovore, ki jih tezi razširjene kognicije in aktivnega eksternalizma zoperstavljajo njuni kritiki. Ti kognicijo postavljajo v človekovo glavo, vse ostalo (deli telesa, artefakti, deli sveta) pa šteje zgolj kot potencialno vzročno delujoče okolje. V drugem delu bom predstavila dva vala razprav o razširjenem umu, ki temeljita na načelu enakosti (prvi val) in na načelu komplementarnosti (drugi val). Razprave v tem prispevku so omejene na kognitivne procese v ožjem smislu, vprašanje, ali lahko na podoben način obravnavamo čustva, izkustvo in zavest, pa bi zahtevalo dodatno razpravo.

2. RAZŠIRJENI UM

Vprašanje, ki je v jedru razprave o razširjenem umu / razširjeni kogniciji, lahko najbolj enostavno izrazimo s stavkom, s katerim Clark in Chalmers začneta svoj članek: »Kje se konča um in kje se začne svet?« (Clark, Chalmers, 2010: 27). Odgovorov na vprašanje je lahko več, tudi če se omejimo le na nedualistična stališča. Mejo lahko predstavlja koža, tako da je vse, kar je zunaj telesa, tudi zunaj uma. Internalisti bi ločnico postavili še bolj ostro in bi izločili vse, kar je izven možganov in živčnega sistema. Na drugi strani so zagovorniki tradicionalnega eksternalizma pomena (npr. Putnam, 1975; Burge, 1986), ki menijo, da pomena ni mogoče reducirati na notranja stanja. Clark in Chalmers pa gresta še dlje in za razliko od take šibkejše, pasivne različice, zagovarjata *aktivni eksternalizem*, katerega značilnost je »aktivna vloga okolja v vodenju kognitivnih procesov« (Clark, Chalmers, 2010: 27).

Trditev o aktivnem eksternalizmu je lahko dvoumna in dopušča dve interpretaciji (Menary, 2010: 1). Po prvem, bolj ali ne trivialnem branju, vzročno delujoče značilnosti okolja vplivajo na kognitivno procesiranje v možganih. Tako razumevanje bi bilo združljivo tudi z internalističnim pogledom. Druga, bolj radikalna interpretacija, pa gleda na okolje kot na konstitutivni del kognitivnih procesov. »Če, ko se soočamo z določeno nalogo, del sveta deluje kot proces, za katerega ne bi imeli zadržkov, da bi ga prepoznali kot kognitivni proces, *v kolikor bi se zgodil v glavi,* potem ta del sveta *je* (tako trdiva) del kognitivnega procesa. Kognitivni procesi niso (vsi) v glavi.« (Clark, Chalmers, 2010: 29). Clark in Chalmers menita, da je v takih primerih človek povezan z zunanjo entiteto v dvosmerni interakciji, ki tvori sklopljen sistem (*coupled system),* ki ga lahko smatramo za kognitivni sistem. Vse komponente v sistemu igrajo aktivno vzročno vlogo in skupaj upravljajo vedenje na enak način, kot to običajno počne kognicija. Relevantni deli sveta so v zanki in niso zgolj bingljajoči deli na koncu dolge vzročne verige. (ibid.). Aktivni eksternalizem torej ni zgolj vzročna trditev, po kateri bi zunanje značilnosti, s katerimi je organizem v interakciji, vzročno vplivale na kognitivne procese, ampak predstavlja konstitutivno tezo.

2.1 Miselni eksperiment: Inge in Otto

Clark in Chalmers v podporo tezi, da so prepričanja lahko deloma utemeljena na značilnostih okolja, v kolikor te značilnosti igrajo ustrezno vlogo pri vodenju kognitivnih procesov, navedeta miselni eksperiment (Clark, Chalmers, 2010: 33 - 37). V njem nastopata Inge in Otto. Inge od prijatelja izve za razstavo v Muzeju moderne umetnosti in se odloči, da jo gre obiskati. Za trenutek pomisli in se spomni, da je muzej na 53 ulici. Zato se odpravi na 53 ulico in gre v muzej. Kot ugotavljata avtorja, se zdi jasno, da je Inge prepričana, da je muzej na 53 ulici in da je to verjela celo preden je »povprašala« svoj spomin. Prepričanje je bilo nekje v spominu in je čakalo na priklic. Nato predstavita Otta, ki ima Alzheimerjevo bolezen. Zato je odvisen od informacij iz okolja, ki mu pomagajo strukturirati življenje. Nove informacije si zapisuje v zvezek in kadar potrebuje stare informacije, pogleda vanj. Zvezek igra vlogo, ki jo ima običajno biološki spomin. Ko Otto izve za razstavo v Muzeju moderne umetnosti in se odloči za obisk, pogleda v zvezek, kjer je zapisano, da je Muzej na 53 ulici. Torej se odpravi na 53 ulico in gre v muzej. Clark in Chalmers sta

1 Izraz "extended mind" bom tu prevajala z izrazom "razširjeni um".

mnenja, da sta oba primera v vseh relevantnih karakteristikah podobna.

2.2 Štiri značilnosti

Kritik bi lahko takoj postavil vprašanje, ali potem vsak zvezek (ali morda kar ves internet) šteje kot del mojega spomina. Da bi se izognila pretirani poljubnosti, avtorja izpostavita štiri značilnosti, ki so prisotne v primeru Otta in ki naj bi onemogočale preveliko poljubnost. Prvič, zvezek je konstanta v Ottovem življenju – v primerih, ko so informacije v zvezku relevantne, bo le redko izvedel dejanje, ne da bi pogledal v zvezek. Drugič, informacije iz zvezka so brez težav neposredno dostopne. Tretjič, ko enkrat pridobi informacije iz zvezka, jih avtomatično sprejme. Četrtič, informacije v zvezku so bile enkrat v zgodovini zavestno sprejete. Glede zadnje točke dopuščata, da je ta kriterij za prepričanje morda preoster, saj je mogoče, da bi lahko prišel do prepričanja tudi na nezaveden način (npr. subliminalno zaznavanje). (Clark, Chalmers, 2010: 39) S temi pogoji je po njunem mnenju mogoče omejiti tiste dele okolja, ki jih je mogoče vključiti v razširjeno kognicijo.

2.3 Odlaganje v okolje

Podobnih primerov, kjer so določene funkcije »odložene« v okolje, je še več. Na primer, pri štetju si pogosto pomagamo s prsti. Kadar moramo sešteti dve veliki števili, npr. 3689 in 2463, potem nam je v pomoč papir in svinčnik, tako da lahko zapišemo števili eno pod drugo in na ta način veliko laže izvedemo seštevanje. Ali pa, dandanes še bolj pogosto, številki vpišemo v računalo v telefonu. Zanimiv primer je tudi računalniška igra Tetris, kjer igralec lahko padajoče like »obrača v mislih« in nato izvede ustrezen obrat na tipkovnici, ali pa obračanje hitro izvaja s tipkami in tako doseže ustrezen rezultat. Na ta način rešuje problem tako, da kognitivno nalogo (mentalna rotacija) prenese v zunanji svet. Orodje, ki ga danes zelo pogosto uporabljamo in se naj zanašamo kot na nekakšen zunanji spomin, pa so internetni iskalniki, o čemer več v nadaljevanju.

2.4 Vzročna sklopitev ali konstitucija

Kritiki teze o razširjenem umu izpostavljajo, da je argumentacija, ki privede do močnejše teze aktivnega eksternalizma, zmotna. Napak je v tem, da iz vzročne združitve predmeta ali procesa z akterjem sklepajo, da je ta predmet ali proces del kognitivnega akterja ali del akterjevega kognitivnega procesa. Adams in Aizawa to humorno ponazorita takole (Adams, Aizawa, 2010: 67):

Vprašanje: Zakaj je svinčnik mislil, da je 2 + 2 = 4?

Clarkov odgovor: Ker je bil sklopljen z matematikom.

Kritika opozarjata, da je relacija vzročne sklopitve različna od relacije konstitucije. Kot ilustracijo navedeta primer živčnomišičnega stika. »Živci, ki vodijo do živčnomišičnega stika, so sklopljeni z mišicami, ki jih oživčujejo, a živci niso del mišic, ki jih oživčujejo. Sprostitev nevrotransmiterjev v živčnomišičnem stiku je sklopljena s procesom krčenja mišice, toda proces sprostitve nevrotransmiterjev v živčnomišičnem stiku ni del procesa mišičnega krčenja.« (Adams, Aizawa, 2010: 68)

Adams in Aizawa menita, da do zmote prihaja zato, ker Clark in Chalmers ne opredelita, kaj razlikuje kognitivno od ne-kognitivnega. Čeprav se tudi sama zavedata, da je težko podati popolno teorijo, kot bistveni določili navedeta dvoje. Prvič, v kognitivnih procesih nastopajo ne-izpeljane reprezentacije, to je reprezentacije, ki pomenijo, kar pomenijo, neodvisno od drugih reprezentacij ali intencionalnih zmožnosti. Drugič, kognitivno je določeno s specifičnimi vrstami mehanizmov za procesiranje informacij, ki jih umestita v možgane (Adams, Aizawa, 2010: 31). Predvsem slednje po mojem mnenju kaže, da avtorja ostajata znotraj internalističnega pojmovanja. Kognitivni in mentalni pojavi so implementirani v možganih, in hkrati samo tisti procesi, ki so implementirani v možganih, štejejo kot kognitivni procesi. Takšno stališče že vnaprej onemogoča možnost razširjene kognicije.

3. DVA VALA RAZPRAV O RAZŠIRJENEM UMU

3.1 Prvi val in načelo enakosti

Zdi se, da velik del nelagodja, ki ga zbuja teza razširjenega uma, izhaja iz *načela enakosti* (*parity principle*), na katerem temelji Clarkova in Chalmersova opredelitev. Gre za idejo, da so kognitivna stanja in procesi razširjeni preko možganov v zunanji svet kadar relevantni deli sveta funkcionirajo na enak način, kot kognitivni procesi v glavi. «Če pri reševanju določene naloge del sveta funkcionira kot proces, ki bi ga brez zadržkov, *v kolikor bi se zgodil v glavi*, sprejeli kot kognitivni proces, potem ta del sveta *je* …. del kognitvnega procesa.« (Clark, Chalmers, 2010: 29). John Sutton diskusije, ki so idejo razširjenega uma povezovale predvsem z načelom enakosti, imenuje *prvi val* razprav o razširjenem umu. (Sutton, 2010: 193). Meni, da načelo enakosti poudarja funkcionalni izomorfizem notranjih in zunanjih procesov in stanj. Če *exogrami* delujejo kot *engrami,* potem je razlika v njihovi lokaciji zgolj navidezna. (ibid.) Bilo bi šovinistično in nepravično, če bi Ottov zvezek in Ingine možgane obravnavali drugače zgolj zato, ker je zvezek zunanji. Na podlagi načela enakosti teza razširjenega uma zavrača meje med možgani, telesom in svetom ter na ta način spodkopava domnevo, da so kognitivni procesi notranji, zunaj pa je nekognitivno. (ibid.: 195) V prvem valu kritiki teze razširjenega uma izpostavljajo predvsem razlike med »znotraj« in »zunaj«. Opozarjajo, da so procesi znotraj in zunaj glave (*intracranial* in *transcranial*) relevantno drugačni kar se tiče oblike reprezentacij in dinamike (npr. že omenjena kritika Adamsa in Aizawe, 2010).

3.2 Drugi val in načelo komplementarnosti

Tezo o razširjenem umu pa ne podpira samo načelo enakosti, v Clarkovem delu je prav tako močno prisotno razmišljanje o tem, na kakšen način pridružiti zunanja stanja in procese, da bo celoten sistem lahko uspešnejši. »Inteligenco uporabljamo za strukturiranje okolja, tako da lahko uspemo z *manj* inteligence. Naši možgani delajo svet pameten, tako da bomo lahko v miru neumni. Ali, če pogledamo z druge strani, možgani *in* deli zunanjega ogrodja na koncu sestavljajo pameten, racionalen sklepalni stroj, ki ga imenujemo um« (Clark, 1997: 180). Taka razmišljanja Sutton jemlje kot izhodišče za drugi val razpravljanja o razširjenem umu, ki temelji na *načelu komplementarnosti*. Po tem načelu v razširjenih kognitivnih sistemih zunanjim stanjem in procesom ni treba posnemati ali ponavljati oblik, dinamike ali funkcij notranjih stanj in procesov. Različne komponente sistema igrajo različne vloge in imajo različne lastnosti, ko prispevajo k razmišljanju in delovanju. *Exogrami* (zunanji simboli) so lahko radikalno drugačni od *engramov* (možganske spominske sledi), ko skupaj prispevajo k skupnim ciljem. (Sutton, 2010: 194).

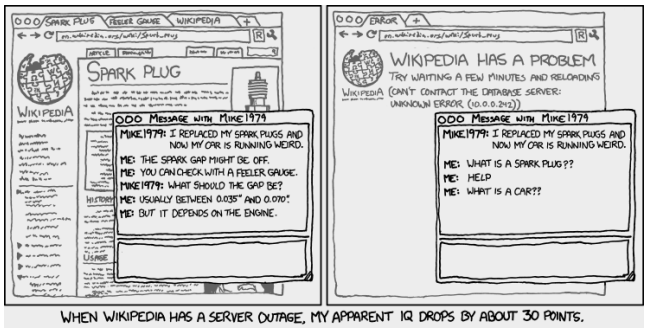
Zdi se, da nekatera nelagodja, ki so bila prisotna v prvem valu, v drugem ne igrajo več tako pomembne vloge. Drugi val ne zahteva,

da sprejmemo trditev, da kognitivna stanja in procese lahko pripisujmo delom sveta, ki lahko obstajajo neodvisno od nas (npr. zvezku). Prav tako artefakti ne delujejo nujno le kot nadomestila za možgane, ki udejanjajo enake procese. Ideja razširjenega uma tako ne sloni le na načelu enakosti, ampak upošteva, da telo, artefakti in druge zunanje strukture skupaj z možgani tvorijo kognitivni sistem, ki opravlja različne kognitivne naloge kot so pomnjenje, zaznavanje, jezikovno sporazumevanje, učenje in sklepanje.

