



Middle European
Interdisciplinary Master Programme
in Cognitive Science

Conference 2008

Bratislava, June 20-21, 2008

Welcome

*Dear Coxies from Bratislava and Vienna,
dear MEi:CogSci Partners,
dear Guests!*

*Today we celebrate the signing of the consortium contract allowing the first
Graduates to be the first to receive the joint degree.
And we are looking forward to very diverse and interesting topics to be covered
today and tomorrow.
A warm welcome to the MEi:CogSci Conference 2008!
Enjoy!*

Igor Farkas & Brigitte Römmner-Nossek

Programme

Friday June 20, 2008

16:00-16:15h	<i>Welcome Conference Opening by Igor Farkaš</i>
16:15-17:00h	<i>Keynote Matthias Scheutz, Bloomington, USA: Affecting Behavior: Roles of Affect in Interactions among Situated Embodied Agents</i>
<i>Session Chair Martin Takáč</i>	<i>Sandra Theresia Weber, Vienna: A computational cognitive model of performance in the Iowa Gambling Task. Are Somatic Markers indicators of risk?</i>
	<i>Tomáš Gál, Bratislava: Strategies of Cooperation</i>
	<i>Johanna Alexopoulos, Vienna: Why do People Behave Fair?</i>
	<i>Andreas Schneeberger, Vienna: A Simple Model of Transferable Reputation</i>
18:20-18:30h	short BREAK
18:30-19:00h	<i>Invited Talk Daniela Ostatníková, Bratislava: Effect of Testosterone on Cognition</i>
19:00-20:00	<i>A toast to MEi:CogSci and Poster session I</i>

Saturday June 21, 2008

09:30-10:00h	<i>Invited Talk</i> Urban Kordeš, Ljubljana: <i>Is Lived Experience Researchable?</i>
10:00-11:00 <i>Session Chair</i> Jan Rybar	Tomáš Princ, Bratislava: <i>False Memory</i>
	Katharina Anna Turecek, Vienna: <i>Deficiency of Cognitive Control as a Predictor of Memory Intrusions</i>
	Mehrdad Farahmand, Vienna: <i>Memory: A Paradigm for Reductionism?</i>
11:00-11:30h	COFFEBREAK
11:30-12:30 <i>Session Chair</i> Andreas Reichelt	David Thallinger, Vienna: <i>What a Difference a Brain Makes - Motor Cortex Representations and Plasticity in Pianists vs. Non-Pianists</i>
	Andreas Kalckert, Vienna: <i>Plasticity of the Primary Motor Cortex in Learning New Movement Trajectories</i>
	Ronald Sladky, Vienna: <i>Schopenhauer's Last Will</i>
12:30-14:00h	LUNCHBREAK
14:00-15:15 <i>Session Chair</i> Nicole Rossmanith	Isabella Hinterleitner, Vienna: <i>Connectionist modelling of irregular verb flexion in Williams Syndrome using two different learning algorithms</i>
	Peter Jankovič, Bratislava: <i>Situational Representation in Language Comprehension</i>
	Dana Retová, Bratislava: <i>Analysis of conceptual metaphors of emotions in Slovak language</i>
	Birgit Peterson, Vienna: <i>How to communicate about language?</i>
15:15-15:45h	COFFEBREAK
15:45-16:45h	Poster session II
16:45-17:15h	<i>Invited Talk</i> Vladimír Kvasnička, Bratislava: <i>A Relation Between Symbolic and Connectionist Representations in Cognitive Science</i>
17:15h -18:15h <i>Session Chair</i> Elisabeth Zimmermann	Erik Hörtnagl, Vienna: <i>How can We Make Sense of What We Perceive?</i>
	Petra Pesak, Vienna: <i>Mastering Architecture - Effects of explicit style related information and knowledge on appreciation of contemporary Architecture</i>
	Stefan Wiltchnig, Vienna: <i>Enabling Spaces for Knowledge Creation and Innovation</i>
18:15-18:30h	End of MEi:CogSci Conference 2008

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Talks Invited Speakers

Affecting Behavior: Roles of Affect in Interactions among Situated Embodied Agents

Matthias Scheutz

Affect seems to be deeply intertwined with many parts of the human cognitive architecture, and also that of many animals. Affective states like happiness, fear, anger, disappointment and many others routinely accompany cognitive processes in humans and can influence attention, problem solving, action selection, and, most importantly, social interactions.

In this talk, I will present an overview of our work on exploring and understanding possible roles of affect in embodied agents that are situated in cooperative and competitive multi-agent environments. Specifically, I will show that affective states can have both beneficial architecture-internal roles (e.g., in deciding what to do next) as well as useful social roles (e.g., for displaying agent-internal states that are indicative of the agent's behavioral dispositions). Throughout the presentation, I will draw examples from our agent-based simulation models in biologically motivated competitive multi-agent environments, where agents compete for limited resources in order to procreate and survive, and from our work on complex robotic architectures for human-robot interaction, where humans need to work with autonomous robots in teams to jointly achieve a task. The latter is of particular relevance to the emerging field of human-robot interaction (HRI) where models of human cognition and behavior can help in the design of robots that will be able to interact with humans in natural ways.

Effect of testosterone on cognition

Daniela Ostatníková

Although, there is no sex difference in general intelligence, men differ from women in specific cognitive abilities. The most often reported differences have been found in mental rotation – men scoring better than women in these tests. Both genders differ in many psychological and behavioral functions. Previous research uncovered sex differences in the drive to analyze a system, in the drive to identify another's mental states and to respond appropriately to them. The sex differences are supposed to be based on nurture and nature influences throughout the life span. Our research team did the first assessments of systemizing and empathizing in Slovak population of young adults and studied the relationship to sex hormone levels. Sex differences in cognitive and psychological functions depend on endocrine factors such as testosterone and estradiol.

Testosterone was hypothesized to influence cognition during intrauterine period (this influence is organizational and permanent) as well as during postnatal life (this influence is activational and transient). Fetal testosterone, which peaks around the middle of the pregnancy, affects brain development by slowing down the growth of parts of the left hemisphere, thus, relatively enhancing the growth of homologous parts of the right one. The mechanism of hormonal influence always includes the hormone, its metabolites and the expressed receptors in certain brain areas. Testosterone, the major masculine hormone, itself is the powerful hormone masculinizing the brain structures and influencing the neuronal synaptogenesis. But even more powerful hormone acting on brain cells and neuronal circuits seems to be estradiol, the metabolite of testosterone and the major feminine hormone. The transformation is dependent on aromatase expression, the enzyme converting testosterone to estradiol within the brain.

The organizational effect of prenatal testosterone on cognitive performance could be studied during the silent prepubertal period in children. More than hundred prepubertal intellectually gifted children were compared with children from general population and their mentally challenged peers. The results proved significantly lower testosterone levels in gifted children and mentally challenged in comparison to control group. There was no difference in endocrine maturation onset in studied groups. The underlying cause remains unclear. Genetic aspects and specific epigenetic factors should be followed in further studies.

Findings of ours other studies on adult healthy population indicate nonlinear relationship between testosterone and spatial performance, with moderate levels of androgens being associated with better spatial ability.

The research was supported by grants AV 4/0038/07, MZSR 2006/22-UK-01, VEGA 1/3438/06 and VEGA 1/3420/06.

Is lived experience research-able?

Urban Kordeš

I will (very briefly) introduce a rather new approach in cognitive science: first-person research. It is a qualitative research project dedicated to inquiry of experience. Instead of objective (third-person) descriptions or theories it focuses on the lived experience as it is given. I will mention most striking arguments *pro et contra* this kind of research and outline the state-of-the-art of the field. Since first-person (or phenomenological) research is a common name for a wide variety of approaches, I will also try to introduce and classify most important directions.

A relation between symbolic and connectionist representations in cognitive science

Vladimír Kvasnička

Within the framework of cognitive science there exist since its origin riot discussions [2] about an interrelationship between symbolic and connectionist approaches to the study of cognitive processes in human mind/brain. In symbolic approaches basic elementary units are symbols that are transformed onto other symbols by making use of hierarchically organized rules. This type of representation leads to a view of human brain as a computer, which is able to manipulate and process symbols. A connectionist approach [4] to cognitive processes is based on an idea that they are running in neural network composed of huge number of mutually interconnected elementary processor units – neurons. In the lecture it will be demonstrated that these two „illusory“ different approaches are mutually equivalent and complementary dual [1]. A theorem will be proved [3,5] that any process running in a neural network may be equivalently represented by a finite-state machine that transforms input symbols onto output symbols. Moreover, a finite-state machine may be transformed [3,5] onto a neural network, where symbols are represented by patterns of neural activities.

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- Bohr, N.: *Atomic Theory and the Description of Nature*. Cambridge University Press, Cambridge, 1934.
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- Kleene, S. C.: Representation of Events in Nerve Nets and Finite Automata. In Shannon, C. E., McCarthy, J. (editors): *Automata Studies*, Princeton University Press, Princeton, 1956, pp. 3-41.
- McCulloch, W. S., Pitts, W. H.: A logical calculus of the ideas immanent in nervous activity. *Bulletin of Mathematical Biophysics*, **5** (1943), 115-133.
- Minsky, M. L.: *Computation. Finite and Infinite Machines*. Prentice-Hall, Englewood Cliffs, NJ, 1967.

Plasticity of the primary motor cortex in learning new movement trajectories

Andreas Kalckert

The control of hand movements is a demanding and complex process for the motor system. It needs an exact calculation of spatiotemporal characteristics and required forces to achieve satisfying movement performance. Unlike decades ago we now know that to some degree these operations are carried out by the primary motor cortex (M1) and that this area is more than a simple and static output structure for motor commands. One of the key components for which neurons in this area fire is the direction of movement (¹). Furthermore M1 exhibits a high degree of permanent plasticity which enables this area to contribute immediately to the acquiring of new motor skills. TMS (transcranial magnetic stimulation) has been found to be a valuable tool to investigate these functions and plastic changes of the motor cortex. Numerous studies have shown that the M1-hand area undergoes changes in its topography and excitability during the learning period and that these are related to movement performance (²). By using this method and measuring the acceleration of the finger movement we are able to show two things: 1. that the acquisition of the new trained movement causes changes within the topography of the map and 2. that the preferred direction of this cortical area responsible for the finger movement can be changed immediately by short training epochs of 20 min. Subjects underwent extensive training of the finger on five consecutive days to reveal the characteristics of motor learning on a larger time-scale. By combining electromyographic responses and acceleration of the finger we are able to determine more precisely what effect this training has and how these are related to the rearrangement of the hand area in whole. These results shed further light onto the functional characteristics of the primary motor cortex and let us conclude that this area is involved in „higher-order“ functions and represents one key area for movement control. The implications for the computational processes of the motor system will be discussed and tried to be embedded into a principal framework for motor control in the human brain (³).