Kot primer, kako kognitivni model temelji na načelu komplementarnosti, lahko vzamemo konekcionistčni model. Predstavljamo si ga lahko kot asociativno mrežo, kjer ne moremo shranjevati izoliranih atomarnih reprezentacij, ki bi jih lahko nadalje sestavljali po pravilih. Da bi taka mreža lahko opravljala kognitivne naloge simbolnega komuniciranja, je morala biti izpostavljena simbolnemu sistemu v okolju. Ustrezna mreža se je na tak način lahko naučila sistematičnega razumevanja stavkov. Vendar kritiki tega niso smatrali za izpolnitev naloge, saj po njihovem mnenju do tega ni prišlo zaradi notranje strukture jezika misli (Fodor in Pylyshyn, 1988). V nasprotju s takim internalističnim stališčem pa so konekcionisti poudarjali, da je potrebno jemati mrežo in zunanji simbolni sistem kot celoto, saj šele tako lahko uspešno opravi nalogo. (Markič, 2011).

Dejstvo, da imajo sodobni računalniški pripomočki, predvsem internet in pametni telefoni, vpliv na naša reševanje kognitivnih nalog, verjetno ni sporno. Sparrow, Liu in Wegner (2011) so raziskovali posledice uporabe iskalnika Google na organizacijo spomina. Svoje izsledke so objavili v članku "Google Effects on Memory: Cognitive Consequences of Having Information at Our Fingertips". Izkazalo se je, da bomo stvari, za katere smo prepričani, da jih lahko najdemo na internetu, prej pozabili kot pa tiste, za katere mislimo, da jih na internetu ne bomo našli. Prav tako se je pokazalo, da si bolje zapomnimo, kje na internetu poiskati informacijo, kot pa si jo zapomniti. Če na rezultate pogledamo v luči prej omenjenega Clarkovega citata, potem lahko pritrdimo, da je človeška inteligenca razvila orodja, ki človeka skupaj z orodji bolje usposobi za kognitivne naloge, a človek sam postaja morda res še bolj neumen.

Uporaba spletnih iskalnikov prav gotov že zdaj precej vpliva na naše vsakdanje aktivnosti in kot tudi na izobraževanje, wikipedia pa je stran, ki jo ponavadi najprej obiščemo, ko iščemo informacije. Če stran ni dosegljiva....



Slika 1: http://xkcd.com/903/

4. ZAKLJUČNE MISLI

Kako torej razumeti vprašanje o mejah kognicije. Adams in Aizawa (2008) vprašanje opredelita takole: »Vprašati se o mejah kognicije pomeni vprašati se, katere predele prostora-časa zavzema kognitivno procesiranje. Vprašati se, kateri fizični, kemični ali biološki procesi realizirajo, sestavljajo ali utelešajo kognitivne procese. Vprašati se o supervenientni bazi kognicije. Vprašati se o fizičnem substratu kognicije.« (Adams, Aizawa, 2008: 16). Spraševanje po mejah kognicije je zanju dejansko spraševanje, kako je omejen fizični substrat, v katerem je kognicija realizirana. Gre za pogled, ki ga delijo fizikalistično usmerjeni filozofi, ki sprejemajo, da je kognicija na tak ali drugačen način realizirana v biološkem organizmu, čeprav med njimi lahko prihaja do razlik, kje natančno je baza realizacije (celotni možgani, del možganov, možgani in hrbtenjača, itd.). Ko pa avtorja vzameta v pretres predloge razširjene kognicije, je zanju dopustna samo razširitev na hrbtenjačo in čutne živce, vse ostale predloge, kjer bi imeli vlogo še ostali deli telesa (mišice, koža, kosti) pa zavrneta kot nesprejemljive z vidika kognitivne psihologije (kar imenujeta ortodoksija). Prav tako zavračata tudi vse nadaljnje razširitve v svet (npr. artefakti kot so zvezek, telefon, itd.). Kot pravita sama, potem ne gre več za razširjeno kognicijo ampak za hipotezo kognitivnega sistema, kar pa po njunem ni isto, saj se pri slednjem kognicija pač vpeta v sistem vzročnih povezav.

Zdi se, da se razširjeni um, utemeljen na načelu komplementarnosti precej približa pojmovanju kognitivnega sistema. A vendarle so med njima pomembne razlike. Zagovornik razširjenega uma poudarjajo, da je procesiranje v biološkem organizmu bistveno določeno z dejavniki utelešenja in okolja, tako da šele sistem v celoti t.j.– razširjeni um lahko opravlja kognitivne naloge. Kot razumem, kognicija zato ne more biti omejena zgolj na živčni sistem (saj je v živem organizmu vedno utelešena). Samo analiza vsakokratnega sistema lahko da bolj natančen odgovor in se izogne preveliki vključenosti vsega. Dobro je, da tak pristop odpira nove perspektive, kako razumeti interdisciplinarnost – relacije med biološkimi, psihološkimi, humanističnimi in družboslovnimi pristopi. Zdi se, da si lahko vsaj v grobih obrisih predstavljamo, kako je vlogo orodja za širitev kognicije odigral jezik (Mithen, 2005). Kakšen pa bo vpliv novih tehnologij, ki predstavljajo nebiološko ogrodje, so kiborgi že na pohodu?

5. REFERENCE

[1] Adams, F., and Aizawa, K. 2008. The Bounds of Cognition. Oxford: Blackwell.

[2] Adams, F., and Aizawa, K. 2010. Defending the Bounds of Cognition. V Menary R. (ur.) *The Extended Mind.* Cambridge, MA: MIT Press, 67-80.

[3] Burge, T. 1986. Individualism and psychology. *Philosophical Review*, 94, 1, 3 – 45.

[4] Clark, A., 1997. *Being There: Putting Brain, Body, and World Together Again.* Cambridge, MA: MIT Press.

[5] Clark, A. 2001. *Mindware: An Introduction to the Philosophy of Cognitive Science.* Oxford: Oxford University Press.

[6] Clark, A., 2008. *Supersizing the Mind.* New York: Cambridge University Press.

[7] Clark, A. Chalmers, D. 2010. The extended Mind. V Menary R. (ur.) *The Extended Mind.* Cambridge, MA: MIT Press, 27-42.

[8] Gibbs, R. 2006. *Embodiment and Cognitive Science.* Cambridge: Cambridge University Press.

[9] Fodor, J.A. and Pylyshyn, Z.W. 1988. Connectionism and Cognitive Architecture: A Critical Analysis. *Cognition*, 28, str. 3-71.

[10] Markič, O. 2011. *Kognitivna znanost: filozofska vprašanja*. Maribor: Aristej.

[11] Menary, R. 2010. Introduction: The Extended Mind in Focus. V Menary R. (ur.) *The Extended Mind.* Cambridge, MA: MIT Press, 1-26.

[12] Mithen, S. J. 2006. *The Singing Neanderthals: the Origins of Music, Language, Mind and Body* London: Phoenix.

[13] Putnam, H. 1975. *Mind, Language, and Reality.* Cambridge: Cambridge University Press.

[14] Sparrow B, Liu J, Wegner DM. Google effects on memory: Cognitive consequences of having information at our fingertps. *Science*. 2011;333 :776-778.

[15] Sutton, J. 2010. Exograms and Interdsciplinarity: History, the Extended Mind, and the Civilizing Process. V Menary R. (ur.) *The Extended Mind.* Cambridge, MA: MIT Press, 189-226.

[16] Varela, F., Thompson, E. and Rosch, E. 1991. *The Embodied Mind: Cognitive Science and Human Experience.* Cambridge, MA: MIT Press.

[17] Wilson, M. 2002. Six views of embodied cognition. *Psychonomic Bulletin & Review*, 9 (4), pp. 625–636.

[18] Wilson, R. 2004. *Bounderies of the Mind: The Individual in the Fragile Sciences.* Cambridge: Cambridge University Press.

Cognitive interpretation of instrumentally assessed pain reports

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ABSTRACT
Pain is one of the most recognised somatosensory modalities with important cognitive connotations. Multimodal unpleasant psychic and physiological phenomenon is expressed in wide spectrum of symptoms and signs which can be convincingly and realistically assessed and evaluated by neurological, neurophysiological and psychological methods. Cognition of alert and cooperative examined person is decisive. Modern instruments with information technology improve accurate diagnostic procedure and support mechanism based management. For confirmation of characteristics like kind, severity, time and distribution of perceptions particular protocols were developed. Subjectivity enriches meaning of reports in diagnostic procedure.

General Terms
Measurement, Reliability, Experimentation, Human Factors, Theory, Verification.

Keywords
Cognition, Pain, Quantitative sensory testing, Sensory perception, Somatic sensory alterations, Subjectivity and objectivity

1. INTRODUCTION
Somatic sensibility includes multiple modalities. Unpleasant experience, e.g. pain, represents a complicated physiological and psychical function, depending on numerous inner and outer factors. It is an important and ubiquitous phenomenon; inherent general characteristics are modulated by subjective experiences [31, 32].

Diverse somatic sensory functions are related to different systems and procedures. Numerous natural science disciplines are concerned with somatosensory and autonomic nervous systems as well as with physical and chemical processes. Psychic, sociocultural and complementary sciences cover other aspects of this multidimensional phenomena. Conscious recognition of information, received from sensory organs or psychic processes, demands integration and appropriate interpretation of accepted particulars [22, 34]. The subject is aware of perceptions and his conscious reports influence diagnostic thinking. Properly educated and informed professionals could recognise, understand and accept altered symptoms and signs of perceptions. Consequently, burdens, e.g. pain, could be appropriately and effectively managed [3, 12, 21, 44].

2. PAIN
Pain is one of the most prominent somatosensations. It represents a bodily modality with qualities like those reported during tissue-damaging stimulation, experienced threat associated with those sensations, and feelings of unpleasantness or other negative emotions based on those experienced threats [37, 39]. This unpleasant subjective experience, conscious evaluation of information, could not be placed on the same level as nociception. Nociception, train of electrical impulses, refers to the ability to process and encode information relating to noxious (unpleasant, painful or dangerous) stimuli. Nociception and pain should not be confused; nociception is a physiological term and has been used for a long time to describe the neural processes, while cognition – thinking, understanding, learning, and remembering – is a psychic term.

Pain is a physiological and mental process. Recognition of unpleasant sensation demands active participation of mindful subject and well-educated and trained professionals. For now, clinical examinations and psychophysical methods are the best way to gain reliable recognition [18, 24, 26]. For accurate determination of subjective perceptions sophisticated instruments were developed.

3. INSTRUMENTAL ASSESSMENT OF PAIN
Multiple instrumental and clinical methods evaluate pain sensation and alterations. Electro- and magneto-physiological instruments record activities of single neurons or whole systems. Functional specifics of cell membrane or complex brain anatomy can be shown, and extremely precise morphological and functional base of physiological procedures represented [4, 5, 19, 20, 23, 35]. Most temporary examinations are laser-evoked potentials; there are many publications describing obtained results [6, 17, 27, 42]. Regarding definitions [33, 37], examined phenomena are not pain but nociception. For appropriate evaluation of subjective perceptions which exist only in the person who feels them, active participation of a conscious subject is essential.

Instrumental devices repeatedly confirm their recognition power in different experimental and clinical states. Subjectively reported

perception is a perceptual phenomenon with neural underpinnings (nociception). Its assessment from the first-person perspective discloses characteristics which could be evaluated in conjunction with the history, physical examination and other neurophysiological investigations [8, 11, 38]. For scientifically relevant assessment of subjective information, generally accepted methods are needed. Quantitative sensory testing is an instrumental individual psychophysical examination, which is widely used and recognised but have not gained large acceptance in clinical practice [1, 2, 40, 41].

4. METHODS AND PROTOCOLS

Instrumental research is a reflective, interpretive, descriptive, and usually reflexive effort to describe and understand actual instances of action and subjective experience [15]. A scientific psychological, neurological and psychophysical approach uses various methods. Psychophysical methods are the tools for measuring perception and performance, revealing basic perceptual processes, assessing observer performance, and specifying the characteristics of experienced phenomena. Classical standards present scientific methods of studying the relations between body and mind, or between the physical and phenomenal worlds [14]. Multiple dimensions have to be analysed and different methods could be appropriate. Last but not least, contemporary studies recognised instrumental methods as superior in identification of somatosensory alterations [30].

In our outpatient pain clinic, somatic sensory alterations are continuously studied. Quantitative studies were the primary goal in first, "somatic" years. Later, with more experiences, multiple dimensions were appreciated. Qualitative perception characteristics have so far been analysed in 3342 persons, 303 neurologically free volunteers and in 3039 patients. Studies have been running continuously since 1990. All include baseline registration of disease history with special attention on somatosensory symptoms and signs. We use sophisticated instruments for assessing somatic sensory phenomena. Different modalities can be tested. Our interest mostly lies in the sensations, evoked by thermal specific and thermal pain stimuli. Research is performed by psychophysical instrumentation, the TSA-II - NeuroSensory Analyzer (Medoc Ltd., Ramat Yishai, Israel) and Thermotest (Somedic AB, Stockholm, Sweden). Comparable methods have to be used. Thresholds of naturally produced stimuli were always determined by the same thermode with well-defined size (3x3 cm by TSA-II - NeuroSensory Analyzer and 2,5x5 cm by Thermotest, respectively). Tested modality (cold, warmth, cold pain and heat pain) is specified before subject's somatic sensibility is determined. Test sites are chosen according to clinical picture. Examined subjects reported characteristics of perceptions and examiners made a written documentation of elicited comments.