References:

- Georgopoulos. Current issues in directional motor control. Trends Neurosci (1995) vol. 18 (11) pp. 506-10
Pascual - Leone et al. The plastic human brain cortex. Annu Rev Neurosci (2005) vol. 28 pp. 377-401
Bizzzi et al. Neural basis of motor control and its cognitive implications. Trends in Cognitive science (1998) vol. 2 (3) pp. 97-102

Connectionist Approach to Language Comprehension Based on Situational Representation of Microworld

Peter Jankovič

Three basic levels of representation can be found in language comprehension process. The lowest level is surface representation that consists of the text's literal wording. From the surface representation textbase (propositional) level is built. It deals with propositions and their interconnections. The highest level is the situation model that relates all the facts in the text with person's long-term memory. Here also most knowledge-based inferences take place. In many models of language comprehension the situational representation is completely omitted. However, there is enough evidence that situational level is significant for explaining and capturing of many aspects of human language.

In the master thesis we create the situational representation of a simple microworld. We study several properties of the generated representation. The model is robust enough, so it can be finally used for the task of language comprehension.

Microworld

It is rather difficult (if not impossible) to describe all the properties of the real-world environment. If we do not want to restrict the amount of knowledge about the world presented to the model, we must limit the world itself. We propose a simple microworld of three geometric blocks (red block, green block, a pyramid) on a 3x3 grid. The world obeys the rules of gravity, but one object can be held in the air.

Situational representation

We create the situational representation that reflects probabilistic distribution of various situations from the microworld. Because creating such representation by hand would be difficult, we use the automatic tool called self-organizing map. Distributed representation is generated from the random examples of the microworld situations, so the representation is non-linguistic – it bypasses the propositional level of text representation.

Language comprehension

We use the proposed situational representation in language comprehension process. We create a simple recurrent network that transform sentences about the microworld (e.g. *red block is left and pyramid is up right*) into situational representation. The original microworld situation can be computed from this situational representation. We train the network with a standard back-propagation through time learning algorithm.

References:

- [1] Frank, S.L., Koppen, M., Noordman L.G.M., Vonk, W. (2003). *Modeling knowledge-based inferences in story comprehension*. Cognitive science, 27, 875-910.
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- [3] Zwaan, R.A., Radvansky, G.A. (1998). *Situation model in language comprehension and memory*. Psychological Bulletin, 123, 162-185.

Analysis of conceptual metaphors of selected emotions in Slovak language

Dana Retová

How can we characterize human emotions? Should we treat them as biological, psychological, or cultural entities? Can they be reduced to purely biological phenomenon, or are they social constructs?

The approach of cognitive linguistics escapes this simplistic division by explaining how concepts of human emotions arise from individuals' embodied experience in different cultural settings. Emotions are indeed constructed differently in diverse cultures but they all share the basis of common bodily experience which cannot be disregarded. In this view, metaphorical language about the emotions, human physiology of emotions and cultural aspects are all part of an integrated system.

The main aim of this thesis is to analyze the figurative language we use when talking about emotion in Slovak. We would like to confirm that the most central metaphors and metonymies are grounded in bodily experience and they are universally understandable across the languages. We intend to compare the metaphorical models of emotion in Slovak language which has not been yet well-documented with the analysis of these models in other languages, particularly in English. Another goal is to have a closer look on universality of such models within the domain of emotions and see which patterns are unique for particular emotions and which can be used for emotions in general.

For our analysis we chose 6 emotions that are relatively well represented in Slovak language as well as in English: Anger, fear, happiness, sadness, pride, and shame.

In our analysis we used the cognitive linguistic framework within the tradition that was established in the 1980s by the work of George Lakoff (Lakoff, 2006; 2002), Mark Johnson (Johnson, 1987; 1992), Zoltán Kövecses (Kövecses, 2000), and others.

We searched for the sources of conceptual metaphors mapped into the expressions of emotions commonly used in Slovak language. To acquire the most complete list of expressions that are related to the concepts of selected emotions we used three types of linguistic sources of metaphors: National corpus (2007), dictionaries of phrases, and common expressions from everyday discourse. We processed the results in two ways:

1. We categorized them into the system of conceptual metaphors
2. We used corpus statistics to analyze the frequencies of collocation of different contexts with each of the studied emotions.

Our analysis showed that there were only very minor differences in conceptualization of the selected emotions in Slovak and English. Most of the central metaphors were identical with only very slight variations in translation. This similarity in conceptualization of emotions can be a result of common linguistic origin of English and Slovak, inevitable trans-cultural transmission and of shared human physiology that has been translated into emotion metaphors. We have also noticed that the range of the metaphors in English is much wider and the use of figurative language and its structure is richer than in Slovak. The reason for this may be that, compared to English, Slovak language is relatively young in its codified written form.

Most of the metaphors turned out to be used quite generally in all of the studied emotion concepts. We have found quite few emotion-specific metaphors. We have also found an interesting example in conceptualization of fear, which seems to contradict the basic hypothesis of Kövecses (2000) that the conceptualization may vary only within the constraints

of universal physiology of emotions. For example, sometimes we conceptualize FEAR as FIRE although it is associated with the feelings of chill or coldness. In some cases we tend to use expressions central to all emotions, even if it does not reflect our understanding of basic physiology.

This makes plausible the hypothesis that, in our folk theory, we tend to conceptualize emotions as specific instances of the same concept of emotion instead of very distinct processes as they are viewed in modern neurophysiology.

References:

- [1] **Kövecses, Zoltán. 2000.** *Metaphor and Emotion: Language, Culture, and Body in Human Feeling*. Cambridge : Cambridge University Press, 2000.
- [2] **Lakoff, George and Johnson, Mark. 2002.** *Metaforý, kterými žijeme [Metaphors we live by]*. [trans.] Mirek Čejka. Brno : Host, 2002.
- [3] **Lakoff, George. 2006.** *Ženy, oheň a nebezpečné věci [Women, Fire and Dangerous Things]*. [trans.] Dominik Lukeš. Praha : Triáda, 2006.

Mastering Architecture – Effects of explicit style related information and knowledge on appreciation of contemporary architecture

Petra Pesak

The cognitive processing model of aesthetic experiences was recently described by Leder, Belke, Oeberst and Augustin (2004) in five processing stages: *Perceptual Analyses, Implicit Memory Integration, Explicit Classification, Cognitive Mastering* and *Evaluation*. Following this model, the earliest stages of information processing of architecture are concerned with perceptual analyses. At this stage variables of interest include for example complexity, contrast and grouping. In the stage of implicit processing the results of the perceptual analyses are set in relation to analyses that result directly from previous experience thus prototypicality and familiarity is most important at this stage. The processing stage called explicit classification provides explicit representations of either depictive content or explicit style information of the architecture.

As a result two aspects become relevant: a) the amount of the beholder's expertise in architecture and b) the nature of the architecture. For architecture-experienced viewers a type of style- related processing seems to be representative while for architecture naïve persons a content- related processing is rather typical. Central to the model is the assumption that subjective "success" in processing architecture during the five processing-stages, is thought to be self-rewarding, raises aesthetic pleasure and might also increase aesthetic evaluation.

In the present study I focus on effects on style-related explicit information on ratings of appreciation of contemporary architecture. The need of individualization in the twentieth century results on a huge competition of artistic styles and concepts. The alternating of styles and trends is getting faster and the development in contemporary architecture is no more comprehensible for laities. Consequently, contemporary architecture requires a particular need for interpretation. Architects provide material, which needs interpretation in terms of style,

which comprises structural, formal and technical features of visual appearance. According to Leder, style can be understood as an art-specific representation of visual information that distinguishes amongst different architects.

In the study I want to measure how rating of appreciation for architecture change selectively when explicit style information is instructed. Providing the viewer with explicit information should enhance style-related processing and allow for self-rewarding experiences of successfully mastering the architecture. As a result, aesthetic appreciation should increase selectively for the architecture with additional information.

A premise of the Master Thesis is that architecture as a phenomenon of culture is beside the fulfillment of functionality a fact of communication. Due to the assumption that the mastering of architecture is related with the state of expertise of the observer, an exchange of information between experts and non-experts or an interdisciplinary discourse is rather difficult.

Within the fields of experimental psychology I am using an empirical study investigating if and how appreciation of subjects is affected by information.

40 Participants in 2 groups, 50:50 experts and non-experts due to a personal data sheet and acquired at the Austrian chamber of architects, will see a ppt-presentation of 3 sets of 18 different architectural models from an invited international architectural competition for the site of the former Stern Brewery at Rainberg, Salzburg. Each of these sets contains the same pictures (3 of each model) but have a different degree of information content. 1st set: no additional information beside the pictures, 2nd set: information in context with the location, the criteria of the investor, and the assignment. 3rd set: additional information about the intentions of the architects, stylistic features, used material, etc. Two control groups (again 50:50 experts and non-experts) will only see three repetitions of set 1 without any additional information.

During each session the participants have to judge the architectural models spontaneous (every model is presented 45 seconds) with a seven-point-scale which comprise cognitive as well as affective aspects of aesthetic processing (a) understanding will be measured by a scale whether the participant believed to have understood the architect's intention; (b) Meaning by whether they found a personal meaning in the architects work; (c) Liking by whether they liked the architecture; (d) Interest by whether the architecture evoked their interest; (e) Emotions by whether the architecture affected them emotionally; and (f) Thoughts by whether the architecture evoked thoughts in them. All ratings will be given on a on a seven-point scale from 1 (fully agree) to 7 (fully disagree).

Changes in rating of architecture appreciation due to two different ways of information will be of most interest. I will further analyse influences of style-related information as related to the participants' level of architecture expertise. I am expecting that novices in architecture are willing to increase their appreciation towards contemporary architecture, instead experts hold on their first ratings.

In this experiment I am going to show under which conditions processing of explicit information can change appreciation of contemporary architecture. I suggest that aiming to understand aesthetic appreciation of architecture should consider a larger number of variables such as expertise of the beholder, in order to understand the complexity of processes in

architecture appreciation. This, together with the strategy to combine cognitive and affective aspects might be a good strategy to understand the fascination of architecture despite the differences between perceivers.

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Leder, H., Belke B., Oeberst, A., Augustin D., (2004) A model of aesthetic appreciation and aesthetic judgements, *British Journal of Psychology*, 95, 489-508.

How to communicate about language? Development of a transdisciplinary theory on evolution of human language and communication by applying Grounded Theory

Birgit Peterson

How could a transdisciplinary theory on evolution of human language and communication look like? The purpose of the research project covered by this master thesis is to explore this question using a very practical approach: to apply a promising method for theory building, “Grounded Theory”, on existing discipline-specific literature.