Protocols with tests sequence evolved from baseline [16] till suggested in last article [30]. Abnormalities of perception are described and assessed in terms of inaccuracy in recognition. Assessed sensory alterations improve the possibilities for their early, proper and efficient management [3, 7, 43, 44].

5. INTERPRETATION OF REPORTS

Sensibility alterations are reported as spontaneous ongoing or intermittent symptoms, stimulus-evoked positive and negative sensory phenomena [2]; instrumental approach disclose additional phenomena. We started with quantitative sensory testing [29] and have been concerned with comprehensive sensory testing [30].

Psychophysically tested signals are mostly evaluated only quantitatively, by quantitative sensory testing. Unfortunately, the other aspects of perceptions (qualitative, timely and spatial) are frequently disregarded. We tested characteristics by thermal specific and thermal pain stimuli. The reported phenomena partly equal sensations, described in the McGill pain questionnaire [25]. Very precise and systematic definition, description and depiction of disclosed perceptions and their modalities in diabetics allow comparison of methods and protocols. The findings from the subjective description of perception actually remain the principal indicator of the less known and mostly ignored, as well as less investigated and less clarified sensory perception.

The most important part of the recognition procedure is the comparing of the perceived sensation with the already known patterns. Only if we can find similarities between the two, will we know how to place a sensation within the system – the more the sensation is similar to the already known ones, the easier this placement will be. With some data we can rely on circumstances and similarities. For all of the above, we need an unimpaired cognition. Therefore we speak about "pain" only in relation to a conscious person and are elsewhere concerned merely with nociception.

Conscious recognition of sensory information is a pronounced achievement in diagnostic procedures. It confirms or denies integrity of sensory function and indicates probable underlying pathophysiological mechanisms. Early detection of clinical and even subclinical states is possible and optimal management can be suggested. Through a proper diagnosis, the most effective therapy can be selected and progression predicted [9, 10, 12, 13, 28, 36, 45].

6. CONCLUSION

Cognition critically influences sensations, perceptions and reactions of alert subject. Diagnosis is the beginning of processes that lead to effective and subject oriented management. Pain and other somatic perceptions and alterations are important symptoms and/or signs which enable and stimulate diagnostic thinking and procedure. Effectiveness is guaranteed if reports of mindful subject are appreciated.

7. REFERENCES

[1] Backonja, M.M. et al. 2013. Value of quantitative sensory testing in neurological and pain disorders: NeuPSIG consensus. *Pain*. 154, 9 (2013), 1807–1819.

[2] Backonja, M.M., Walk, D., Edwards, R.R., Sehgal, N., Moeller Bertram, T., Wasan, A., Irving, G., Argoff, C. and Wallace, M. 2009. Quantitative sensory testing in measurement of neuropathic pain phenomena and other sensory abnormalities. *The Clinical Journal of Pain*. 25, 7 (2009), 641–647.

[3] Baron, R., Binder, A. and Wasner, G. 2010. Neuropathic pain: diagnosis, pathophysiological mechanisms, and treatment. *Lancet neurology*. 9, 8 (2010), 807–819.

[4] Barraza-Sandoval, G., Casanova-Mollá, J. and Valls-Solé, J. 2012. Neurophysiological assessment of painful neuropathies. *Expert review of neurotherapeutics*. 12, 11 (2012), 1297–1309.

[5] Basbaum, A.I. and Woolf, C.J. 1999. Pain. *Current*

biology : CB. 9, 12 (1999), R429–R431.

[6] Beck, B., Làdavas, E. and Haggard, P. 2016. Viewing the body modulates both pain sensations and pain responses. *Experimental Brain Research*. 234, 7 (2016), 1795–1805.

[7] Boivie, J. 2003. Central pain and the role of quantitative sensory testing (QST) in research and diagnosis. *European journal of pain (London, England)*. 7, 4 (2003), 339–343.

[8] Decety, J. and Moriguchi, Y. 2007. The empathic brain and its dysfunction in psychiatric populations: implications for intervention across different clinical conditions. *BioPsychoSocial medicine*. 1, (2007), 22.

[9] Denislic, M. and Meh, D. 1997. Early asymmetric neuropathy in primary Sjögren's syndrome. *Journal of neurology*. 244, 6 (1997), 383–7.

[10] Denislic, M. and Meh, D. 1998. Sjögren's syndrome in patients with chronic idiopathic axonal polyneuropathy. *Journal of neurology, neurosurgery, and psychiatry*. 65, 1 (1998), 138–9.

[11] Devor, M. 2008. Nociception in Kyoto. *Pain*. 140, 3 (2008), 519-20–1.

[12] Dworkin, R.H. et al. 2003. Advances in neuropathic pain: diagnosis, mechanisms, and treatment recommendations. *Archives of neurology*. 60, 11 (2003), 1524–1534.

[13] Dworkin, R.H. 2002. An overview of neuropathic pain: syndromes, symptoms, signs, and several mechanisms. *The Clinical journal of pain*. 18, 6 (2002), 343–349.

[14] Ehrenstein, W.H. and Ehrenstein, A. 1999. Psychophysical methods. *Modern techniques in neuroscience research*. U. Windhorst and H. Johansson, eds. Springer. 1211–1241.

[15] Fischer, C.T. 2006. *Qualitative research methods for psychologists: Introduction through empirical studies*. Elsevier Academic Press.

[16] Fruhstorfer, H., Lindblom, U. and Schmidt, W.C. 1976. Method for quantitative estimation of thermal thresholds in patients. *Journal of Neurology, Neurosurgery & Psychiatry*. 39, 11 (1976), 1071–1075.

[17] Geber, C., Baumgärtner, U., Fechir, M., Vogt, T., Birklein, F. and Treede, R.D. 2011. Comparison of LEP and QST and their contribution to standard sensory diagnostic assessment of spinal lesions: A pilot study. *Neurological Sciences*. 32, 3 (2011), 401–410.

[18] Groth-Marnat, G. and Wright, J.A. 2016. *Handbook of psychological assessment*. John Wiley & Sons.

[19] Hartemann, A., Attal, N., Bouhassira, D., Dumont, I., Gin, H., Jeanne, S., Said, G., Richard, J.-L. and Working Group on the Diabetic Foot from the French-speaking Society of Diabetology 2011. Painful diabetic neuropathy: diagnosis and management. *Diabetes & metabolism*. 37, 5 (2011), 377–88.

[20] Hatem, S.M., Attal, N. and Plaghki, L. 2010. Évaluation fonctionnelle des douleurs neuropathiques. *Douleur et Analgésie*. 23, 2 (2010), 78–84.

[21] Hurley, R.W., Adams, M.C.B. and Benzon, H.T. 2013. Neuropathic pain: treatment guidelines and updates. *Current opinion in anaesthesiology*. 26, 5 (2013), 580–7.

[22] Jazayeri, M. and Movshon, J.A. 2006. Optimal representation of sensory information by neural populations. *Nat Neurosci*. 9, 5 (2006), 690–696.

[23] Jensen, K.B., Regenbogen, C., Ohse, M.C., Frasnelli, J., Freiherr, J. and Lundström, J.N. 2016. Brain activations during pain: a neuroimaging meta-analysis of patients with pain and healthy controls. *Pain*. 157, 6 (2016), 1279–1286.

[24] José, B., Gregory, G. and Brazis, P. eds. 2011. *DeMyer's The neurologic examination: A programmed text*. McGraw-Hill Professional.

[25] Katz, J. and Melzack, R. 2011. The McGill Pain Questionnaire: Development, psychometric properties, and usefulness of the long-form, short-form, and short-form-2. *Handbook of pain assessment*. D.C. Turk and R. Melzack, eds. Guilford Press. 45–66.

[26] Lavrič, A. and Janko, M. 2007. *Klinična nevrološka preiskava*. Medicinski razgledi.

[27] Leo, A., Naro, A., Cannavò, A., Pisani, L.R., Bruno, R., Salviera, C., Bramanti, P. and Calabrò, R.S. 2016. Could autonomic system assessment be helpful in disorders of consciousness diagnosis? A neurophysiological study. *Experimental Brain Research*. 234, 8 (2016), 2189–2199.

[28] Maier, C. et al. 2010. Quantitative sensory testing in the German Research Network on Neuropathic Pain (DFNS): somatosensory abnormalities in 1236 patients with different neuropathic pain syndromes. *Pain*. 150, 3 (2010), 439–50.

[29] Meh, D. and Denišlič, M. 1994. Quantitative assessment of thermal and pain sensitivity. *Journal of the Neurological Sciences*. 127, 2 (1994), 164–169.

[30] Meh, D. and Georgiev, D. 2017. New challenges in recognition of somatosensory information: comprehensive sensory testing. (2017), In print.

[31] Melzack, R. 2005. Evolution of the neuromatrix theory of pain. *Pain practice*.

[32] Melzack, R. and Katz, J. 2006. Pain in the 21st Century: The Neuromatrix and Beyond: EBSCOhost. *Psychological Knowledge in Court*. (2006), 129–148.

[33] Merskey, H., Lindblom, U., Mumford, J.M., Nathan, P.W. and Sir Sunderland, S. 2012. Pain terms: a current list with definitions and notes on usage. *Classification of chronic pain: descriptions of chronic pain syndromes and definitions of pain terms*. H. Merskey and N. Bogduk, eds. IASP Press. 210–13.

[34] Norman, D.A. 1968. Toward a theory of memory and attention. *Psychological review*. 75, 6 (1968), 522–536.

[35] North, R.B., Streelman, K., Rowland, L. and Foreman, P.J. 2012. Spinal cord stimulation paresthesia and activity of primary afferents. *Journal of neurosurgery. Spine*. 17, 4 (2012), 363–6.

[36] Pike, A., Hearn, L. and de C Williams, A.C. 2016. Effectiveness of psychological interventions for chronic pain on health care use and work absence: systematic

review and meta-analysis. *Pain*. 157, 4 (2016), 777–785.

[37] Price, D.D. 1999. *Psychological mechanisms of pain and analgesia*. IASP Press.

[38] Price, D.D. and Aydede, M. 2005. The experimental use of introspection in the scientific study of pain and its integration with third-person methodologies: The experiential-phenomenological approach. *Pain: New essays on its nature and the methodology of its study*. M. Aydede, ed. The MIT Press. 243–273.

[39] Price, D.D., Barrell, J.J. and Rainville, P. 2002. Integrating experiential-phenomenological methods and neuroscience to study neural mechanisms of pain and consciousness. *Consciousness and Cognition* (2002), 593–608.

[40] Rolke, R. et al. 2006. Quantitative sensory testing in the German Research Network on Neuropathic Pain (DFNS): standardized protocol and reference values. *Pain*. 123, 3 (2006), 231–43.

[41] Rolke, R., Magerl, W., Campbell, K.A., Schalber, C., Caspari, S., Birklein, F. and Treede, R.-D.R.-D. 2006. Quantitative sensory testing: a comprehensive protocol for clinical trials. *European Journal of Pain*. 10, 1 (2006), 77–77.

[42] Staikou, C., Kokotis, P. and Kyrozis, A. 2016. Differences in Pain Perception Between Men and Women of Reproductive Age: A Laser-Evoked Potentials Study. *Pain Medicine*. (2016), In print.

[43] Truini, A. and Cruccu, G. 2016. How diagnostic tests help to disentangle the mechanisms underlying neuropathic pain symptoms in painful neuropathies. *Pain*. 157, Supplement (2016), S53--S59.

[44] Woolf, C.J. 2004. Dissecting out mechanisms responsible for peripheral neuropathic pain: Implications for diagnosis and therapy. *Life Sciences*. 74, 21 (2004), 2605–2610.

[45] Woolf, C.J. and Mannion, R.J. 1999. Neuropathic pain: Aetiology, symptoms, mechanisms, and management. *Lancet*. 353, 9168 (1999), 1959–1964.

MORAL ENHANCEMENT: POSSIBLE, PERMISSIBLE, A DUTY?

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ABSTRACT
Attempts to enhance individual and communal morality are as old as human communal living itself. But only recently have philosophers, bioethicists and scientists begun to seriously consider the possibilities and implications of employing technological interventions into the human body, especially the brain, in order to enhance traits and capabilities that underlie what we might term as moral reasoning, action and behavior. As our knowledge of our underlying neurophysiology grows, so do the technologies of manipulating those systems directly. Some illicit drugs, prescription pharmaceuticals and non-invasive brain stimulation techniques have been shown to have effects on diminishing or enhancing certain of our mental traits that constitute moral thinking, action and behavior in healthy adults. This hints at the possibility of targeted interventions that might predictably improve communal morality and through it societal cooperation. The first part of the paper will delve into some of the conceptual issues connected with moral enhancement as part of the broader trend of cognitive enhancement and human enhancement in general. The second part will look at some experiments and interventions that support the plausibility of technologically enhancing moral reasoning and moral behavior. The third part will present some of the arguments that have been put forth in favor of moral enhancement, including whether we might in certain situations have a duty to morally enhance ourselves. Namely, as some bioethicists have argued, some form of moral enhancement might not only be necessary in order to give ourselves better chances of becoming better persons, but might be necessary to ensure the survival of human civilization in the future.