Starting with interdisciplinary exploration of human language and communication in order to get a more holistic view of this interesting topic led to the necessity to define possible benefits and aims of interdisciplinary research as well as interdisciplinary methodology. Following the terminology of Pohl and Hirsch Hadorn [2], interdisciplinarity means a kind of temporary change of the researchers’ position into another discipline as well as intense dialogue between researchers from different disciplines (the merely parallel work on the same topic within different disciplines without dialog would be defined as multidisciplinary approach). The paradigms and methodologies of each discipline stay untouched and separated, which complicates problem centred conclusions crossing the borders of disciplines.

Transdisciplinarity means even more[2]: The merge of different disciplines and their paradigms results in synthesis of a new approach, a new paradigm and maybe also new methodologies. This process of transdisciplinary science can give birth to a new more problem- or phenomenon- centred discipline. According to Grunwald and Schmidt [3], Euler sees “methodological consequences” of this critical understanding of interdisciplinarity, because the “generation of methodology” is “crucial for interdisciplinary research” to manage discipline- specific bottlenecks.

One arising question defined by Grunwald and Schmidt [3] concerns methodology of interdisciplinary research: How could transdisciplinary methodology look like? If transdisciplinary perspective must not be rooted in a discipline specific paradigm, from what kind of basis shall the researcher grasp the field of language and communication? One approach- when missing predefined paradigms- might be to see the researcher herself as focal point for transdisciplinary research. To include intentionally and explicitly her first person perspective into the methodology, adds a higher potential for developing completely new

approaches. The core of transdisciplinary methodology is that it is characterised by being "knowledge created by argumentation".

Grounded Theory is qualitative method for theory building out of data, not dependent on specific types of data, scientific disciplines or theoretical interests [1]. It was developed in the 1960s by Strauss and Glaser [1] who were rooted in symbolic interactionism and quantitative sociology. Grounded theory aims to "develop theoretically systematically guided interpretations" of a Phenomenon, including the creative potential of the scientist to develop "conceptual labels" that result in re-integrable concepts for theoretical explanation of the phenomenon. The basic principle of the methodology is a triadic repetition of: 1st Theoretical sampling due to relevance, 2nd open, selective and axial coding, later categorising and restructuring, all accompanied with 3rd self-reflective memo writing. The research process is neither hypotheses-guided nor merely descriptive, but based on abductive reasoning.

Grounded Theory fits quite well to the demands of transdisciplinarity described above. Although well approved in social sciences it has not been applied for transdisciplinary theory building yet. Within this study I will therefore try to adapt the method for transdisciplinary demands, especially in connection with "theoretical sampling" and "theoretical sensibility" [1] for insurance of transdisciplinary sampling of literature as data. Then I will apply Grounded Theory on literature on the evolution of human language and communication out of different disciplines, such as Biology, Philosophy, Psycholinguistics and Neuroscience.

It is not intended by this thesis to evaluate the potential of Grounded Theory as a method for transdisciplinary theory building in terms of theory of science. This research tries to develop an application-oriented starting point for a transdisciplinary theory on human language and communication, focused on evolutionary issues. Semantic categories will be gathered [throughout](#) application of Grounded Theory on existing literature, grounded on first person perspective. Those semantic categories, that might structure the field of research in a new, transdisciplinary way, will be confronted with the discipline specific categories, found primarily in the literature analysed. The resulting theoretical onset might give us a more holistic view on this complex and interesting phenomenon and show possibilities for the future how to "communicate about human language" in a transdisciplinary way.

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Strategies of cooperation

Tomáš Gál

Human decision process, which may lead to cooperation, can be decomposed in two ways. Firstly it is an algorithmically view of scientific access, such is the game theory, where the most important criteria are, if subject has cooperated or not, if it has maximized its profit or not. By this point of view, the decision process is an output of conscious analytical process with quantified determinants of one with free will.

The other side is a point of subject's intention, whose may lead to cooperation, or avoiding it. For this way is not so certain, that subject will decide according to seemly rules of the game.

To analyze this, it is necessary to know, how the decision leading to cooperation appear.

It is based on human neurological hardware, including amygdale, ventromedial prefrontal cortex (vnPFC) and orbitofrontal cortex (OFC), which are stimulated, enforce the cooperation and if inhibited or damaged, enfeeble it. But human being is not determined by its physiology. Physiological basis can by overcome by cultural spoils. So analyzing cultures, such are those, where free market was never established or known, may also help to interpret the naturalness of human cooperative decision making.

In addition, human decision making is based not only on the brain hardware, or cultural necessities, but also on individual biases and the structure of mind, which may invoke limited rationality solutions. We may consider two kinds of beliefs, which a human has about its environment. The reflective beliefs, which are reflected by conscious mind and probably even more used non-reflective beliefs, which manipulate human reasoning unconsciously. Both non-reflective, based on mental tools like naïve morality or reflective, based on doctrines, like the one, which oblige to believe in supreme guarantee punishing non-cooperation lead to suboptimal actions, done with limited rationality. Impact of those beliefs on human social contracts is not fully explored, yet. This thesis suggests possible tests, which may result in further knowledge about this particular problem.

Cumulating all of those particular aspects of human cooperation may moreover points the problems of the limited rationality and reasoning under cognitive biases in generally. Ideas of forms and procedures of possible tests are the main addition of this thesis.

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Schopenhauer's Last Will

Ronald Sladky

My topics of interest in Cognitive Science always have been the big questions: What is mind? How can we describe our conscious being in the world? How free is our will? What is love, happiness and meaning of life? In three words: What is man?

I think those are the key concerns of every human being with a reasonable amount of time for thought plays. While most of the researchers are asking for them implicitly, I'm going to face them directly, because they are the foundation for all further scientific investigation. Without the merest understanding of the nature of the answers to those questions, any research can be considered as pure speculation: How can one talk about some perception abilities of our mind when they have no idea what this very mind could be?

This is one of the reasons why contemporary discussions in (neuro) philosophy and neuroscience on consciousness and free will are so deflating. Consciousness gets eliminated (cf. Churchland), determined (cf. Wegner) or simply ignored. Free will is sometimes voluntarily given up (cf. Roth), to deny basically the meaning of each of our lives by calling volition a false attribution.

My goal is to get a better understanding on where to start approaching the first person ontology - the mind - scientifically. To get a grip on this big mystery within a master thesis one could (a) limit the size of the phenomenon by looking on certain smaller properties (like free movement, cortical blindness, split brain patients etc.) or (b) limit the depth of the investigation admitting to stay on a fragmentary level. However, when talking about a theory of mind all knowledge and models have to be called fragmentary and temporary. That's why it's more than fair to submit to approach (b), admitting the sheer incredible scope of the phenomenon, instead of doing (a) and break it into smaller chunks of problems that seem easily manageable but have nothing to do with the core phenomenon of interest anymore, by denying its complexity.

My intellectual journey will start at Arthur Schopenhauer's (1788-1860) theory of mind. In his main work (see References) he considers the world as *Vorstellung* (conception, representation, idea) of the individual Subject. This *Vorstellung* is created when a person interacts with reality by perceiving the causalities in the objective, material world (body and environment). By this interplay of Subject and the real world a subjective world of *Vorstellungen*, which are the subjective correlates of real-world object constitutes. The subjective domain of wilfulness, motivations, and feelings is produced by the so called Will. This transcendental Will is the only thing in itself, the ultimate reason and driving force behind all things happening. While for us inaccessible for direct investigation the Will reveals itself by our actions, which can be observed and understood by reasoning.

In my work I will reconstruct Schopenhauer's theory of mind in detail. His ideas seem relevant to me when working on consciousness and free will and are candidates to bypass and overcome some of the problems in modern neurophilosophy. For this cause I will take my elaboration of his concepts and combine it with contemporary philosophy of mind and findings in cognitive neuroscience.

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Deficiency of Cognitive Control as a Predictor of Involuntary Memories

Katharina Turecek

In order to engage in goal-directed acting it is crucial to focus on the current task and to suppress irrelevant thoughts and memories. Irrelevant information needs to be removed from working memory, a task which is considered to be accomplished through inhibitory control. This way, the limited capacity of working memory can be optimally utilized. As inhibitory control is critical for updating working memory in order to engage in goal directed planning a lack of inhibition leads to disturbed information processing such as less accurate retrieval of relevant information and enhanced retrieval of irrelevant information. The consequences are psychopathological symptoms such as involuntary memories.

The present study aims to investigate the relation between a working memory inhibition task and memory intrusions.

The modified Sternberg Task was designed to measure the ability of controlling attention in working memory. Subjects are asked to suppress irrelevant information in working memory to identify relevant stimuli. (Joormann & Gotlieb, 2008).

Since it would be unethical to induce real trauma the trauma film paradigm is applied and the subjects are shown traumatic film material (Holmes & Bach, 2008). In a subsequent phase of three days all spontaneous memories of the film are noted (Intrusion Diary).

The present study intended to find a correlation between individual scores in the modified Sternberg task with later involuntary memories. However, no significant correlation could be found. The modified Sternberg task appears to have little predictive value for involuntary memories.

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A computational cognitive model of performance in the Iowa Gambling Task. Are Somatic Markers indicators of risk?

Sandra Weber, University of Vienna

The Somatic Marker Hypothesis (SMH) provides a plausible neurobiological explanation for the deficits observed in real-life decision making, and for impairments found in patients with ventromedial prefrontal cortical (VMPFC) lesions in the Iowa Gambling Task (IGT) [1]. Roughly, the SMH assumes that overt reasoning processes, including the recall of available knowledge of a given situation and derivation of behavioural strategies to handle it, are preceded by covert emotional biases (somatic markers) that help to decide advantageously under uncertainty and risk. Recent studies suggest that similar mechanisms are responsible for the inferior performance of substance dependent individuals (SDIs) [2] and the superior performance of players with high scores in neuroticism [3]. Bechara [4] proposes an imbalance between reflective and impulsive processes in decision making as the cause of observed deficits: in VMPFC patients the reflective processes would be directly affected, in SDIs hyperactivity in the amygdala would lead to an attenuation of reflective processes and thereby to sensitivity to immediate reward and ignorance of possible negative future consequences of decisions.

In my study, I employ computational cognitive modelling as a tool to disentangle the complex cognitive and motivational interactions in decision making under uncertainty and risk that contribute to the overall performance of different patient groups including normal controls in the IGT. The decision strategy of the model employs the computed expected valence for the next card with respect to the four different decks based on former experiences [5]. Several parameters regulate the performance of the model, i.e. attention to reward and punishment, speed of learning and sensitivity to expected valence. The aim of my work is to study the hypothesis that deficits in the IGT can result at least in part from a decreased sensitivity to punishment and an increased sensitivity to reward. Furthermore, the hypotheses that differences in risk aversion can account for the high variability in performance of normal controls and that decreased emotional awareness of risky situations in VMPFC patients can explain their bad performance in the IGT and superior performance when risk-taking is rewarded [5] are to be evaluated within the framework of my computational cognitive model that simulates performances in the original and alternative versions of the IGT. Further psychological mechanisms that have been proposed to explain the IGT deficits of different patient groups will also be tested. Preliminary results suggest that hypersensitivity to reward may play an important role in the decision process of SDIs.

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Enabling Spaces for Knowledge Creation and Innovation – finding a self-directed transdisciplinary approach towards creating and holding supportive environments for joint knowing and innovating in practise

Stefan Wiltschnig

Serious challenges are facing our world these days and call for finding creative solutions and initiating joint action across borders, sectors and institutions. Having the intuition that solutions from the past or muddling through with more of the same will not suffice to tackle the challenges ahead, MIT-researcher and organisational consultant Claus Otto Scharmer looks in his recent book for ways to address these burning issues from the perspective of the “emerging future as it arises”. With his “Theory U” and what he calls “Presencing” (a neologism comprised of “presence” and “sensing”), Scharmer offers a process-heuristic and social technology for sensing and actualising emerging futures. [1]

By bringing together European, American and Asian thinking, a vast number of interviews with eminent thinkers and organisational leaders and his experience as a consultant he provides the outline for a new understanding of profound change and innovation based on an expanded view on research and knowledge creation. One of the four key principles of “Presencing” is the “Power of Place” – the situatedness of the related process-practises in some context of holding space. [1]:187 “How to use and leverage the presence and power of certain places for accessing the authentic dimension of self in individuals and communities” is considered by Scharmer in the following as “one of the most interesting research questions for the years to come.” [1]:188

My master-thesis is taking up this hint concerning the importance of place/space embedded in the U-Process and exploring it further, framed by the metaphor of “enabling spaces for knowledge creation and innovation”. “Enabling” understood in the meaning of a verb, referring to the practises sustaining such environments, and as an adjective pointing to the properties of the spaces under discussion in terms of allowing new things to emerge in the different phases of the U-Process. “Space” is incorporating a number of possible meanings as well. Here I begin with the concept of “Ba” by Ikujiro Nonaka who distinguishes between Physical Place, Virtual Place, Social/Mental Place (shared context, trust) and the dimension of Shared Purpose and Intention. [2] As the notion of “ba[sho]” originates from the work of Kitarō Nishida in the context of the Kyoto-school, it provides an interesting philosophical

background for the topic at hand by bringing together European and Asian thought concerning human knowing and consciousness. [3]

Starting with the above mentioned traces, the aim of this work is to spell out a working definition for “enabling spaces” and to explore explanations and contributions from different disciplinary perspectives with literature research and dialogical interviews. The results are linked up in a kind of map of the metaphor and combined with a discussion concerning the methodology and scope for further research. Thereby the basis for my PhD-project should be laid.

Such an endeavour has to be considered first hand as an “assemblage” of perspectives and materials with me - the author - being the source of the re-search, selection and combination of the presented material. The methodological challenge lies in ensuring scientific standards for such a quest in terms of explicating my assumptions and vantage points in order to allow others to follow the steps and decisions taken as well as to be able to trace the sources of the data presented. Action research, Actor-Network Theory and Practise Based Approaches in Sociology are considered as candidates for guiding my work in this respect.

The project is guided by my wish to take all five intellectual virtues proposed by Aristotle in his *Nicomachean Ethics* serious, to live up to the promise of cognitive science as being truly multi-/transdisciplinary and to consider my observations rooted in the phenomenological tradition from Husserl and Heidegger to Merleau-Ponty and Varela.

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Why do people behave fair?

Johanna Alexopoulos

Decision making is influenced by various psychological and emotional factors and hence is not only a cognitive (rational) process. In my master thesis I try to answer the question, how the presence of people influence our decision making process, especially in economic decision making.

Game theory provides good tools to study social aspects of economic decision making. One well known paradigm is the so called ultimatum game or the extended version the three person ultimatum game. In this games a proposer has to split a sum of money between himself and the responder. The responder can either accept or reject the proposal. If accepted the money is allocated accordingly. However, if rejected nobody receives anything. Assuming

that both players behave rational and do not care about the outcome of the other player, the responder has to accept any positive outcome and the proposer has to offer the smallest amount of money to the responder and keeps the rest to himself. In fact, most of the offers are about 40%- 50% of the total amount and offers under 20% are rejected with a probability of about 50% (Güth et al., 1982). In the extended version a third player (dummy-player) accrues, who has no say in the game, but he has to be included in the division of the money.

The experimental evidence described above caused several efforts to explain the observed behavior across different experiments. Most economic theories assume that players are motivated to reduce differences between their own payoff and the payoff of others ("inequity aversion"). Others assume that fairness depends on who fair the others behave ("reciprocity"). Culture-gene coevolutionary models assume that reciprocity, reputation and social norms make us behave fairly. And that specific genes allow us to identify people who will cooperate by using specific cues like physical appearance.

In my master thesis proposed here I try to show how social desirability and justice sensitivity influence economic decision making.

Social desirability is the urge to present oneself favorably regarding current social norms and standards. Haley and Fessler (2005) showed that just displaying eyespots on a screen forces people to give more money to their partners than the control group does. Justice sensitivity has been described as a personality disposition concerning the reaction to unfair situations. Using a social desirability scale (SES-17; Stöber, 1999) and a justice sensitivity scale (Schmitt et al., 2005) I try to show whether fair offers in the three person ultimatum game are correlated with socially desirable responding or internal fairness standards. Additionally I will try to describe the relation between justice sensitivity and social desirability.

In a second study I try to find whether we actually have the ability to identify cooperators. For that reason I will make pictures from the proposers who made the offers in the ultimatum game described above. After that this pictures will be rated on a semantic differential with scales like fair – unfair and attractive – unattractive (in sum there will be 6 bipolaric scales). I hypothesize that there will be a correlation between offers in the ultimatum game and the way those proposers have been evaluated.

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Memory: A Paradigm for Reductionism?

Mehrdad Farahmand

The objective of this project is to examine whether the logical requirements of the concept of reductions can be applied successfully to the notion memory. In other words, does memory research provide a model for the reductionist project?

Memory offers an excellent framework, since it has a rich historical and empirical heritage. Traditionally, the question of nature and mechanisms of memory has been approached from three distinct perspectives, which constitute autonomous areas of research: cognitive, systemic, and cellular/molecular. Our concern is whether we could properly reduce the *higher* levels to the lower levels. To do this, we have to clarify what the concept of reduction entails and possible distinction between the notion of reducibles and correlates. Furthermore, we have to present the current research in these fields with the main emphasis on episodic memory and hippocampus place cells.. Finally, we pose question whether our current knowledge justifies the assumption of reductionism.

Reductionism is the view that proposes that the complex phenomena of the universe should be explained in terms of more foundational principles. This usually a directional enterprise, which assumes a hierarchy of natural science with physics at its foundation. There are different types of reductionism: ontological, methodological, semantic, and theoretical reductionism. Clearly, ontological reductionism makes the strongest claim, while methodological and semantic reductionism make the weaker claims. Moreover, reductionism assumes certain ontology. Accordingly, the world is composed of logically independent concrete particulars, which characterized by separately analyzable quantifiable properties. These concrete particulars enter into interaction with each other through causality.

The job of reduction of theory 2 to theory 1 is comprised of derive the laws of theory 2 from those of theory1. This requires the development of *bridge principles*. We can think of bridge laws as translators, which for every principle in theory 2 gives the correct principle in theory 1. The possible candidates for bridge laws can be definitions or empirically observed lawful relationships. Our question is whether such bridge laws can be found in between the cognitive, systemic, and molecular accounts of memory?

Are there bridge principles, which can relate the phenomena of Long Term Potentiation (LTP) and other molecular frameworks of memory such as phosphorylation of various proteins, dendritic spine tagging, RNA localizations, gene expression, etc to the systemic behavior of circuits such as EEG 200 Hz ripples of place cells in the hippocampus in particular and rhythmic electrical behavior of brain as expressed in EEG in general. Furthermore, are there bridge laws, which relate these more ‘fundamental’ aspects of memory to the cognitive dimension such as spatial thinking and episodic memory. It is important to note that at the cognitive level a new stage of complexity emerges, which includes meaning, semantics, content, value, and intentionality.

It is my contention that the reductionist model, although useful and successful in some very important instances, cannot be successfully applied to the realm of cognition and consciousness. This requires a paradigm shift reminiscent of the paradigm shift in physics at the beginning of the 20th century. Here, we are challenged to reject the primacy of the substantialist ontology, the monopoly of causality, and superiority of the representationalist theory of mind. We are required to think in terms of processes, systems, autonomous complexities, and emergence.

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Connectionist Modelling of verb irregular flexion in Williams syndrome and typically developed children

Isabella Hinterleitner

Williams Syndrome (WS), which is a rare genetic disorder at the chromosome 7q23, is an interdisciplinary field for Cognitive Linguistics as it gives the opportunity to integrate many disciplines from psycholinguists to computational linguists. A crucial issue in Williams syndrome (WS) research explores, whether the inflectional system is Clahsens approach is based on the Minimalist Morphology in order to explain regular and irregular inflection. The aim of the work is to model the syntactical features of verb flexion in Williams syndrome individuals in a neural network based on a similar model of Plunkett and Marchman (1996). The novelty aspect is that the network takes in account over-generalization effects induced by the verb frequency.

The architecture is a recurrent feed-forward three layer network that reflects best the syntactical properties of language. The input layer of the network is represented by the phonological representations of the verb stems. E.g. Halt 'hold' The amount of hidden units was varied at values of 10,15, 20, 50, 200 unit, with 50 units presenting the normal condition. Training: Weight changes were calculated using a back-propagation (Rummelhart, Hinton, & Williams) and ART-2 learning algorithm, whereas the latter is based on the adaptive resonance theory. The network performance on training was tested at 5,10,20,25,50,100,150,200,250,500,1000,2000 and 5000 epochs. Apart from that testing was performed by using the nearest neighborhood classification. The technical realization of the algorithms used was done in MatLab.

(1) **Normal model:** When testing lexical representations with the original settings this resulted in irregularization of novel irregular rhyming in accordance to Plunkett's and Marchman's original model. The network showed an initially rising, then declining level of over-generalization errors. There were different results depending on the training algorithm used. The **back-propagation** training algorithm induced **slower learning at the beginning and slower learning at the end** of the training with a **short overgeneralization span**. The **ART training algorithm** on the other hand was learning **faster at the beginning and slower at the end** of the training including a **shorter overgeneralization span than in the back-propagation and in the WSM**. It simulates language learning as in the natural language development and is matched to the characteristic U-shaped profile that occurs in younger children.