Keywords
moral enhancement, morality, ethics, duty, neuroenhancement, prescription pharmaceuticals, drugs, non-invasive brain stimulation

1. WHAT IS MORAL ENHANCEMENT
Generally, human enhancement can be seen as the use of direct technological interventions into the human body with the goal of enhancing the average or normal capabilities of healthy adults. The aim of such interventions is to extend the healthy lifespan, improve physical capabilities, and enhance cognitive capacities, including mood, in short, to make us healthier, smarter, happier and longer lived [1, 2]. Much of the discourse on human enhancement has so far revolved around cognitive enhancement, technological interventions to improve, for example, concentration, memory, learning, problem solving, decision-making, etc. in healthy adults. A big part of the reason for this is that in contrast to many other potential human enhancement technologies, which are still in the early R&D phase or purely theoretical, certain prescription pharmaceuticals, illicit drugs, dietary supplements and non-invasive brain stimulation devices, such as transcranial magnetic stimulation and transcranial current stimulation devices [3, 4], are already available in the healthcare, consumer or illicit markets and are being used by self-experimenters, certain professional groups, and students among others [5,6]. Only recently have some philosophers and bioethicists begun a discussion on the possibility of using such technological means in order to enhance what we might term morality, that is, improving moral reasoning, action and behavior [7, 8].

While we might view the whole history of human communal living as attempts to promote, enhance and enforce morality in order to benefit the group or community, such attempts were mostly restricted to community enforcement through education and sanctions, moral codes and societal mores.

In parallel, and at least for the entire history of human civilization, we can also observe many attempts to enhance individual moral traits by pursuing personal quests for enlightenment and liberation through meditation, fasting, prayer and other ascetic practices, some of which have grown into sociocultural and religious movements and communities such as the various strands of Buddhism, the Jainism community and various New Age movements and communities. While both of these endeavors at least nominally pursue a common goal, there can be many different ways of interpreting what is moral, and while there are at least some human moral universals that span times and cultures, there is also much variation and change in regard to what is deemed moral and immoral, and to what extent the wellbeing of the individual can be sacrificed for the "good" of the community.

The Anthropocene age, with its increasing understanding of the structure and function of the biological systems that make up the human body, as well as a growing array of tools that can influence or even enhance its various capabilities and functions, now offers the possibility of using technological interventions to enhance the moral capabilities of healthy individuals who do not fall into any abnormal psychological category.

It is certainly no easy task trying to define what the moral traits and capabilities that we need to enhance in order to enhance morality are. Moral philosophy and psychology as well as cognitive science and neuroscience have long struggled to

discover and map the psychological traits and the underlying neurophysiological systems that constitute moral reasoning and moral behavior. While considerable progress has been made in this regard, we are still far from knowing all the details and intricacies of the mental processes that lead to the execution of a moral action, let alone of the underlying biological systems and processes involved.

In order to better understand what we might mean by moral enhancement, we could start off with a list of traits that we associate with moral persons, such as strength of character, self-control, kindness, compassion, tolerance, altruism and others. Still, many of these are context dependent in the sense that their outcomes could result in the improved wellbeing or in the increased suffering of others. In order to deem something moral, we must usually consider it in its wider, specific sociocultural context, taking into account its immediate and also long-term consequences.

The enhancement of one trait involved in moral reasoning and action, for example self-control, could result in the diminishment of another, for example risk taking, and thus lead to a reduced willingness to take risks to help others.

Ultimately, we are talking about an interconnection between our evolutionary conditioned responses to the environment and the behavior of other members of our species, and culturally produced and contextually specific norms and practices.

Although specific types of morality are created, transferred and transformed in interpersonal relationships within a community or society in complex feedback loops involving our evolved instincts and emotions, they still remain encoded in the specific brain structures of individuals. And possessing the technological tools that can influence these neurological structures, hints at the real possibility of manipulating these structures and through them the mental mechanisms underlying moral thinking and action.

2. THE MEANS OF MORAL ENHANCEMENT

While defining moral enhancement remains elusive, we can recognize traits and tendencies that are connected with moral reasoning, action and behavior and interventions that produce changes in those traits and outcomes. As we have hinted, throughout history individuals, communities and cultures have developed a vast array of tools that are intended to enhance the morality of its members and through it the survival and functioning of the communities.

In recent times, various experiments have shown that non-invasive brain stimulation devices, prescription pharmaceuticals, illicit drugs, and dietary supplements can influence the various traits and mechanisms involved in moral thinking and action.

Experiments with transcranial magnetic stimulation have for example shown effects on moral reasoning, for example by reducing the influence of beliefs on the moral judgment of actions or the compliance with socially constituted sanctions [9, 10]. The use of transcranial current stimulation for example reduced the tendency to punish unfair behavior [11]. Further experiments have investigated the effects of antidepressives, hormones, blood-pressure medication and illicit drugs. An increased level of serotonin through the use of SSRI antidepressives in healthy people could enhance resistance to violent actions that harm other people and thus influence moral judgment and moral actions [12]. The use of oxytocin, the bonding hormone, has had an impact on the moral behavior of healthy adults, but differently for men and for women. Women behaved in a more altruistic manner, while men behaved more selfishly [13]. Taking propranolol for high blood pressure reduced the implicit racial bias in healthy people performing jury duty [14]. The use of MDMA or "ecstasy" strengthened the recognition of emotions, emotional empathy and prosocial behavior in healthy volunteers, but again differently in women and in men [15]. Using theanine, the amino acid found in tea and responsible for calming effects on the nervous system, might make people less prone to impulsive decisions and reactions made in anger.

There is also considerable overlap of the techniques for moral enhancement with the other categories of human enhancement, especially cognitive enhancement and the interventions that have been employed to enhance various cognitive abilities in that context [3]. Being better able to concentrate, recall facts, and make quality decisions makes us more capable of good moral reasoning. Taking a cognitive stimulant that enhances motivation and self-control could give us the motivation and self-restraint to perform moral actions of which we might not be capable otherwise.

Further, our current moods and perceptions of the world and of ourselves, if positive, generally make us more tolerant, forgiving, loving, helpful and kind. Feeling like we are having a "pretty good day" can thus make us more moral than if we feel like we are having a bad day. In that sense, technological mood enhancement might also be seen as contributing to moral enhancement.

We should acknowledge that both our internal states and our surrounding environment strongly influence our capacity to think and to behave morally. Experiments in psychology, such as those performed by Milgram and Zimbardo, have shown that we have a strong tendency towards group and social conformity when we perceive a strong consensus, but again, strengthening our internal moral capabilities might make us better able to perform moral actions that might go against the prevailing behavior of the community. Whether such actions would be judged as moral or immoral of course depends on the observer and the sociocultural context. But we might at least argue that enhancing the traits that promote loving kindness would be less likely to result in moral actions which nevertheless hurt the wellbeing of others.

Finally, as we have noted before, enhancing only one capability or trait could lead to the diminishment of others, which are equally important in performing moral reasoning and actions. In this regard, it would be necessary to engage in an endeavor that would enhance and develop all virtues of one's character in a balanced manner in order to produce a "virtuous person" [16].

So as with most endeavors, it might be prudent to take a more comprehensive, holistic approach to moral enhancement. In this way, using drugs or non-invasive brain stimulation should not be seen as a replacement, but possibly as a complementary addition to more traditional means of enhancing morality, such as character building, virtue development, education, meditation, etc. Another, perhaps less controversial venue of technologies that could enhance our moral behavior, would be the use of apps or trackers that would remind us, prompt us and warn us whenever we are to engage in moral behavior, to take a certain, predefined action. We might view these as external morality algorithms, as outsourced moral mechanisms, or as a high-tech version of the "What Would Jesus Do" armbands popular as morality reminders in the US.

3. THE PERMISSIBILITY AND DUTIFULNESS OF MORAL ENHANCEMENT

While the experiments and the technological means of enhancing some aspects and traits that influence moral reasoning and behavior described above represent only the first tentative generation of technological interventions for moral enhancement, they do raise

the question of whether such interventions should be socially permissible, and further, whether in specific situations we might actually have a duty to enhance ourselves morally by technological means.

For example, Savulescu and Sandberg [7] have argued that couples who are freely and rationally committed to a relationship should be free to pursue the strengthening of this relationship by employing various means, including pharmacological substances that enhance feelings of love and bonding, which would lead to greater emotional commitment, satisfaction and fidelity, if they so choose. They have further extended this argument that individuals in specific situations or circumstances should not only be permitted to engage in moral enhancement, but might actually have a duty to do so (a moral duty, not a legal obligation) [17]. In this regard they argue that especially parents with children might have a duty to try and make their marriage work, as long as there are reasonable grounds for both parties to do so, including using technological means, which could be added to the category of marriage therapy.

If we pursue such an argument further, we might ask ourselves whether people in certain professions or in positions of responsibility might have a similar duty to morally enhance themselves, including through technological means. Would it make sense to say that members of a jury should consider it to be their duty to use enhancements in order to deliver a more objective verdict? Would a judge have a duty to be morally enhanced in order to pass a more rational and dispassionate verdict? Here we should also keep in mind whether we want a verdict that is compassionate and loving kind, or one that is dispassionate and objective, or more precisely what the balance between the two extremes should be? What about politicians? CEOs of companies? Would we want them to be morally enhanced?

Also, if we were to enhance ourselves in order to be less prone to violence, would this affect our capability for self-defense, or our capacity to rise up and struggle against an unjust authority and society?

Ultimately, Persson and Savulescu have also argued that as our technological capabilities, including other forms of human enhancement such as cognitive enhancement, grow, it will be necessary for humans to enhance themselves morally through technological means, as the destructive power that is available to an individual person through technological development increases rapidly [18].

As we have noted, many of the technological interventions that influence mental systems and capacities connected to moral thinking and action, are prescription pharmaceuticals, which means that many patients across the world are already using them and might be subject to their morality enhancing side effects [19].

Finally, all this raises the question if the examples described above represent the actual enhancement of moral capabilities in average healthy people or "only" the treatment of below average or diminished capacities in people with diseases, injuries or disabilities, or neuropsychological structures that could be labeled as psychopathic or sociopathic. This leads us to the question of whether even less extreme versions of antisocial behavior might in the future become categorized as illnesses or malfunctions that need to be treated in a medical context. This raises wide-ranging implications for the concepts of personal responsibility and free will, which have already been opened by modern neuroscientific research and brain imaging, for example in the fields of insurance and law, as well as societal engagement.

And whenever the debate extends beyond what rational individuals should be permitted to do if they so choose in pursuit of their desires and goals as long as they do not harm others, we should be careful of discourses that turn to what might be seen as mandatory biomedical treatment of individuals who are "morally deficient", especially if that morality is defined in terms of narrow societal norms and historically bound mores.

4. REFERENCES

[1] Bostrom, N. and Roache, R. 2008. Human Enhancement: Ethical Issues in Human Enhancement. In New *Waves in Applied Ethics*, J. Ryberg, T.S. Petersen and C. Wolf, Ed. Palgrave Macmillan, 120-152.

[2] Hughes, J.J. 2004. *Citizen Cyborg: Why Democratic Societies Must Respond to the Redesigned Human of the Future*. Westview Press.

[3] Bostrom, N. and Sandberg, A. 2009. Cognitive enhancement: Methods, ethics, regulatory challenges. *Science and Engineering Ethics* 15(3), 311–341.

[4] Reis et al. 2009. Noninvasive cortical stimulation enhances motor skill acquisition over multiple days through an effect on consolidation. *PNAS* 106(5), 1590-1595.

[5] Sahakian, B. and Morein-Zamir, S. 2007. Professor's little helper. *Nature* 450, 1157-1159.

[6] Smith, M.E. and Farah, M.J. 2011. Are Prescription Stimulants "Smart Pills"? The Epidemiology and Cognitive Neuroscience of Prescription Stimulant Use by Normal Healthy Individuals. *Psychological Bulletin* 137(5), 717-741.

[7] Savulescu, J. and Sandberg, A. 2008. Neuroenhancement of Love and Marriage: The Chemicals Between Us. *Neuroethics* 1(1), 31-44.

[8] Douglas, T. 2008. Moral Enhancement. *Journal of Applied Philosophy* 25(3), 228-245.

[9] Young et al. 2010. Disruption of the RTPJ withTMS reduces the role of beliefs in moral judgments. *PNAS* 107(15), 6753–6758.

[10] Ruff et al. 2013. Changing Social Norm Compliance with Noninvasive Brain Stimulation. *Science* 342(6157), 482-484.

[11] Knoch et al. 2008. Studying the Neurobiology of Social Interaction with tDCS—The Example of Punishing Unfairness. *Cerebral Cortex* 18(9), 1987-1990.

[12] Crockett et al. 2010. Serotonin selectively influences moral judgment and behavior through effects on harm aversion. *PNAS* 107(40), 17433-17438.

[13] Schelee et al. 2014. Opposing effects of oxytocin on moral judgment in males and females. *Hum Brain Mapp* 35(12), 6067–6076.

[14] Terbeck et al. 2012. Propranolol reduces implicit negative racial bias. *Psychopharmacology (Berl)* 222(3), 419-424.

[15] Hysek et al. 2014. MDMA enhances emotional empathy and prosocial behavior. *Soc Cogn Affect Neurosci* 9(11), 1645-1652.

[16] Hughes, J.J. 2014. Moral Enhancement Requires Multiple Virtues. *Cambridge Quarterly of Healthcare Ethics* 24(1), 86-95.

[17] Earp, B.D., Sandberg, A. and Savulescu, J. 2012. Natural Selection, Childrearing, and the Ethics of Marriage (and Divorce): Building a Case for the Neuroenhancement of Human Relationships. *Philos. Technol*. 25, 561-587.

[18] Persson, I. and Savulescu, J. 2012. *Unfit for the Future: The Need for Moral Enhancement*. OUP: Oxford.

[19] Levy et al. 2014. Are You Morally Modified?: The Moral Effects of Widely Used Pharmaceuticals. *Philosophy, Psychiatry & Psychology* 21(2), 111–125.