(2) **Williams Syndrome model (WSM):** The result of the WSM showed that phonological representations are less redundant and similar in comparison to the normal model. Thus, there is a delay for regular and irregular verbs produced that reflects the target pattern in Williams syndrome. For the WSM there was used the normal training algorithm and the ART training

algorithm. The latter was implemented in a version where slower learning than in back-propagation occurred. The **WSM using back-propagation showed slower learning at the beginning and slower learning at the end** including a greater span of overgeneralization in the middle showing a delay in language development. The WSM using ART **showed slower learning at the beginning and faster learning at the end where overgeneralization was longer than in the normal model**. This simulates a delay in language development.

The clinical relevance of the modeling is very high as it can be used by cognitive psychologists as well as psycholinguists for predicting impairments and simulating language development under certain phonological constraints.

Furthermore, connectionist modeling allows to simulate different cognitive impairments that show the same output. It offers possibilities to simulate (double) dissociations in cognitive development without making invasive tests

Connectionist modeling has the advantage that apart from modeling genetic diseases such as WS we can also simulate complex disorders such as SLI where we do not know causal factors that lead to the disorder.

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How can we make sense of what we perceive?

DI Erik Hörtnagl

The often cited motto of Descartes *"I think, therefore I am"* or in other (Damasio's) words *"I feel, therefore I am"* can be reformulated in an embodied way *"I am, therefore I think"* (Ron Sun [1]). This little play on words symbolizes one of the major issues in the whole discussion of *"How can we make sense of what we perceive"*. These issues have been discussed under many different names and paradigms. I focus on two:

The Symbol Grounding Problem:

"How can the semantic interpretation of a formal symbol system be made intrinsic to the system, rather than just parasitic on the meanings in our heads?" Steven Harnad [2]

Intentionality:

"Intentionality is the circular process of generalization/abstraction of input and specification/concretization of output by which brains achieve understanding of their environments through the cycle of prediction, action, sensation, perception, and assimilation by learning." Freeman [3]

In my work I want to reflect on the ongoing discussion on how these two concepts are related, if they are the same or not and how they are related to meaning. However, when thinking about these problems it will be necessary to analyse some related topics too: *"Interactivism"* (Bickhard), intention, active sensing, interactive perception, subjective perception, social grounding and physical grounding, affordances, growing up through experience, embodied memory and representation.

In the discussions mentioned Descartes' motto *"I think, therefore I am"* has often been used. I believe it is very important to address this question the other way round, thus: *"I am, therefore I think"*. This means that before I can talk about thinking and/or meaning I have to look at *"who am I?"* and *"what am I?"*. Before I can use my body and my perception in a meaningful way, I have to learn how to do this. Learning to use my body and my perception means learning to interact with the environment. Generalizing/abstracting my experience based on former experience in this interaction process leads to my individual representation of the environment. Sun [1] used Heidegger's idea to distinguish between mediated and unmediated interaction. The low-level unmediated (in the sense of mindless) interactions (Bickhard, Brooks) with no internal representation are everyday actions and are called comportment. Higher levels of interactions which use internal representation and have an intention are put together with comportments. This compartment will emerge from interaction with the environment (Smith, Gibson)

Conclusion: In the discussion of *"How can we make sense of what we perceive"* I believe that the distinction of these two levels of interaction is often ignored or blurred or completely mixed up. Before we can talk about intention and representation we have to talk about comportment. The aim of my study is to research these two levels of interaction and try to combine them in order to make a step towards the solution of the above mentioned discussions.

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A Simple Model of Transferable Reputation

Andreas Schneeberger

Decision making is of particular interest to cognitive science. Especially decisions made in a social context, thus involving more than one agent, lead to interesting constellations. Reputation in this context assists in predicting another agent's behaviour. First attempts to formalize reputation effects have already been undertaken ([7],[8],[10],[11]). Experimental studies have also confirmed the importance of reputation in decision making ([3],[6],[9]). Besides pure scientific interest reputation has gained momentum also due to its importance in online trading in electronic marketplaces like e.g. eBay.com ([5]).

Due to the growing interest in reputation research attempts to formalize reputation have been undertaken ([1],[2]) and even a testing environment for agent reputation and trust (ART) has already been developed ([4]). However, a very prominent example of reputation in our everyday life has received little attention so far. Transferable reputation is the phenomenon, that an agent might be able to use another agent's reputation to her favour. This is often used e.g. by companies, which employ e.g. celebrities to promote their products as testimonials. Recent fMRI-studies have revealed some further insight on why this concept might be so successful [12].

The idea of this project is to suggest a framework in which transferable reputation can be investigated formally and by simulation in analogy to [10]. The project has just started and the model has only been theoretically developed. Simulation and experimental investigation as well as a more interdisciplinary perspective have to be worked out in the near future.

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False memory

Tomáš Princ

Memory is made up of interrelated systems, organized structures of operating components consisting of neural substrates and their behavioral and cognitive correlates. Memory is the ability of living organisms to retain and to utilize acquired information or knowledge.

It is common experience that human memory may be unreliable to some degree, whether by failing to remember at all or by remembering incorrectly – we remember events that never happened. Reason of memory incorrectness could be caused by any type of amnesia when some areas of our neural networks in the brain are impacted by damage and memory show gaps in the recollections or disability to acquire new knowledge. False memory syndrome is the next type of memory incorrectness when our memories are implanted by other person for example repressed memories brought out in therapy by psychotherapist.

For the theories of cognition is important how well we remember things. It is crucial because almost every aspect of cognition depends on memory to some degree. Important role is distinguishing between reproductive memory – accurate output of information from memory and reconstructive memory – emphasizes the active process of filling in missing components with frequently occurring errors. It generally has been assumed that the act of remembering information rich in meaning (stories and real-life events) gives rise to reconstructive processes and therefore errors, whereas the act of remembering more simplified information (word lists) gives rise to reproductive (accurate) memory. For example, a vivid and detailed memory may be based upon inaccurate reconstruction of facts, or largely self-created impressions that appear to have actually occurred. Likewise, continuity of memory is no guarantee of truth, and disruption of memory is no guarantee of falsity.

Recognition experiment to investigate false memory used in this work demonstrates one methodology that biases people to recall things that did not occur. This method was used by H. L. Roediger and K. B. McDermott. A sequence of 15 words is presented with frequency about 2 sec. per word in 6 cycles and the observer is to subsequently classify a set of words as either in the sequence (old) or not in the sequence (new). The main point of this experiment is that the sequences are specially designed to bias observers to report a particular word that was not included in the list (example of words from the list words “thread, pin, eye, sewing, sharp,

point, pricked, thimble, haystack, pain, hurt and injection” are associates and closely connected with nonpresented word “needle”). When people report that nonpresented word was in the sequence, but it really was not, they are having a false memory. Participants in this experiment are divided into two groups. The first group (noninformed group) is going through this experiment without any explanation about the meaning of the experiment. The second group (informed group) is going through the experiment with explanation what the false memory is, how this experiment is built up and what is the main aim of this experiment. The purpose of splitting the subjects into two groups is to find out the differences in creation of false memory between the groups. The question is whether the second group could avoid to the false memory or at least would be better in the elimination of false memory, when they were reminded few times not to confuse presented words with nonpresented critical word. But, the result of this experiment showed almost no differences between these groups and warnings about the critical nonpresented words (biases – closely connected to the presented words) which are responsible for false memory creation, took no effect.

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Strategies of cooperation

Tomas Gal

Human decision process, which may lead to cooperation, can be decomposed in two ways. Firstly it is an algorithmically view of scientific access, such is the game theory, where the most important criteria are, if subject has cooperated or not, if it has maximized its profit or not. By this point of view, the decision process is an output of conscious analytical process with quantified determinants of one with free will.

The other side is a point of subject’s intention, whose may lead to cooperation, or avoiding it. For this way is not so certain, that subject will decide according to seemly rules of the game.

To analyze this, it is necessary to known, how the decision leading to cooperation appear.

It is based on human neurological hardware, including amygdale, ventromedial prefrontal cortex (vnPFC) and orbitofrontal cortex (OFC), which are stimulated, enforce the cooperation and if inhibited or damaged, enfeeble it. But human being is not determined by its physiology. Physiological basis can by overcome by cultural spoils. So analyzing cultures, such are those, where free market was never established or known, may also help to interpret the naturalness of human cooperative decision making.

In addition, human decision making is based not only on the brain hardware, or cultural necessities, but also on individual biases and the structure of mind, which may invoke limited

rationality solutions. We may consider two kinds of beliefs, which a human has about its environment. The reflective beliefs, which are reflected by conscious mind and probably even more used non-reflective beliefs, which manipulate human reasoning unconsciously. Both non-reflective, based on mental tools like naïve morality or reflective, based on doctrines, like the one, which oblige to believe in supreme guarantee punishing non-cooperation lead to suboptimal actions, done with limited rationality. Impact of those beliefs on human social contracts is not fully explored, yet. This thesis suggests possible tests, which may result in further knowledge about this particular problem.

Cumulating all of those particular aspects of human cooperation may moreover points the problems of the limited rationality and reasoning under cognitive biases in generally. Ideas of forms and procedures of possible tests are the main addition of this thesis.

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Posters

Mortality Salience & Dual-Processing Effects

Andreas Huber

According to Terror Management Theory (TMT), reminders of mortality increase adherence to cultural norms, heighten estimates of social consensus for culturally relevant attitudes and increase optimal distinctiveness strivings. Numerous studies (e.g. Greenberg, Porteus, Simon, Pyszczynski, Solomon, Simon & Breus, 1995; Rosenblatt et al., 1989) support the assumptions that mortality salience (MS) leads to a bolstering of self-esteem and a cultural worldview defence. This investment into cultural worldview provides a base of making sense of the world as stable and orderly, a place where the one gains rests their hopes on symbolic immortality (e.g., fame, having children, legacies of wealth or fortune) or literal immortality (e.g., the promise of a life in an afterlife). Importantly, MS effects appear to occur only if death-related thoughts are relegated to the “fringes of consciousness”, i.e. if death primes are either subtle (e.g. subliminal) or subjects had sufficient time to repress their experimentally triggered death related mentation. On the other hand the Dual-Processing Theories say that the effects of TMT are not grounded in symbolic immortality and cultural worldview defence. They argue that stigmatized group or attacks against the own culture automatically leads to a defensive behaviour tendency, but most people have learned to suppress these tendency and to prefer another, more civilized behaviour. So the Dual-Processing Theories say that there is (a) an automatic primary reaction and (b) a controlled reaction. A person is able to execute such a controlled reaction if there is enough motivation and there are enough cognitive capabilities available. The study now described here underlies the following hypothesis: The effects of MS reduce either the motivation or the cognitive capabilities for controlled behaviour, because person primed by MS have to focus their attention on the imminent danger of death and not on secondary things like civilized conventions. If this assumption is right, tests, which need a cognitive performance but without a cultural relevance at all should show stronger automatic effects, like the classic TMT-experiments. The prediction is that TMT-effects also occur in other contexts without a binding to symbolic immortality and cultural worldview defence. The experimental setting of the study is the following: The test persons are separated into two groups. The first will be subjected to death priming; the second is the control group without priming. After that each person should answer to questions where they should estimate a number between 0 and 70 (e.g. „What was the highest temperature in February ever measured in Vienna?“). On the same questionnaire, where these questions are, is the number 11 placed, close to the questions. According to the Dual-Processing Theories should this number act as an anchor, which influences the estimations of death-primed persons. A majority of death-primed persons could not resist the anchor and estimate a number close to it. The control group should estimate without being influenced by this anchor.