Odločanje kot opomenjanje: Kritični pogled na sodobne pristope k raziskovanju odločanja

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POVZETEK

V prispevku bom poskusil nakazati, da je razumevanje odločanja večine sodobnih pristopov k raziskovanju odločanju močno problematično. Namreč, izhajajoč iz nekaterih predpostavk klasične kognitivne znanosti, jih večina nima (in ne more imeti) vpogleda v to, kakšen smisel in pomen ima odločanje za odločevalce. Na podlagi analize določenih vidikov odločanja in primerih empiričnih raziskav bom prikazal, da odločanja ne v razlagi, ne v raziskovanju ne moremo oddvojiti od tega, kako odločevalci razumevajo in ustvarjajo odločitvene situacije – tj., od smisla in pomena, ki ga odločevalci v interakciji z njimi ustvarjajo. Zagovarjal bom trditev, da je odločanje bolj ustrezno razumeti kot dejavnost ustvarjanja smisla in pomena kot pa proces preračunavanja z reprezentacijami zunanjega, od odločevalca ločenega sveta. Enaktivizem (osredotočil se bom na opomenjanje (*sense-making*) in izkustvo) tako po mojem predstavlja bolj ustrezno začetno točko razumevanja in raziskovanja odločanja kot sodobne koncepcije odločanja, ki bolj ali manj implicitno sprejemajo reprezentacionalizem in nekatere ostale predpostavke klasične kognitivne znanosti.

Ključne besede

Enaktivizem, izkustvo, odločanje, odločitvena situacija, opomenjanje, reprezentacionalizem.

1. UVOD

Odločanje je v splošnem razumljeno kot proces izbiranja med alternativnimi možnostmi oz. poteki delovanja, ki odločevalcu prinaša ugodne izide ali izide, ki so skladni z njegovimi cilji. Večina raziskovalcev in teoretikov proces izbiranja koncipira in raziskuje kot proces primerjanja *vnaprej danih* alternativ in njihovih lastnosti, ki naj bi potekal predvsem kot ocenjevanje, predvidevanje in presojanje o (negotovih) dogodkih in stanjih *zunanjega sveta* (kot so npr. izidi, ki potencialno sledijo izbiri določene alternative ali vrednosti izidov) ter tudi kot ocenjevanje, predvidevanje in presojanje o subjektivnih posledicah (v veliko manjši meri) kot *odzivih ali reakcijah* na potencialne izide.

Večina sodobnih pristopov k raziskovanju odločanja nadalje "upa", da bodo s preučevanjem specifičnih odločitvenih nalog – ki so povečini ekonomske narave, enostavne, ne vsebujejo relevantnih subjektivnih posledic, so nekonsekvenčne ipd., in se kot take močno razlikujejo od nekaterih odločitev v vsakdanjem življenju – uspelo odločanje razumeti in razložiti v celoti. Nenazadnje se večina empiričnih pristopov k raziskovanju odločanja poslužuje "objektivnih" raziskovalnih tehnik, ki, skupaj z uporabo enostavnih specifičnih odločitvenih nalog, raziskovalcem omogočajo odločanje "zapakirati" v objektivne mere, modele in teorije.[1]

Takšno razumevanje in iz njega izhajajoče raziskovanje odločanja – ki poudarja "objektivne" dogodke in stanja zunanjega sveta, v katerih tudi prikladno utemeljuje subjektivne vidike odločanja in ki se jim nadalje poskuša čim bolj izogniti – po mojem delno izhaja iz bolj ali manj implicitnega sprejemanja nekaterih predpostavk klasične kognitivne znanosti: reprezentacionalizma, realizma in predpostavke, da mora biti kognitivna znanost objektivna znanost, ki se s perspektivo oseb ali njihovim izkustvom ne ukvarja, če pa že (ker nima druge izbire), poskuša to storiti na čim bolj "objektiven" način. Takšen pristop se morda zdi na prvi pogled povsem ustrezen, vendar je, kot bom pokazal v nadaljevanju, močno problematičen, saj raziskovalce vodi v to, da ne vedo in ne morejo vedeti, kakšen smisel in pomen ima odločanje za odločevalce, z vidika odločevalcev – bistven vidik odločanja, brez katerega o odločanju sploh ne bi mogli govoriti.

2. OD REPREZENTACIONALIZMA DO ENAKTIVIZMA

Osnovna predpostavka klasičnih in večine sodobnih razumevanj duševnosti je, da kognicija poteka kot proces manipulacije z mentalnimi reprezentacijami zunanjega sveta (reprezentacionalizem), ki je neodvisen od opazovalca ali aktivnosti subjekta (naivni realizem). Takšen pogled na duševnost pojmuje organizem kot nekakšen "funkcionalen stroj", ki vase sprejema objektivne, od njega neodvisne, informacije (input), jih notranje reprezentira, z njimi manipulira (npr. računa) in tako proizvede bolj ali manj ustrezno vedenje.

Pogled na kognicijo, ki se odraža v splošno sprejetem razumevanju in raziskovanju odločanja, kjer: a) so alternative večinoma postavljene kot entitete, ki nekako že obstajajo v zunanjem svetu odločitvenih situacij (tako so npr. v odločitvenih nalogah, ki jih uporabljajo študije z različnih področij za preučevanje odločanja, večinoma dane vnaprej); b) sta

[1] Za takšne in podobne koncepcije ali raziskovalne pristope glej npr. Bechara, Damasio, Tranel in Damasio (1997), De Martino et al. (2006), Dijksterhuis, Bos, Nordgren in van Baaren (2006), Frydman in Camerer (2016), Hardman (2009), Hastie (2001) ipd. Treba je reči, da so trditve v prvih dveh odstavkih relativno splošne in tako vse ne veljajo v dobesednem smislu za vse naštete pristope. Poleg tega so med zgoraj naštetimi pristopi k razumevanju in/ali raziskovanju odločanja razlike, posebej, če v zakup vzamemo raznolikost naštetih pristopov. Vendar po mojem karakterizacija splošnega razumevanja in raziskovanja odločanja za zgornje pristope v grobem drži.

odločevalec in svet strogo ločena in so tako alternative, negotovosti, pomembnosti ipd. v osnovi koncipirane kot neodvisne od odločevalcev, posebej pa niso koncipirane kot kreirane s strani odločevalcev; c) je poudarjeno presojanje in ocenjevanje negotovih dogodkov v zunanjem svetu, negotovim dogodkom v duševnosti odločevalcev pa je namenjeno relativno malo pozornosti; d) so subjektivne posledice večinoma pojmovane kot odzivi oz. reakcije na izide in s tem pojmovane kot odzivi na "dražljaje", kar lepo sovpada s klasično predstavo o delovanju duševnih procesov kot "dražljaj-manipulacija z reprezentacijami-odziv(vedenje)"; e) je odločanje velikokrat koncipirano kot nekakšno preračunavanje z verjetnostmi, možnostmi ipd.

V nasprotju s takšnim klasičnim pogledom na duševnost enaktivizem trdi, da strogo ločevanje sveta in subjekta, zunanjega in notranjega, predstavlja napačno postulirano dihotomijo. Varela et al. (1993) zagovarjajo trditev, da kognicija oz. kognitivna dejavnost leži nekje vmes med "resnico" realizma in idealizma. Tako kognicijo konceptualizirajo kot nekaj, česar ni najti ne v zunanjem svetu, ne v notranjem svetu subjekta, ampak v medsebojni povezanosti/relaciji (lahko bo rekli sokreiranju) in interakciji sveta ter organizma. Subjekt in svet, "notranje" in "zunanje" drug drugega intrinzično sodoločata in se medsebojno definirata v nekakšni krožni specifikaciji in pogajanju. Kognitivna dejavnost organizma in sveta sta skratka neločljivo povezana.

V tem smislu vsakršna kognitivna dejavnost nujno predpostavlja, da so svet, dejavnost organizma in relacija organizma ter njegovega sveta, prežeti s smislom/pomenom (ang.: *sense/meaning*). A od kod prihaja smisel/pomen? Enaktivizem trdi, da ta ne leži ne v objektivnem svetu, v katerem bi ga moral organizem le odkriti, niti znotraj organizma, ki bi ga moral le položiti na svet. Tretja možnost oz. srednja pot, ki jo ubere enaktivizem pravi, da smisel/pomen nastaja oz. se ustvarja v aktivni interakciji organizma z njegovim svetom. Ustvarjanje in prepoznavanje smisla ter pomena za organizem v interakciji z lastnim svetom (opomenjanje, ang.: *sense-making*) predstavlja enega izmed ključnih in konstitutivnih vidikov enaktivizma[2].

Opomenjanje nadalje predpostavlja živeto ali izkustveno perspektivo, s katere organizem ustvarja/prepoznava smisel/pomen; perspektivo, s katero je organizem vedno obdan. Kot to lepo izrazi Colombettijeva: "Opomenjanje … nujno vključuje neko točko pogleda, s katere sta sistem in okolje vrednotena. Prilagodljiv avtonomen sistem ni le skupek medsebojnih odnosov med procesi, ampak perspektiva na svet, ki zase ustvarja pomen in norme, mesto notranjosti … Enaktivistična ideja opomenjanja je prav tako intimno povezana z idejo *Umwelt*-a (dobesedno, "svet okrog"), v smislu Uexküllovega ([1934] 2010) pojmovanja okolja kot izkušenega ali živetega s perspektive organizma. To, da je živ sistem sistem opomenjanja, pomeni, da živi v svetu, ki je vedno *Umwelt*, namreč, v okolju, ki ima za sistem določeno pomembnost oz. vrednost. … Z enaktivistične perspektive je kognicija pravzaprav zmožnost udejanjanja oz. vznikovanja sveta smisla, namreč *Umwelt*-a, ki ima za organizem, ki ga udejanja, posebno pomembnost." (Colombetti, 2014: 17-18).

[2] Po Di Paolo, Rohde in De Jaegher (2010) enaktivizem vsebuje pet ključnih, definirajočih vidikov (avtonomija, opomenjanje, emergenca, utelešenost, izkustvo), vendar bom v prispevku govoril le o opomenjanju in izkustvu.

V skladu s povedanim, enaktivizem ostro kritizira težnjo večjega dela sodobne kognitivne znanosti k temu, da bi bila oz. postala objektivna veda o duševnosti. Očita ji, da na notranje procese sklepa na podlagi objektivnih "mer", kot je npr. vedenje, in ne na podlagi "mer" izkustva. Kot taka, kognitivna znanost ostaja podobna behaviorizmu, ki ga je tako trdovratno poskušala ovreči. Če predpostavimo (kar tu predpostavljam), da je mentalno nekaj, za kar se nam vsaj s prvoosebnega vidika zdi, da vsebuje izkustveno plat, oz. nekaj, kar prvoosebno izkušamo, potem je objektivistična kognitivna znanost le "teorija o tem, kaj se dogaja v naši duševnosti … brez da bi bila teorija o tem, kako je biti ta duševnost." (Roy, Petitot, Pachoud and Varela 1999: 7).

Težava, ki je prisotna v večini empiričnih pristopov k raziskovanju odločanja, saj le ti subjektivne in izkustvene vidike odločanja večinoma izključujejo (ali nanje sklepajo z vedenja) iz svojih raziskav ali pa jih preučujejo le površno (npr. z uporabo vprašalnikov)[3]. V skladu z osnovnimi predpostavkami klasične in večjega dela sodobne kognitivne znanosti je osnovni problem prevladujočih pristopov k razumevanju in raziskovanju odločanja tako v tem, da raziskovalci pravzaprav ne vedo (to jih *neupravičeno* niti ne zanima), kako odločevalci interpretirajo, razumevajo in kreirajo odločitvene situacije s svoje lastne izkustvene perspektive.

V nadaljevanju se bom osredotočil na nekatere vidike odločanja in nakazal, da odločanja, odločitev in odločitvenih situacij ne moremo ločiti od tega, kakšen smisel in pomen imajo za odločevalce. To pomeni, da odločitvene situacije in "elementi" odločanja (kot so alternative, negotovi dogodki ipd.) niso nekaj, kar je od odločevalcev ločeno, ampak nekaj, kar se intrinzično ustvarja znotraj interakcije odločevalcev, njihove dejavnosti in izkustvene perspektive, ter sveta, v katerega so umeščeni.

3. ODLOČANJE KOT OPOMENJANJE: NEKAJ VIDIKOV

Kot rečeno, so v večini eksperimentov o odločanju alternative dane vnaprej, kot da je alternativa entiteta, ki leži nekje v objektivnem svetu, opredeljiva s tretjeosebnega vidika in kot taka obstaja neodvisno od odločevalcev. Nasprotno alternative nikakor niso takšne vrste entitet, ampak je njihov "obstoj" močno odvisen od samih odločevalcev in njihovega razumevanja neke situacije kot odločitvene (relevantne alternative za odločevalce obstajajo) ali kot ne-odločitvene (relevantne alternative za odločevalce ne obstajajo).

Nekatere kvalitativne študije odločanja jasno kažejo na to, da alternativ ni iskati v objektivnem svetu, zunaj odločevalčeve interpretacije "odločitvenih" situacij. V svoji znani kvalitativni študiji Klein, Calderwood and Clinton-Cirocco's (2010) lepo pokažejo, da izkušeni gasilski poveljniki v kriznih situacijah pod časovnim pritiskom niso izbirali ali preudarjali med alternativnimi poteki delovanja, ampak so sledili enemu možnemu poteku delovanja. Raziskovalci po eni strani trdijo, da gre za odločanje (tj. odločanje kot intuitivno prepoznavanje), po drugi strani pa

[3] Čeprav je res, da je preučevanje vloge čustev in občutkov (kot subjektivnih posledic ali kontekstualnih faktorjev) v zadnjih dveh desetletjih postalo pomembno in celo popularno na področju raziskovanja presojanja in odločanja, pa raziskovanje vloge čustev in občutkov v odločanju večinoma ostaja ukoreninjeno v predpostavkah klasične kognitivne znanosti.

poročila gasilcev jasno kažejo na to, da se sami – vsaj v smislu izbiranja med alternativnimi možnostmi – niso odločali.

Vendar vprašanje ali v takih primerih lahko govorimo o odločanju ali ne, ni le vprašanje definicije odločanja, ampak kaže na osnovni "razkol" med perspektivo raziskovalca, ki povečini poskuša zavzemati objektivno, tretjeosebno perspektivo, in perspektivo odločevalca, ki je primarno prvoosebna, izkustvena.

Raziskava lepo kaže vsaj na to, da preučevanje tretjeosebne perspektive odločanja nikakor ni zadostno. Če bi "podobno" raziskavo izvedli v laboratoriju, kjer bi gasilce soočili s podobnimi namišljenimi kriznimi situacijami gašenja požarov, jim pri vsaki dali na izbiro nekaj alternativnih potekov delovanja in jim naročili, naj izberejo najboljšega (ter bi v zakup vzeli le vedenjske rezultate), bi najverjetneje mislili, da so se gasilci med temi alternativami pač odločali v smislu preudarjanja med alternativnimi možnostmi. Zaključek, ki bi bil povsem drugačen od tega, kar kaže raziskava Kleina et al. (2010), ki je vsaj do določene mere raziskovala perspektivo odločevalcev.

Naslednja raziskava, ki kaže na podobne zaključke, je fenomenološka empirična raziskava van Manena (2014), v kateri je raziskovalec prišel do zaključka, da nekaterih etičnih odločitev odločevalci sploh niso razumeli kot odločitvenih situacij (glej prvo alinejo v nadaljevanju za razlago).

V tem kontekstu je večina laboratorijskih študij odločanja omejena od vsega začetka, saj ne vedo niti tega, če subjekt, ki mu alternative ne bi bile predstavljene (in tudi, če so mu), "odločitveno" situacijo sploh razume kot odločitveno oz. kot situacijo, kjer "bi se bilo potrebno" odločati. Nadalje, čeprav subjekt razume neko situacijo kot situacijo, ki zahteva odločanje, to nikakor ne pomeni, da zanj alternative že kar obstajajo. Namreč, najprej mora ugotoviti, katere alternative so zanj relevantne, tj., katere "alternative" sploh so alternative. To pomeni, da odločitvene situacije niso nekaj, kar je ločeno od odločevalca, ampak nekaj, kaj je bistveno povezano s tem, kakšen smisel in pomen odločevalci ustvarjajo in prepoznavajo v (odločitvenih) situacijah.

Fenomenološka raziskava van Manena (2014) nadalje kaže na različne načine, kako so odločitvene situacije neločljivo povezane s tem, kako jih razumevajo in ustvarjajo odločevalci. Same odločitvene situacije, zunanji in notranji negotovi dogodki, ipd. ter njihov smisel in pomen v nadaljevanju naštetih načinih (ne)odločanja, ki jih našteva van Manen, nikakor ne obstaja nekje v zunanjem svetu, ampak so neločljivo konstituirani s tem, kako jih, če sploh, udejanjajo odločevalci.

Van Manen (2014) je preučeval izkustvo[4] etičnega (ne)odločanja staršev nedonošenčkov ali novorojenčkov, ki so ob rojstvu potrebovali intenzivno nego v bolnišnici. Diagnoze otrok, ko so jih sprejeli v bolnišnico, so bile ekstremna nedonošenost, kompleksne prirojene napake, nevrološke poškodbe ipd. Starši, ki so sodelovali v raziskavi (štirinajst staršev), so se morali odločati o prekinitvi terapij življenjske podpore (npr. mehanske ventilacije, kardiovaskularne podpore, umetnega hranjenja) ali sprejemati odločitve o spremembi smeri zdravljenja (npr. operaciji srca, presaditvi organa ali traheostomiji). Intervjuju s starši so potekali v času, ko so bili otroci na oddelku za intenzivno nego. Van Manen (2014) je v svoji raziskavi prišel do petih glavnih "tem" izkustva zgoraj opisanih odločitev:

- *Odločitev, ki nikoli ni bila izbira.* Samovi starši naj bi se morali odločiti, ali (da) naj prekinejo življenjsko podporo svojemu novorojenčku. Sami so poročali o tem, da so se počutili prisiljene v odločitev za prekinitev podpore, vendar tega, da prispevajo k smrti novorojenčka in mu ne omogočijo možnosti preživetja, nikakor niso videli kot možnosti, čeprav so npr. vedeli, da ima novorojenček velike možnosti, da bo prizadet, če preživi. Situacije, v kateri so zdravniki od njih zahtevali "odločitev", niso izkušali ali videli kot takšne, v kateri bi se bilo sploh mogoče odločati. Situacija skratka zanje ni bila odločitvena situacija.

- *Odločitev kot iskanje poti stran.* Odločanje kot iskanje poti stran van Manen (2014) opisuje kot iskanje dokazov (informacij), ki bi odpravile negotovost odločitve. Starša, katerih transkript navaja van Manen, sta se morala na hitro odločiti med tem ali naj otroka pustita na umetni podpori dihanja (kar bi vodilo v počasno smrt) brez zdravil ali z zdravili, ki potencialno vodijo v možganske poškodbe (prekinitev terapije zanju ni bila možnost). Starša se nista spraševala le o tem, kakšne posledice ima lahko zdravilo za možgane in dihanje, ampak sta se v svoji odločitvi spraševala o tem, kakšno bi bilo otrokovo življenje, kaj bi to pomenilo zanju ipd. Na koncu sta se odločila, da pred izbiro naročita pregled, ki bi pokazal, ali ima otrok možgansko krvavitev: če je nima, bosta izbrala drugo možnost (podpora dihanja z zdravili), če jo ima, za prvo. Nemogočo odločitev sta tako preložila na izid ultrazvoka glave. Pravita: "Čutila sva, da bi bila to pot stran od tega, da se morava odločiti." (van Manen, 2014: 283).

- *Odločitev kot razmišljanje in občutenje samega sebe skozi posledice.* Tretji primer lepo prikazuje, kako starša, ki sta se morala relativno hitro odločiti, ali naj prekineta življenjsko podporo ali ne, negotovosti nista odpravljala z "racionalnim" premislekom o tem, kaj je najbolje za njunega otroka. Namesto tega sta si podrobno predstavljala in poskušala občutiti, kaj bi zanju in otroka pomenilo, če bi, sicer prizadet, preživel. Starša recimo poročata: "Mislim, da nisva preudarjala in primerjala zdravstvenih alternativ, vprašala sva se le, ali to zmoreva?" (van Manen, 2014: 283).

- *Odločitev kot neodločenost*. Neodločenost po van Manenu v kontekstu situacij, ki jih je raziskoval, izvira iz tega, da starši izbire, v katere so prisiljeni, občutijo kot nemogočo odgovornost. Oče Isaiaha, ki bi bil, če bi preživel, močno prizadet, je razmišljal o tem, kaj bi to pomenilo za njune druge otroke, kaj bi morali za to žrtvovati ipd. Vseeno pa je vedel, da je Isaiah le njun otrok. Odločitev se je tako prevesila v neodločenost, o kateri van Manen (2014) pravi, da je za očeta morda edina odgovorna pot delovanja.

- *Odločitev kot nekaj, v kar pademo.* Mama, o kateri poroča van Manen (2014), je živela v stalnem stanju odločanja. Čeprav je odločitev že sklenila, le te ni izkušala kot dokončane, zaključene: "V resnici sem v katerikoli dejavnosti – ko jem, pijem, vozim, kar koli – še vedno v tem trenutku odločitve. Čeprav je izčrpavajoče, svoje odločitve enostavno nisem pripravljena sprejeti. … Je tako, kot da je odločitev prostor, kamor se ne morem ustaliti, a iz katerega prav tako ne morem oditi." (van Manen, 2014: 285). Po daljšem obdobju "ujetosti v odločanje" je mama poročala, da je kar naenkrat začutila "ustalitev odločitve": začutila je, da mora

[4] Podobno kot pri nekaterih ostalih praksah empirične fenomenologije (glej npr. Petitmengin, 2006) je bistvo van Manenove (2014) "fenomenologije prakse" v tem, da raziskovalec ne sprašuje po mnenjih, stališčih in prepričanjih ampak poskuša pridobiti podatke o dejanskem "živetem izkustvu". Metoda se, kot velik del sodobne empirične fenomenologije, opira na Husserlovo filozofsko "metodo" fenomenološke redukcije (za kratek opis glej npr. Varela, 1996).

hčeri dati možnost preživetja, in namesto paliativne nege, počakati na presaditev srca, ne glede na možne usodne posledice.

Opisane odločitve staršev so močno povezane z občutki, odgovornostjo in najglobljimi osebnimi vrednotami; so odločitve, za katere starši pravzaprav ne vedo dobro, kaj prinašajo; "odločitve", ki jih nekateri starši nikakor ne morejo videti ali občutiti kot odločitev ali pa jih ne želijo ali ne morejo skleniti; odločitve, o katerih starši ne morejo prenehati razmišljati, čeprav so "odločitev" že sklenili, razrešitev odločitve pa izkusijo kot realizacijo nekakšne *nujnosti* tega, kaj je prav; odločitve, katerih različni vidiki so bistveno določeni s tem, kakšni so odločevalci, kako vidijo in občutijo svet (oz. svoje lastno okolje), kaj je zanje smiselno ipd.; odločitve, katerih alternative, dogodki v zunanjem ali notranjem svetu odločitev nikakor ne obstajajo ločeno od odločevalcev, njihove izkustvene zgodovine, socialnega konteksta, telesnosti itd.

Procesi odločanja, (ne)odločitve in (ne)realizacija odločitev, ki jih opisuje van Manen, so bistveno konstituirani s tem, kakšen smisel in pomen vanje, v interakciji z lastnim okoljem, prinašajo odločevalci z izkustveno perspektivo – bistveno so konstituirani s tem, kako odločevalci udejanjajo pomembnosti sveta, v katerem delujejo. Van Manenova (2014) raziskava po mojem lepo prikazuje, da je odločanje bolj smiselno razumeti kot dejavnost udejanjanja kot pa nekakšno preračunavanje z mentalnimi reprezentacijami zunanjega, od odločevalcev ločenega sveta.

Opisane odločitvene situacije se sicer razlikujejo, recimo od potrošniških in drugih nekonsekvenčnih ter enostavnih laboratorijskih kot tudi drugačnih vsakodnevnih odločitev. Vendar sem z raziskavama Kleina et al. (2010) in van Manena (2014) želel nakazati, da odločanja in odločitev ne morem pojmovati kot ločenih od odločevalcev, saj, če jih odstranimo iz enačbe, niti ne vemo, kaj so alternative, notranje in zunanje negotovosti, ipd. – ne vemo, o čem sploh govorimo, čeprav si s tretjeosebne perspektive morda predstavljamo, da govorimo o odločanju, da so negotovosti pač takšne kot smo jih definirali, da je "odločevalcem" mar za odločitvene probleme, ki smo jim jih predstavili ipd.

Nadalje, čeprav v omenjenih raziskavah gre za specifične odločitvene situacije – tako se vsaj zdi, ko poskušamo s tretjeosebne perspektive raziskovalna "spoznanja" urediti v teorijo z jasnimi "kategorijami" in razmejitvami in/ali z vidika lastne prvoosebne predstave o tem, kaj je odločanje, svet urediti tako, da se od lastnega ne razlikuje preveč –, pa sem želel prikazati pravzaprav enostavno spoznanje: da lahko enaka ali zelo podobna odločitvena situacija za enega odločevalca predstavlja (je) nekaj *povsem* različnega kot za drugega odločevalca, tj., nikakor ni enaka ali podobna odločitvena situacija, ampak povsem različna.

Van Manenova (2014) raziskava recimo ugotavlja, da različne osebe "zelo podobno odločitveno situacijo" razumejo / ustvarjajo na zelo različne: nekateri čutijo nenehno stisko in so, čeprav so se že "odločili", v neprestanem stanju odločanja, drugi bolj preudarjajo o posledicah, tretji je sploh ne vidijo kot odločitvene situacije ipd. Če spoznanja predstavljenih raziskav vzamemo resno, moramo priznati, da gre pravzaprav za povsem različne odločitvene situacije – situacije, ki jih ne moremo prišteti pod neko "vrsto" odločitvenih situacij, saj enostavno ne gre podobne odločitvene situacije, ampak za povsem različne. Ne vidim razloga, zakaj to ne bi držalo tudi za drugačne (spet, to je trditev, postavljena s tretjeosebnega vidika) situacije, na primer za situacijo izbiranja okusa sladoleda, avtomobila, študija, karierne poti, imena otroka ipd. (to bi bilo potrebno nadrobneje pokazati, vendar to presega obseg prispevka; cf. Strle 2016).

4. ZAKLJUČEK

Predstavljeni vidiki odločanja kažejo na to, da o odločanju, odločitvah in odločitvenih situacijah ne moremo govoriti izven smisla in pomena, ki ga v interakciji s svojih okoljem ustvarjajo oz. udejanjajo posamezni odločevalci. Pogled na odločanje, ki se izmika klasičnim predstavam o duševnosti in večini sodobnih objektivističnih pristopov k raziskovanju odločanja, ki, če ga ne bomo upoštevali in raziskovali, lahko vodi le v upanje, da naše abstraktne predstave o tem, kaj se dogaja v duševnosti odločevalcev, ko naj bi se odločali, niso predaleč od resničnosti odločanja. Prazno upanje, ki se ga večji del sodobnih pristopov k raziskovanju odločanja še vedno oklepa.