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Object recognition

Marek Cifra

In 1989 Y. Le Cun created Neural Network (NN) able to recognize handwriting digits¹. This NN has been used in practise, because of its benefits. In this work I'm using his knowledge, written in articles, to build up neural network able to recognize more complex objects, trees (e.g. trees in the forest). So the task is to determine, if there is one or more trees on the input (image) or not, true or false, 1 or 0. (There is no reason for what I choose trees.)

Why to use Le Cun's NN architecture? Steffen Nissen described in his article² possible simplification of Le Cun's NN and he also mentioned, that Le Cun's NN should be able, after layers resizing, to recognize larger inputs than 28 by 28. So I found set of pictures with trees (180) and set of non-tree pictures (240), then resized them to max. 112 by 112 pixels (keeping ratio) and gray scaled them to be more easier to represent by numbers from -1 to 1. Output of Le Cun's NN will be reduced to only one neuron whose output will be -1 for false (there is no tree) or 1 for true (yes, there is at least 1 tree). Value in range $<-1, 1>$ represents how sure is the NN in what it is "saying".

As first, to prove Le Cun NN, implemented by myself, is working, I had tried to learn NN to recognize handwriting digits. After this proving, I rebuild the net to be able receive on input larger images. Le Cun NN consists of Input layer, 4 hidden layers and Output layer. Input layer represents image of 28x28 neurons, in this case pixels. Digits are sent to the input, centred to the middle of the Input layer. There are 10 possible digits 0-9, so the Output layer has 10 neurons. First Hidden Layer (HL1) is divided into 4 groups, every with 24 by 24 neurons, called feature maps. These feature maps extracts some kind of information from previous layer, aka. Input layer. Second Hidden Layer (H2) is also divided into 4 groups, but now every of 12 by 12 neurons. In this layer subsampling and averaging is made. Hidden layer 3 (HL3) works like HL1 except that previous layer is HL2 and neurons in H3 read from corresponding neurons in every group of H2 at the same position. HL3 consists of 12 groups of 8 by 8 neurons. Last Hidden Layer (H4) has 12 groups, with 4 by 4 neurons and works like H2. Output Layer is fully connected to H4 and has 10 neurons, which means 10 digits. Output uses one-hot encoding.

After the NN had been able to recognize these simple objects, the NN was rebuilt. As mentioned above, Input layer was resized from 28 by 28 to 112 by 112 (that's 4x positive scaling in each size). Input type was the same kind, numbers from -1 to 1. Output layer was reduced to 1 neuron. There is no reason to use more neurons as output. And of course, all other layers were scaled 4x in each size too.

Training that kind of NN was time-consuming process, so I will try to make it parallel by using threads. Le Cun's NN architecture can be easily divided into 1 + 4 + 12 independent parts, communicating to each other using sockets, when every NN part is listening on its own port. This solution allows me to distribute NN to more computers and connect them to each other using LAN. The question is, whether this is more efficient than the single thread solution. I hope yes and I expect max. 2-3 hours using 1 + 16 computers to learn NN to recognize the trees.

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Neural Networks between Neuroscience and AI

Wolfgang Pilz

Neural Networks are an important tool in AI and also used for many kinds of models in Cognitive Science. The applications of ANNs (Artificial Neural Networks) are quite diverse and range from processes of pattern recognition to the control of movement and action patterns.

ANNs often capture a surprising amount of the relevant features of cognitive systems although they generally consist of very abstractly defined neurons and only biologically inspired architectures.

In the case of Computational Neuroscience on the other hand one often tries to model single neurons (or networks) and their properties in the most detailed way possible. This is generally done to gain insight into the workings of biological neurons and their functions[1]. The modelling of such systems is mostly executed in a level of detail far beyond anything commonly found in cognitive connectionist models.

In the course of this project I'll try to sketch out some possible answers to the question of how the level of abstraction used in those models might influence their functional characteristics in comparison to the real biological system.

By the example of computation in a single neuron [2] it will be shown how computational processes may arise on the basis of relatively simple biophysical properties. In some cases a simple conceptualization of a neuron as a computational element can be justified in such a way.

The practical work that was performed consists of simulations run in the NEURON environment, exploring a concept of single neuron multiplication as an addition of logarithms. In many cases the transfer function of biological neurons is quasi logarithmic in relation to the firing frequency. Given this property already a single neuron can perform operations akin to multiplication, exploiting the mathematical relation $\log(x) + \log(y) = \log(x*y)$.

The conclusions of this project are twofold and not necessarily new: first of all the modelling of neuronal systems probably has to be executed in as much detail as feasible, in order to be able to clarify necessary and sufficient requirements for certain cognitive processes. This step of model building has to rely heavily on experimental evidence from classical neuroscience. After clarification of the role of as many neuronal mechanisms as possible, an attempt to extract more abstract rules from the complex behavior of the system can be made. This kind of approach might shed light on biologically relevant solutions to cognitive problems even by the use of more formalized models.

This leads to the second conclusion that there has to be a connection between the research of neuronal networks in AI and computational neuroscience, which can help to clarify the role of computation as a function of the brain beyond the classical symbolic approach [3].

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The World Color Study Visualisation

Kristína Rebrová

The World Color Survey [1] is a wide-range experiment with data from whole world gathered to test Berlin and Kay's hypotheses on universal mechanisms in color categorisation [2]. Data from this research, published on the Internet, can find their usage not only for further investigations in the region of their original role, but also as an interesting data collection for studying the cognitive process of categorisation and color naming in general, or for instance as a source for creating data sets for artificial intelligence program for categorisation [3] [4]. In order to gain better understanding and overview on given data, this work focuses on visualisation of WCS results.

In short, the WCS experiment consists of the color naming task, in which subjects are asked to call the simplest and most general names for 330 color chips separately, and then to choose the best examples of submitted colors on a color palette consisting of all input colors. The Visualisation program at first integrates data from WCS archives [5] to form the color grid, then it counts the "average" (most frequent) responses for each color chip and for each language creates a middle-stage product to be read and visualised separately. From pre-processed data sets it generates the visualisation for each language's vocabulary, projected on the WCS color grid, including the mapping of color categories, best example responses and reliability of answers (percentage of agreement of participants on certain name for given input) in several ways of spatial display of dimensions of these data. The output maps (images) should be readable and comprehensible to researchers as well as to people, who are not familiar with this problematic, and serve as suitable complementary material for any work, that uses the WCS data. Certain outputs and the program in form of web application will be published on the Internet for free use.

Another part of this project consists of a slightly modified version of color naming experiment in Slovak language and interpretation of its relationship to WCS and previous studies of Berlin and Kay. Data from Slovak color naming task argue mostly for B&K's universalistic hypotheses and are very similar to results of this experiment in English and other European languages. In comparison with the WCS's languages with the same number of categories, which all spare a written form and are not from industrialised culture, it is obvious that Slovak language is being influenced by other European languages, industrialisation and information technologies.

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Linguistic Meme Analysis in a Local Virtual Community

Vladimír Dziuban

Language is a subject of constant change, which naturally evolves along with the community of its speakers and is undoubtedly an integral part of a community's culture. One of the possible approaches in study of language is the so called meme approach, when language and all of its atomic parts are seen as competing replicators called memes [1][2]. Memes reside in human minds in the form of ideas and are transferred among others through communication and social contact. Internet technologies have opened new possibilities of executing connections between people and also provided interesting sources of information on these interactions.

Kyberia.sk is a virtual community started in late 1990s by a young philosophy student Daniel Hromada as a personal web page oriented towards latest technologies, transhumanist philosophy and alternative ways of life, but soon a community spontaneously emerged around the site. As for now, Kyberia has a population of approximately 7500 users out of which about 1600 are active daily and although evolution brought more mainstream topics and loss of interest in creating original content within the range of alternative culture, it remains one of the very few alternative virtual social networks in Czechoslovak cultural region.

One of the original ideas in the development of Kyberia was to create a system that would allow studying various aspects of meme behaviour. This work focuses on a special group of memes – neologisms in language, their attributes and evolution in the environment of a virtual community. These memes have very much in common, but under examination according to Heylighen's General Selection Criteria [3][4] they show a number of key diversities such as complexity of their meaning, usage possibilities and origin. This work aims to develop an interpretation of the data and statistics obtained from the submission database of Kyberia.sk community server based on these differences and to provide basis for a fresh direction of research. Evolution of written and spoken languages in near future will be significantly influenced by various forms of electronic communication such as short messages, instant messaging or community sites and we are now able to detect and to examine these changes in their original environment. Research in this field could lead to development of a virtual sandbox for modelling and memetic engineering.

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Gender Differences in Hand Gestures

Lisa Szugfil

Gestures play a crucial role in human communication. Numerous studies focused on various aspects of the interplay between language and gestures (cp.[1],[2]). The present study further investigates qualitative differences between the hand gestures of males and females.

Additionally, we tested the effect of the gender of the communication partner, thus investigating the plasticity of this behaviour complex. We hypothesize that (a) There are qualitative differences in the gestures of men and women, and (b) Men make more gestures when they communicate with women, than when communicating with other men.

In our experiment we placed two participants in separate rooms in front of a computer, instructed that the experiment was targeted at communication quality via the Internet. We videotaped 60 interactions (20 male-male, 20 female-female and 20 female-male interactions) while they were communicating with each other via video chat.

In order to create a communication need, subjects were given the task to explain something to the communication partner in two minutes, so the partner would be able to retell or recognize the described after the interaction. One participant had to retell a short animated movie, the other had to describe a picture of a house, which was fixed on his desk in front of him.