5. REFERENCE

[1] Bechara, A., Damasio, H., Tranel, D. in Damasio, A. R. 1997. Deciding advantageously before knowing the advantageous strategy. *Science 275*(5304), 1293-1295.

[2] Colombetti, G. 2014. *The Feeling Body: Affective Science Meets the Enactive Mind*. Cambridge, MA: The MIT Press.

[3] De Martino, B., Kumaran, D., Seymour, B. in Dolan, R. J. 2006. Frames, biases, and rational decision-making in the human brain. Science *313*(5787), 684-687.

[4] Di Paolo, E. A., Rohde, M. in De Jaegher, H. 2010. Horizons for the enactive mind: values, social interaction, and play. V *Enaction: Toward a new paradigm for cognitive science*, J. Stewart, O. Gapenne in E. Di Paolo, Ur. Cambridge, MA: The MIT Press, 33-87.

[5] Dijksterhuis, A., Bos, M. W., Nordgren, L. F. in van Baaren, R. B. 2006. On Making the Right Choice: the Deliberation-Without-Attention Effect. *Science 311*(5763), 1005-1007.

[6] Frydman, C. in Camerer, C. F. 2016. The Psychology and Neuroscience of Financial Decision Making. *Trends in Cognitive Sciences*, *20*(9), 661-675.

[7] Hardman, D. 2009. *Judgment and Decision making: Psychological Perspectives*. BPS Blackwell Publishing Ltd.

[8] Hastie, R. 2001. Problems for Judgment and Decision Making. *Annual Review of Psychology 52*(1), 653-683.

[9] Klein, G., Calderwood, R. in Clinton-Cirocco, A. 2010. Rapid Decision Making on the Fire Ground: The Original Study Plus a Postscript. *Journal of Cognitive Engineering and Decision Making 4*(3), 186-209.

[10] van Manen, M. A. 2014. On Ethical (In)Decisions Experienced by Parents of Infants in Neonatal Intensive Care. *Qualitative Health Research 24*(2), 279-287.

[11] Petitmengin, C. 2006. Describing one's subjective experience in the second person: An interview method for a science of consciousness. *Phenomenology and the Cognitive sciences 5*(3), 229-269.

[12] Roy, J.-M., Petitot, J., Pachoud, B. in Varela, F. J. 1999. Beyond the Gap: An Introduction to Naturalizing Phenomenology. V *Naturalizing Phenomenology: Issues in Contemporary Phenomenology and Cognitive Science*, J. Petitot, F. J. Varela, B. Pachoud in J.-M. Roy, Ur. Stanford CA: Stanford University Press, 1-80.

[13] Strle, T. 2016. Odločanje: od laboratorija do resničnosti vsakdanjega življenja. *Analiza* (v pregledu).

[14] Varela, F. J. 1996. Neurophenomenology: A methodological remedy for the hard problem. *Journal of Consciousness Studies 3*(4), 330-349.

[15] Varela, F. J., Tompson, E. in Rosch, E. 1993. *The embodied mind: Cognitive science and human experience*. Cambridge MA: The MIT Press.

Sta čustveno in moralno vrednotenje lahko eno in isto?

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ABSTRACT

Med raziskovanjem vprašanja odnosa med čustvi in moralnim odločanjem ter med čustvi in razumom vpeljem pojem zaznava/vrednotenje/odziv, kot enoten fiziološki pojav utelešene kognicije. Osredotočam se na vrednotenje kot enovit proces, s katerim življenje ločuje med relevantnimi in nerelevantnimi dražljaji ter skladno izbira (relativno) najustreznejše odzive. Vrednotenje delim glede na odvisnost od konteksta in glede na vrsto dražljajev, ki jih vrednotenje zajema. Vse vrednotenje, ki je nujno odvisno od kontekstov, poimenujem kot čustveno vrednotenje. Opredelim še logično/matematično vrednotenje, ki je nujno neodvisno od kontekstov in s tem diametralno nasprotno čustvenemu.

Ključne besede

Čustva, čut, kontekstualno vrednotenje, nekontekstualno vrednotenje, razum, zaznava/vrednotenje/odziv, zavest.

1. UVOD

V prispevku se ukvarjam z vprašanjem istosti čustvovanja in moralnega vrednotenja. Predpostavil sem, da je poleg čustev edini potencialno relevanten faktor za moralno odločanje še razum, zato je bilo nujno, da poskušam razmejiti med vplivi obojega. Pa se je težava pojavila ob ugotavljanju, kaj razum sploh je, kar me je privedlo do modela kognitivnega vrednotenja, ki ga želim pred nadaljevanjem dela izpostaviti javnosti te konference. Skušam predstaviti pogled na vrednotenje, kot nujno sestavino troedinosti zaznave, vrednotenja in odzivanja utelešene kognicije v zvezi z različnimi dražljaji, ki jo najbolje opiše pojem zaznava/vrednotenje/odziva. Od vseh plati tega trojčka se posvetim vrednotenju in zatrjujem, da človeška utelešena kognicija lahko vse stvari vrednoti v nujni soodvisnosti od kontekstov, kar izenačujem s čustvenim vrednotenjem oziroma s čustvovanjem. Drug način vrednotenja pa je nujno neodvisen od konktekstov, za kar menim, da je značilnost matematičnega/logičnega vrednotenja. Vrednotenje delim še glede na to, katero vrsto dražljajev je mogoče vrednotiti na vidno, slušno, … vrednotenje, ki jih naslonim na delovanje „tradicionalnih“ čutov ter na matematično/logično vrednotenje, ki ga povezujem z delovanjem na novo opredeljenega čuta za matematiko/logiko.

V prispevku predstavljam pogled, ki mi omogoča v primeru verodostojnosti naknadno dokazovanja trditve, da je čustveno vrednotenje glavna in včasih celo edina sestavina pravnega vrednotenja, s čimer je moralno vrednotenje, ki ga prikazujem kot opazno manj logično/matematičnega kot pravno odločanje, v celoti lahko označeno za čustveno vrednotenje.

2. ZAZNAVA/VREDNOTENJE/ODZIV

Čustva so že bila videna kot nevarnost moralnosti in racionalnosti, čeprav nam je najbrž bližja romantična predstava o čustvih kot središču človeške individualnosti in moralnosti (Nussbaum, 2001). V obeh teh pristopih je očitno izključevanje čustvovanja in razumnega. Moj prispevek je usmerjen k temu, da pomagam odstranjevati pogled izključevanja. Želim predstaviti stališče, da, če že lahko govorimo o čustvenem in razumnem kot o dveh različnih oblikah procesov, to skupaj tvori sistem vrednotenja, ki je potreben za sprejemanje najboljših možnih (glede na kontekste okolja in notranjih splošnih stališč) motoričnih in miselnih odzivov. Pod pojmom *vrednotenje* v svojem razmisleku pojmujem enovit proces, s katerim življenje ločuje med relevantnimi in nerelevantnimi dražljaji ter skladno izbira (relativno) najustreznejše odzive. Menim, da se znotraj tega enovitega procesa pojavljajo možnosti za razlikovanje po dveh kriterijih: po kriteriju kontekstualnosti in po kriteriju unikatne zmožnosti prepoznavanja določenih tipov dražljajev iz okolja (del katerega je tudi utelešena kognicija sama).

Glavni gradnik moje misli je moj pogled na vrednotenje, kot nujno in bistveno sestavino utelešene kognicije – *autopoesis* (Maturana in Varela, 1998), ki nam omogoča vse tisto, kar omogočata čustvovanje in kognicija skupaj. Oziroma, vzpostavim rabo zveze zaznava/vrednotenje/odziv, ki mi predstavlja enoten fiziološki odziv na dogajanje v okolju. Vsa polja preučevanja kognitivne znanosti (spomin, odločanje, pozornost, prepričanja ...; res pa v modelu povsem zanemarjam motivacijo) so zgolj lastnosti, ki so posledica dejstva, da utelešena kognicija stalno zaznava, vrednoti in se odziva, oziroma, kot trdim, gre za takšno povezanost in sotvorbo celic, da je smiselneje razmišljati o zaznavi/vrednotenju/odzivanju najprej kot o enem in šele potem iskati specifike posameznih stopenj enega procesa, saj utelešena kognicija ves čas vrednoti/zaznava/se odziva kot ena cela sama. Trdim, da ne more biti česarkoli brez vseh treh stvari iz tega trojčka. Čim pri neki utelešeni kogniciji obstaja kakršenkoli spoj senzorika - motorika, mora biti zraven še neko vrednotenje, saj sicer ne senzorika in ne motorika ne moreta imeti nobene vloge. Senzorika nam lahko pomaga le, če prepoznamo relevantnost dražljajev in se nanje ustrezno motorično odzivamo. In takoj, ko imamo v stavku besedi relevantnost in ustreznost, potem mora nujno prihajati do vrednotenja dražljajev in, morda evolucijsko ne povsem na začetku, vrednotenja možnih odzivov.

3. ČUTI

Kot sem že omenil, enovito vrednotenje lahko delim po kriteriju unikatne zmožnosti prepoznavanja določenih tipov dražljajev iz okolja. Da ne bo zvenelo preveč zapleteno: govorim o čutih. Vse vrednostne sodbe v sistemu utelešene kognicije sprejemamo ob uporabi miselnih procesov. Na tem mestu se nočem odpravljati na stranpot raziskovanja pojma misli, vendar ne najdem razloga, ki bi pričal v smer, da miselni proces in vrednotenje ni eno in isto. Pri razumevanju pojma miselni proces si pomagam z Baumom (2004), ki trdi, da struktura in narava misli, pomena, zaznave in zavesti naravno izhajajo iz evolucije «kognitivnih programov ..., ki izkoriščajo vedenje o kompaktnosti strukture sveta ... ». Po Baumu je bistvo misli zakodirano v DNK; na način, ki omogoča le procesiranje bistvenega. Bistvo misli nam omogoča razumevanje pomenov dražljajev iz okolja za izbiro ustreznih motoričnih odzivov.

Te miselne procese razlikujem glede na to, na delovanje katerega od čutov so vezani, oziroma so neločljiv del čuta samega. Pod čutom razumem večji ali manjši skupek nevronov, ki je edini zmožen izmed dražljajev (izključno v mejah za ta čut specifično določenih lastnosti dražljajev), ki so mu na voljo, izvajati vrednotenje. Čut definiram kot sposobnost prepoznavanja pomena specifičnih dražljajev iz okolja, vrednotenja teh dražljajev in proženja odzivov, pri čemer je vsak čut vezan na točno določene tipe lastnosti dražljajev. Glede tega med čuti ni prekrivanja in ob izpadu enega čuta drug čut ne more nadomestiti izpadle prepoznave dražljajev.

Poleg vida, sluha (občasno razvitega v sonar), okusa, voha in dotika, sposobnosti zaznave temperature, dražljajev relevantnih za obvladovanje ravnotežja, bolečine, poleg kinestetičnega čutenja, kemoreceptorjev za sol in koncentracijo ogljikovega dioksida v krvi ter poleg mnogih drugih čutov pri evkariontih, živalih in rastlinah, bom postavil še dodatne čute, ki ustrezajo definiciji. Menim, da je za prepoznavo matematičnih pomenov dražljajev iz okolja pristojen čut za matematiko/logiko. Verjetno je temelj slednjemu mnogo starejši čut jezika. Med še starejšimi lahko morda celo iščemo čute na ravni drugih aktivnosti, ki jih je življenje skozi evolucijo dovolj pogosto ponavljalo. Moja intuicija se nagiba k potrebi, da bi enakovredno kot na ostale čute gledali tudi na recimo tako »preproste« mehanizme, kot so čut za gibanje/tek in pa recimo celo morda čut za grizenje. Verjetno ne smem izpustiti stališča do vprašanja ali obstaja tudi moralni čut. Sem prepričan, da bi ga lahko iskali edino v okviru čuta za socialno bivanje.

Tako vrednotenje po kriteriju prepoznave različnih tipov dražljajev med drugimi delim na vidno ali slušno, matematično ali jezikovno vrednotenje. Pri čemer so vsa ta vrednotenja vedno najprej zgolj sestavina enovitega procesa vrednotenja utelešene kognicije.

Čustva so duševni procesi in stanja, ki izražajo človekov vrednostni odnos do zunanjega sveta ali do samega sebe (Lamovec, 1991). Sam bi sicer takšno misel dopolnil s tem, da *vzpostavljajo in izražajo človekov vrednostni odnos* …vendar, če zgornje stališče drži, potem drži, da je celoten pojem čustvovanja zajet v pojmu vrednotenja, kot ga opisujem.

Predstavljani pojem vrednotenja najlepše opišem z mislijo, ki jo je avtor sicer namenil čustvom: »...čustva niso diskretne točke, niso stanja...čustva so samo naše zvezne (časovno, prostorsko, vsebinsko) težnje/nagnjenja glede različnih vprašanj« (Vöröš, str. 350).