Subjects were instructed to describe it in detail, as the communication partner would have to choose among very similar pictures.

The tasks were assigned to the participants in random fashion. Afterwards both participants filled out a questionnaire about their current emotional state (PANAS), their personality, their familiarity with PCs and video chats, and questions regarding the communication and their communication partner.

We classified the 1400 gestures identified in the 120 video recordings in 7 categories:

ikonic-gestures which outline an object, mimetic - gestures which mimic an action, methaphoric - symbolic gestures e.g. conductor for music, deictic spatial - pointing somewhere e.g. over there, deictic literal - pointing at something e.g. this one, emblematic - use of common signs e.g. peace, victory, counting.

We tested inter-rater reliability to compare gesture-category-attribution of different observers (Kendalls W=0,857, N=13). To verify our hypotheses we used the Mann-Whitney-U-Test.

The results showed that, regarding hypothesis b) there was no significant difference in the number of gestures. In our study men don't make more gestures when they communicate with women, than when communicating with other men. Further women show significantly more emblematic gestures than men.

We are currently simulating the recorded gestures in an Avatar. This enables us to compute body angles in the different phases of the recorded gestures, thus enabling us to measure the dynamic and spatial quality of the gestures. Thereby we will investigate whether men show bigger gestures than women, and reconstruct typically male and female gestures.

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Neurospell – A brain-computer interface application

Philip Reisinger

A brain-computer interface (BCI) is a communication system that translates brain activity into commands for a computer or other devices. BCIs can provide communication control to people who are totally paralyzed and further may also represent a totally new approach to the issue of man-machine interaction. Such alternative application areas can be found in the field of multimedia communication, the gaming industry and even on the military sector.

Current challenges in the research area of invasive and non-invasive BCI technologies lie in the development of suitable sensors and in the evaluation of reliable and performant algorithms which implies a deep understanding of neurophysics (i.e. patterns of brain activity that can be used for communication) and several theories concerning pattern recognition.

Another research area is the development of new BCI applications.

Based on an existing exploratory BCI setting, this project aims to develop a BCI-Speller-application (Neurospell) which enables a subject to make textual inputs with appropriate speed and reliability. Neurospell is based on a phase coherent detection method for discrimination which was introduced by the Department of Neuroinformatics, Smart Systems Division, Austrian Research Centers GmbH. EEG-signals from three electrodes are recorded and processed while the subject gazes at a stimuli which corresponds to the letter to spell. With the current configuration of the system, it is possible to spell about 10 chars/min. Besides becoming acquainted with the existing exploratory BCI setting, the main goal of this project was the conception, design and implementation of a speller application within a C++/OpenGL MS-Windows environment.

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Dissociation of Motor- and Cognitive Processes in Multistable Perception

Pomper U., Mathes B., Walla P., Basar-Eroglu C.

Multistable visual perception refers to phenomena, in which one invariant stimulus pattern is perceived in at least two different, mutually exclusive ways. Thus, such stimuli offer unique insights into the organization of visual perception, as well as the mechanisms that integrate stimulus-driven (bottom up) and attention-driven (top down) aspects of information processing (1).

Previous work from our group has shown the occurrence of a positive delta-component starting about 200ms before perceptual reversals (2, 3). However, as subjects had to press a button in order to indicate reversals, a possible overlap with motor-related potentials could not be ruled out. The current study set out to dissociate the time point of the perceptual reversal from the button press, in order to investigate the reversal-related components independently from motor activity.

The stimulus used was the so called stroboscopic alternative motion (SAM). This dynamic multistable pattern consists of two diagonal pairs of black dots flashing up alternately, which results in the perception of an either horizontal or vertical movement. Subjects were instructed to press a button whenever a perceptual reversion occurred. In addition to the 'standard' condition, where the response should be made immediately after reversals, we introduced a 'dissociated' condition, in which subjects were asked to delay their response for a period of 4 movement-cycles of the SAM. As every cycle takes 250 ms to complete, this procedure separates the perceptual reversal from the motor-response by 1000ms.

13 subjects (7 female, mean age 23 years) were included in the data analysis. EEG was recorded with 12 electrodes from frontal, central, parietal and occipital sites and epochs from -3000ms to 1000ms around the button press were extracted from the continuous data. Offline, epochs containing eye and muscle artifacts were eliminated and the remaining artifact-free data was filtered in the delta frequency band (0-4Hz) using FFT.

For statistical analysis, the maximum positive deflection in each channel and epoch was determined for the following time windows: 2000ms to 1500ms before button press; 750ms before to 250ms after the button press. Consequently, delta amplitudes within those time windows were compared between the 'standard' and the 'dissociated' condition.

The results strongly suggest that the reversal-related positivity observed so far is a stable electrophysiological correlate of perceptual reversions, and independent of overlapping motor processes.

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Rhythm – a General Property ?

Barbora Kamrlova

The content of “Rhythm” is well defined for music (determined periodicity and regularly distributed values called also metre), language (typical patterns of distribution of long/short phonemes – syllables, versification), biorhythms (day-night) and for various other rhythms (individual rhythm – life style). We add one more sense – rhythm in mathematics. To all these rhythms we can distinguish common features: repetition, periodicity, variations, association. They determine patterns (on their turn forming objects like song, mathematical string, linguistic sentence or one terrestrial day) which are then obviously present.

It is possible that what we call “rhythm” does have a deeper sense, much more general than those mentioned above, allowing us to discover an interior structure of objects, sometimes just by “feeling”, without being able to verbalize it or to express it in some exact way.

To develop our performances in music, mathematics or language, we have to evolve following some particular education, instruction, courses, to develop our cognitive competences for each of them apart, what makes impossible to play deliberately on intersections of all these fields - structures.

We suppose that possibly we only need (though in visibly disjoint fields and skills) to develop one “competence” allowing us to discern, perceive, create, interpret and apply “rhythm” with all its senses.

The exploitation of this intersection should facilitate learning of mathematics to the children “good in music”, enable children to see mathematical patterns in languages, to derive benefit from maths and language in music education.

To open the long-term research on these intersections and their impact on higher cognitive development, we look for positive correlation between a status of development in all three fields – mathematics, music and language, concerning perception, reproduction and creation of “rhythm”.

Responding children (11, 14 and 17 years) are asked to complete given patterns from mathematics (sequences of numbers), language (sentences and sequences of words) and music (sequences of notes and sounds) and to look for analogies between patterns of sounds, words and numbers, to recognize their common features and structure. The second important point is an individual affinity to each field – if they feel interested, good or gifted in music, language and mathematics.

The first analyses confirm our hypothesis on existence of the positive correlation between mentioned aspects (development, interest, results of problem solving in all music, mathematics and languages) on a tested level.

There are still many other facets to be discovered in this research to contribute to the advancement of pedagogy, but actual results represent a positive starting point to the long-term research on an utility of intersections in higher cognitive development with focus on music, mathematics and languages.

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Comprehension of Pictogram/Symbol Information in traffic environments

Reea Mynttinen, Eva Mayr, Karin Siebenhandl

Traffic security depends much on the ability of the drivers to perceive the environment and to react to it. Due to the complexity of road information in the Trans-European road network, there is a strong need to present information to the driver in a standardized and comprehensible way. In the framework of EU-project “InSafety” Danube University Krems ran evaluation of the existing and newly designed pictograms/symbols intended to be displayed on variable message signs [3] [4]. These evaluations were based on the recommendations of international standard ISO 9186 [1]. The design of the pictograms was done by “International Institute for Information Design” (IIID).

Present study aims to further analyse the test results from InSafety project’s Comprehension Tests. Even though these tests provided information on comprehensibility of the pictograms it did not go in depth on reasons behind. Present exploratory study investigates if there are some visual characteristics of pictograms making them comprehensible in the road context – or opposite, and why do differences in comprehension of pictograms used in traffic communication (variable message signs) exist?

Even if there are several general recommendations for planning pictograms, the research available in relation to comprehension in traffic communication is quite limited. The objective of this study is to extract some attributes or elements that constitutes a well comprehensible or poorly comprehensible pictogram. The results of the research project could be utilized in developing design standards for traffic pictograms.

In this exploratory study guided interviews were used to collect in-depth information in relation to the selected pictograms under evaluation. For the interviews ten pictograms were selected for further analyses. Five of these were well comprehended in the Comprehensions Tests and the other five were poorly comprehended. The ones affecting road security most were chosen; security relevant pictograms were selected rather than pure informative ones. The initial results based on the interviews show differences in certain information elements between pictograms that are understood well in previous tests and the ones understood poorly: Better comprehended are those pictograms that 1) contain more information on road context and are more realistical, 2) have perspective similar to the drivers actual view to objects, 3) offer subjects information of expected action.

Based on the results of these qualitative analyses, quantitative analysis will be conducted. Other pictograms used in the Comprehension Tests are classified according to the found visual elements making a pictogram comprehensible. Regression analyses will show whether the elements identified in interviews can predict these pictograms comprehensibility.

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Human Courtship Behaviour and Flirting – the Role of Movement

Gregor Konicar, Karl Grammer, Iris Holzleitner, Susanne Schmehl, Eva Matt

Human courtship and flirting behaviour consists of numerous highly complex interactions between male and female participants. Although each interaction in itself is unique, there are certain patterns of behaviour, which should be typical of either male or female behaviour. [1] According to the Bielefeld-Model there are three different levels of human behaviour – the Symbol-Level, the Icon-Level and the Index-Level - the most basic and least conscious level of human behaviour. Since the motivation for cheating and sending fake signals is rather high during flirting [2], we decided to focus our attention on movements on the Index-Level.

Based on the concept of asymmetric investment, which states that the sex that invests more in their offspring gets to choose their partner, while there is high intra-sexual competition for access to prospective mates amongst the less-investing sex, we investigate the number and speed of movements during flirting behaviour:

We predict that male movements should get larger and slower when they are interested in a female, while females are expected to make more but smaller movements.

To test our hypothesis, we examined interactions in a strangers-meet-experiment: 89 male and 89 female subjects were paired off and left in a “waiting room”, while their behaviour was covertly filmed. Afterwards, they were asked to fill in a questionnaire on their socio-sexual orientation (SOI – Socio-sexual Orientation Inventory) [3], as well as several questions designed to rate the attractiveness of the other person, and their chances for a mutual relationship.

Video-files were analysed by computer using E-Motion, which allowed us to investigate their motion history – how much movement had occurred during a specified time.

The results were then related to data obtained from the questionnaires (e.g.: interest in the partner) to test whether our hypothesis held true.