S tem, ko trdim, da je čustvovanje v celoti zajeto v pojmu vrednotenja, pa ne pojasnim vsega, saj je odprto vprašanje naših čustev in razuma, ki mora imeti kakšne fiziološke temelje. Zato vrednotenje po kriteriju kontekstualnosti delim na dva ali morda tri različne sisteme: kontekstualno (nujno odvisno od konteksta), nekontekstualno (nujno neodvisno od konteksta) ter morda jezik kot močno kontekstualno procesiranje, z elementi formalno dogovorjenih (v neki meri nujno neodvisnih od konteksta) pomenov pojmov. Za prvega od sistemov, kontekstualno vrednotenje, ki je starejši, ki je usposobljen za vrednotenje vsega, še tako neverjetnega in nepričakovanega, pri čemer pa je vrednotenje vedno organsko vezano na kontekst, je najbrž zelo blizu ali enako temu, kakor pojem čustev razume Damasio v svoji hipotezi somatskih markerjev (Damasio, 2005), po kateri čustva prevzamejo odločanje v situacijah, ko nam razum ne zmore dati odgovora glede optimalnosti neke izbire v danem trenutku. Somatski markerji, kot kemijski spomin na v preteklosti doživeto čustveno izkušnjo, ki nam v danem trenutku pomagati vzpostavljati primerjavo med danim trenutkom in podobnimi trenutki iz preteklosti, na podlagi česar potem pride do končne končne odločitve v eno ali drugo smer.

Pri sistemu kontekstualnega vrednotenja (čustvovanja) napovedovanje rezultatov vrednotenja nikakor ni mogoče brez poznavanja kontekstov podatkov, pri čemer je različno prepletenih kontekstov vedno izjemno veliko. Z večanjem kompleksnosti zmogljivosti tega vrednotenja se pojavi nova zmogljivost: vrednotenje neodvisno od kontekstov. Vrednotenje našega čuta za matematiko/logiko, ki svet zaznava na način, ki ni sposoben subjektivnosti. Za razliko od kontekstualnega vrednotenja je pri nekontekstualnem vrednotenju rezultat vrednotenja vedno nujno povsem neodvisen od kakršnega koli subjektivnega stališča opazovalca ali akterja. Ko so znani vhodni podatki za logično ali matematično vrednotenje, je mogoče „v naprej napovedati“ rezultat vrednotenja, neodvisno od poznavanja kakršnega koli konteksta, matematično in logično procesiranje je nekontekstualno, ker je breztelesno, kar enako obstaja za katerega koli posameznika. Korak evolucije stran od svoje utelešenosti. Produkt čutenja matematike/logike v dogovorjeni simbolni obliki pretvorimo v sredstvo popolne komunikacije, ki je, za razliko od jezika in drugih čutov, objektivno enako za vse. Rezultat vrednotenja zaporedja matematičnih simbolov je subjektivno enako doživeto pri vseh. Ta sposobnost nekontekstualnega vrednotenja okolja je verjetno nujna posledica razvoja vrednotenja, ki je pred tem v jeziku že začelo vzpostavljati, še vedno ne povsem razumljen, fascinanten odnos med subjektivostjo kvalij in med formalno objektivnostjo nekontekstualnih besed. Menim sicer, da jezik lahko brez večje škode tudi povsem umestim med kontekstualne čute, saj menim, da praktično vsako besedo posamezniki subjektivno napolnjujemo s pomeni, zaradi česar pri različnih posameznikih ves pomen določene besede nikoli ne more biti povsem enak.

Skupna mešanica delovanja nekoliko hibridnega jezika in nekontekstualnega čuta matematike/logike/razuma ter povsem kontekstualnih čutov (vrednotenje vonja ali okusa …) zagotavlja delovanje utelešene kognicije. Skozi svoje čute bitje zaznava/vrednoti/se odziva. Živi. Biva.

Ob bok čustev, ki mi predstavljajo sistem kontekstualnega vrednotenja postavim razum, ki mi predstavlja sistem nekontekstualnega vrednotenja. Tako lahko v eno povežem na eni strani pojma kontekstualnih čutov ter čustev in pojme razuma ter čuta za matematiko/logiko.

4. KVALIJE UTELEŠENE KOGNICIJE

Pred zaokrožitvijo razmisleka se ne morem izogniti pojmu zavesti, ki je v ozadju prisoten ob vsem razmišljanju na temo, čeprav glede na mojo osnovno vprašanje morda predstavlja stranpot. Zavest razumem kot kvalijo. Kvalijo razumem kot subjektivno doživljanje/vrednotenje (česarkoli, lahko tudi predstave o ali spomina na). Ne bom šel tja, ampak pri opredelitvi kvalije bi se zagotovo moral ukvarjati tudi s časovno komponento – njenim trajanjem. Za poenostavitev, za potrebe tega besedila kvalijo časovno razumem kot trenutek. Pod pojmom kvalije ne razumem zgolj rdečine rdečega. Enak pojav, enako kvalija, četudi drugačna po vsebini, je tudi pravičnost pravičnega, razumnost razumnega. Kvalija je predstava pravnika o pravnem problemu, kvalija kirurgu omogoča operacijo. Celotna duševnost kot nepregleden splet morja kvalij skozi katere se zrcali naše (in verjetno v določenem obsegu tudi naših prednikov) že doživeto in vrednotenje tega vsega. Menim, da je zavedanje enako zaznava/vrednotenje/odzivanju. Pri čemer pa moram poudariti, da v pojem zavedanja nikakor ne vključujem samozavedanja, kot pojava pozornosti na našo pozornost, oziroma subjektivnega zavedanja svojega subjektivnega zavedanja.

Hameroff in Penrose (1996; Hameroff, 1994; Penrose, 1994) ponujata možnost, da zavest vzhaja iz mikrotubulov, celičnih proteinskih struktur, ki so lastne evkariontom in naj bi bile sposobne procesiranja informacij. Sam tipam še dlje. Bakterije s

proteinskim senzorjem svetlobe lahko le to zaznavajo in se nanjo odzivajo s premikom, špekuliram o obstoju za zaznavo/vrednotenj/odzivanje nujnih informacij, že na ravni podatomskih delcev.

5. ZAKLJUČEK

Da se na koncu opredelim do zastavljenega vprašanja ali je čustveno vrednotenje enako moralnemu vrednotenju, v ponazoritev podajam nenatančno prispodobo razvoja sistema vrednotenja s pojmi bivanje, premikanje, emocije, morala, pravo. Življenje, ki se ne premika, ima neprimerljivo manj kompleksen sistem vrednotenja kot bitje, ki se že premika, saj premikanje terja upoštevanje več različnih možnih sprememb. Naslednji večji korak lahko prikažem po tem, ko se sistem vrednotenja premikajočih bitij dodatno opremi z limbičnim sistemom sesalcev, ki omogoča veliko kompleksnejše operacije zaznava/vrednotenje/odziva. Z moralo razumem kompleksnost vrednotenja najvišjih primatov, vključno s človekom, ki se je s časom povzpela do današnjih višav kompleksnosti človeškega vrednotenja, ki ga ponazarjam z besedo pravo, saj naj bi pravni sistem simboliziral sistem objektivne, „slepe“ pravice, torej sistem, kjer odloča vrednotenje razuma. S tem ponazarjam, da bi bilo glede vprašanja odnosa med čustvi in moralo mogoče sklepati, da je morala bolj čustvena in manj razumska - formalno logična kot pravo. Nekaj let izkušenj enega pravnika sicer gotovo ni dovolj velik vzorec za resne znanstvene zaključke, vseeno pa predvsem na podlagi osebnih izkušenj zagovarjam stališče, da je logično formalno v pravu večinoma kvečjemu začimba v kotlu čustvenega odločanja. Če stališče drži, potem je seveda formalno logičnega v morali še bistveno manj in lahko zaključim, da je moralna sodba rezultat kontekstualnega vrednotenja utelešene kognicije, ki ga označujem tudi kot čustveno vrednotenje. Med srečevanjem z ugotavljanjem vsebine temeljnih pojmov mojega razmisleka (vrednotenje, čustva, razum, zavest) se bežno dotaknem odločanja in ugotovim, da nobena odločitev ne more biti povsem razumska, lahko pa temelji na bolj ali manj utemeljenih dejstvih in pri tem lahko bolj ali manj uporablja pravila formalne logike. Ob vsakem raziskovanju tovrstnih pojavov se nujno srečamo z dvojnostjo sveta dejanskih, v celoti po znanstveni metodi pridobljenih dejstev, kot razlogih neke odločitve (na tem polju sem obsojen na izključno teoretski razmislek) in sveta dejansko zazanavanih procesov odločanja, ki so v pretežni meri kontekstualen (čustven) proces. Taksni odločevalski procesi so praviloma materialno in procesno drugačni, kadar posameznik presoja sebe, svoje ali tuje, oziroma so v izjemno veliki meri odvisni od mnogih faktorjev (subjektivnega, odločevalčevega) konteksta.

Naša sposobnost čutenja/zavedanja z evolucijskim poglabljanjem abstrakcije liže nova in nova spoznanja, o okolju okoli sebe in o sebi znotraj tega okolja. Svojo utelešenost živi in, kot dokazuje človek, o njej lahko visoko abstraktno razmišlja ter piše.

6. LITERATURA

[1] Baum, E. (2004). What is Thought? Cambridge, MA. Massachusetts Institute of Technology.

[2] Hameroff, S. R. & Penrose, R. (1996). Orchestrated reduction of quantum coherence in brain microtubules: A model for consciousness. In Toward a science of consciousness. I. The first Tucson discussions and debates (ed. S. R. Hameroff, A. Kaszniak & A. C. Scott). Cambridge, MA: MIT Press: str. 507-540.

[3] Damasio, A. (2005). Descartes's error, Emotion, Reason, and the Human Brain. London: Penguin Books.

[4] Lamovec. (1991). v Kompare, A., Stražišar, M., Vec, T., Dogša, I., Jaušovec, N. in Curk, J. (2002). Psihologija – Spoznanja in dileme. Ljubljana: Državna založba Slovenije: str. 169.

[5] Maturana, H. & Varela, F. (1998). Drevo spoznanja. Biološki izvor razumevanja človeka [prevod Uroš Kalčič]. Studia humanitatis, Ljubljana.

[6] Nussbaum, Martha (2001). Upheavals of thought: the intelligence of emotions. Cambridge New York: Cambridge University Press.

[7] Vöröš, S. (2013). Podobe neupodobljivega (Nevro)znanost, fenomenologija, mistika. Kud logos : Znanstvena založba Filozofske fakulteta.

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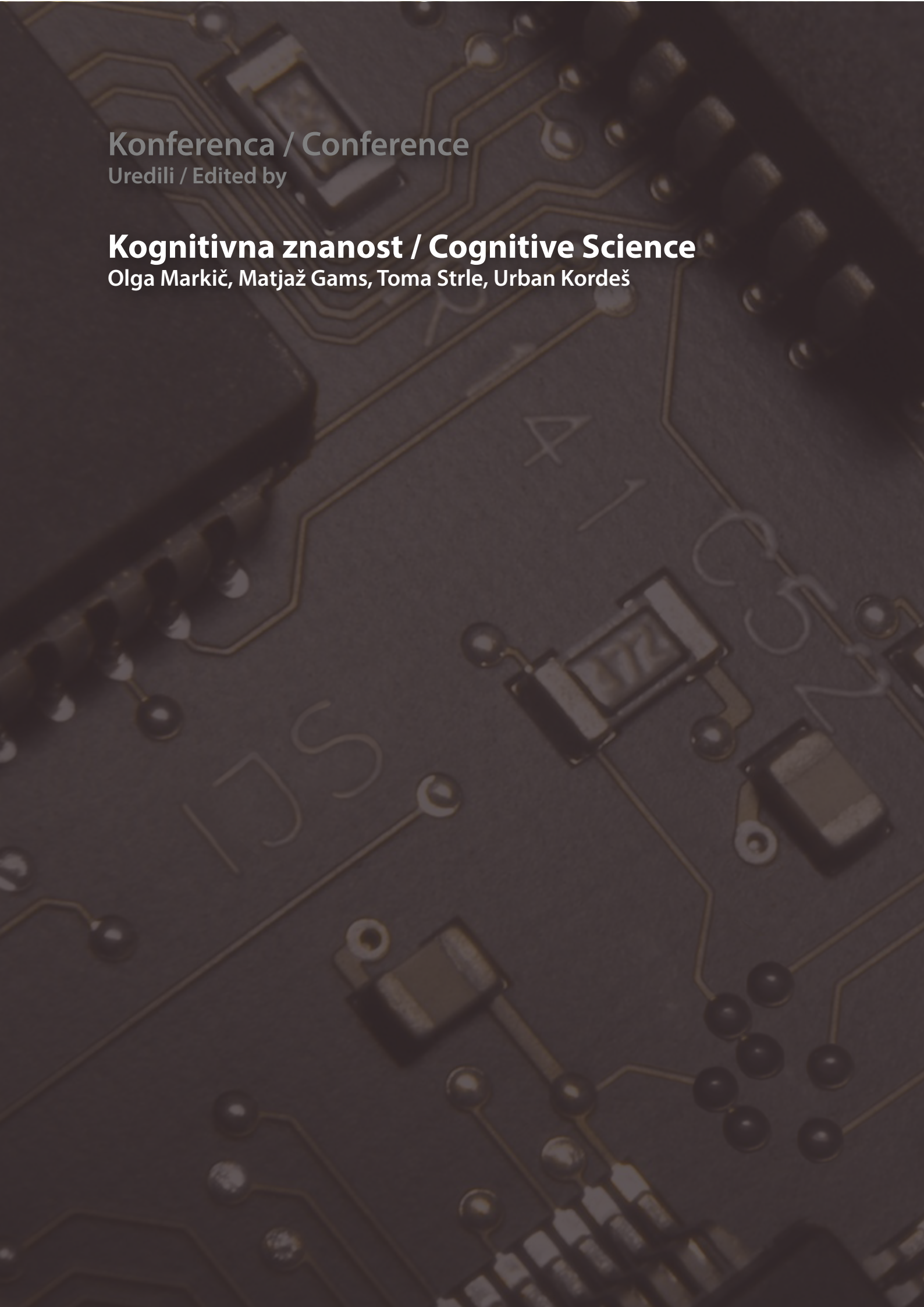

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