We found that the self-reported interest in the interaction-partner did not correlate significantly with any aspect of motion for either sex. However, further analysis showed a high correlation between participants’ scores from their SOI-questionnaires with several aspects of motion:

For women, speed of movements, expressiveness, emphasis, highest registered amount of motion and total sum of motion all showed a highly significant positive correlation with SOI-scores. For men, the lowest registered amount of motion showed a highly significant negative correlation with SOI-scores.

If these results can be corroborated, it would be the first evidence of a direct connection between socio-sexual orientation and movements on the Index- Level.

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A Study of Verbal Mating Strategies

Boris Grkinic

According to Human Ethology, certain behavioral patterns of human courtship behavior emerged out of evolutionary adaptation. Women and men find themselves in different biological roles when it comes to courting, mating and parental care. Thus, biological predispositions lead to certain gender-specific strategies when courting with an individual of the opposite sex.[1]

The principle of *asymmetrical investment* claims females to be the sex which is biologically predetermined to invest more in rearing the offspring. As a consequence, females carry a higher risk than males when it comes to mate choice. It brings them in the position to choose. On the opposite, males find themselves in the role to compete on an intra- and intersexual level for access to the opposite sex.[2] This principal is supposed to mating strategies

Together with students of Biological Anthropology and Cognitive Science, I am conducting a research project investigating mating strategies in mixed-sex dyads of young students in a “waiting room situation”. The interaction is recorded and then analysed on three separate levels: The verbal, the gestical and the analogue. Furthermore, extensive questionnaires (PANAS, SOI, NEO-FFI) are filled in by the probands, exploring individual preferences, feelings and motives.

The present study investigates the level of verbal communication. Based on the concept of *asymmetrical investment* various hypotheses are set: Delivering extensive information and promoting themselves, in the interaction men will tend to (a) speak more; (b) speak more about themselves, thus using terms that refer to themselves – like „I“ – extensively; (c) and finally use more Commissives [3] than their female counterparts.

On the contrary, it is assumed that women will tend to (a) speak less; (b) encourage to speak via giving extensive feedback; (c) thus, use terms like „you“ frequently; (c) use more Directives [3]; (d) use more Expressives [3]; (e) and furthermore choose more indirect expressions than their male opposites.

These gender differences are expected to be more pronounced, the higher the sexual interest in the interaction partner is. The collected data of the study indeed suggests the correctness of the presumptions, although one specific hypothesis (male (b) /female (c)) turned out to be the opposite way around.

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An Agent-based Simulation of Riot Behavior

Dirk Eichhorn

A riot, in its most basic form, is an unorganized crowd where widespread aggression occurs. The facts that not every crowd leads to a riot, and that not every act of aggression constitutes a riot, make it clear that there have to be certain factors present that are either necessary for, or at least strongly encourage rioting behavior. The goals of this project are to validate candidates for these factors and to develop a computer model that captures the “turnover-point” where a crowd becomes a riot. In a meta-analysis of studies on rioting, Postmes and Spears [1] argue that, contrary to a more intuitive understanding of the psychology of the riot phenomenon, deindividuation plays a much smaller role than previously thought: Psychology-oriented accounts do in fact stress the role of individual agents within the pre-riot crowd. Of special interest for this project are, for example, those individuals Haddock and Polsby [2] call the *entrepreneurs*; in a sense the nuclei of aggression, around which larger patterns of violent behavior begin to grow. Further archetypes identified within a rioting crowd are *hangers-on*, as well as more passive *bystanders*.

The simulation itself is realized in NetLogo, a multi-agent based simulation suite particularly suited for the modeling of social phenomena and other distributed processes. A generic crowd situation with two opposed groups of individual agents is realized in a simple simulated environment. The up to 400 agents are able to scan their surroundings, and to change their behavior depending on both the given situation and certain individual traits. The program incorporates elements of an approach-avoidance model by Jager et al. [3], and of a cognitive system developed by Wijermans et al. [4]. The assumption is made that agents within a crowd are influenced by factors on three different levels: the environment; the groups present in the situation; and the individuals. More specifically, factors like *crowd density*, *noise levels* and *temperature* on the environmental level, and *in/out-group*, *friendship*, and *leadership* relationships on the group level are considered. On the intra-individual level of agents, physiological factors like *energy*, and functional factors such as *saliency*, *motivation*, and *insecurity* influence and modify behavior selection.

The results indicate that the simulation is capable to reproduce some important characteristic roles agents might play within a riot, such as the aforementioned entrepreneurs, hangers-on, and bystanders. These roles and their associated behavioral patterns are observable within the graphical simulation of the crowd, and can be linked to properties based on the assumed factors described above. It is hoped that further work on this first model can provide helpful insights and concepts for the understanding of the mechanisms and dynamics that underlie riot behavior.

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The Role of Memory Competition in Retrieval Induced Forgetting

Attila Keresztes, Mihály Racsmány

The concept that humans can actively inhibit memories is heavily disputed in cognitive psychology. Understanding the role of facilitatory and inhibitory mechanisms in memory retrieval can reveal crucial information on how forgetting works, and more generally how memories are formed, stored and retrieved. It also provides structural and functional information for computational models of memory[1].

In the Retrieval Practice Paradigm (RPP) [2] subjects learn category - member pairs (e.g. City – Paris, City – Rome, Sport – Football) then practice retrieval of some members of some categories with a category plus word stem cue (e.g. City – Pa...), and finally are tested for all learned members with a category plus stem cue. The typical result is that recall of practiced (RP+, e.g. Paris) items is greater while recall of non practiced items from practiced categories (Rp- items, e.g. Rome) is poorer than recall of items from non practiced categories (NRP items, e.g. Football). This latter finding is referred to as retrieval induced forgetting (RIF).

Interference theories posit that practice strengthens the relationship between category cues and RP+ items and that the RIF effect reflects interference from strong items at test. In contrast, inhibition theories posit that the RIF effect emerges due to active inhibition of RP- items during practice.

To explore the effects of competition during practice, we introduced three modifications to the original RPP. First, at practice the specifying cue for the target was not the learning cue. Subjects were provided with only a word stem and the last letter of the target. Second, half of the words in NRP categories (NRP Similar items) began with the same two letters as RP+ items. This introduced an additional type of competition (in addition to the usual RP+ vs RP- competition a RP+ vs NRP Similar competition). Third, subjects performed two tests. In the aided condition the cue was a category plus a word stem, in the stem-only condition only a word stem and the last letter.

We hypothesized that an initial pattern of activation/inhibition over memory items is modified by competition during practice. The pattern reactivated at test is consistent with test conditions, i.e. the aided condition activates a pattern in which RP- items are inhibited, whereas the stem-only condition activates a pattern in which NRP Similar items are inhibited. Without being fully conclusive our results support this hypothesis: subjects produced the classical RIF in the aided condition, whereas only NRP Similar items were inhibited in the stem-only condition.

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Ontology-driven Categorization of Blog Postings

Juraj Frank and Martin Homola

On the `blog.matfyz.sk` portal, we employ a rather standard tagging method for distributed collaborative categorization of blog postings. This approach allows the authors to assign one or more keywords (called “tags”) to every blog posting. Tags provide typical characterization of content and allow other users to access postings on particular topic by filtering out only articles marked up by particular tags.

However, several problems are associated with tagging. For instance, different people usually use different tags to describe same topics or types of content. We will apply clustering algorithms [4] to group similar tags and also blog postings. Furthermore, by stochastic machine learning approach [5] we will evaluate the correct assignment of particular tags to the textual content by the user. These methods are generally based on the Harris’ distributional hypothesis [3] - the idea is that words that tend to occur in the same contexts tend to have similar meanings.

Building on previous work [2], our goal is to use ontology-based knowledge and semantic technology in blog posting categorization. We will apply already existing techniques from the field of ontology learning [1] on blog postings and on tags already assigned by the authors.

We hope that such ontology-enhanced blog posting categorization system will be able to automatically provide suggestions and corrections of tags, group similar blog postings, discover new content relations and facilitate the process of finding the right information, enhancing the current user experience on our blog portal.

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Environmental Influences on TFT Success in the Iterated PD

Andreas Schneeberger

Decision making in a social context is of particular interest for cognitive science. Agent-based modelling (ABM) is one of the means by which related phenomena can be investigated. A trend-setting work in this context is a computer tournament conducted by Robert Axelrod in 1980 [1]. Leading scientist had been invited by Axelrod to submit strategies to compete in an Iterated Prisoner's Dilemma (IPD) tournament. The winner was a simple strategy called TIT FOR TAT (TFT), submitted by Anatol Rapoport. A repetition of the tournament later that year again revealed TFT as the winner [2]. In the meanwhile extensive research has been conducted based on this setting [7].

A replication of the first tournament has been conducted within this project. Based on the findings of this replication a further modification has been added to test further aspects of the setting. The results showed some commons with Axelrod's findings. However, it also revealed some differences. In particular the often cited superiority of TFT did not materialize.

The differences between Axelrod's findings and the replication suggested that the reason is to be found in the different initial conditions of the experiments. To test this further a modified setting has been established in order to investigate the influence of this initial composition of the population on the success of TFT in analogy to Hirshleifer and Coll's idea [6]. This simplified setting with just three strategies – namely ALLD, ALLC, and TFT - revealed that the success of TFT indeed depends on the initial composition of the population. This has been shown not only by simulation but also formally.

The success of TFT does not just depend on the hostility of the environment. TFT can do well even in environments where most agents always defect (ALLD). However, if there are enough agents playing strategies like e.g. ALLC (always cooperate) and so let themselves being exploited by more greedy strategies like ALLD, TFT does comparably worse. Overall - that is, in different settings from friendly to hostile - it can be concluded that TFT and ALLD can both be successful. However, both strategies have their strength and weaknesses which materialize in different environments.

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Universal Data Categorizing Agent Architecture

Ludovít Malinovský

Organization of data in computer and in human mind is very different. Mind uses only one associative way of data organization and the main unit of data is category or concept. Concepts can be accessed via words used for it or words used for similar or somehow related concepts. In computer, basic unit of data can theoretically vary from bit or byte to file or resource. Depending on purpose, many different ways of data organization have been developed, but they usually reflect more needs of application or system than needs of its user. As a result, user is the one who has to adapt. Pieces of data in various kind of hierarchies (filesystem trees, object and class hierarchies, web resources identified by URL) are organized into groups mainly functionally – depending on how they are used, not conceptually – what they are about, what they contain. When user has to find or store data in such system, practical complications arise, organization of user data is messy and time consuming, and user has to cope with inability to find wanted or relevant resource. Theory of databases does not address this problem, search engines do better job, but still have their drawbacks and often it is user who has to learn to work with them, not vice versa. Tags are more mind-like nonhierarchical system. They are popular in web, for example in blogs or bookmarking sites. They can be ex post analyzed for correlations, hierarchical structures and other relations, but don't enforce any of them. This project is trying to develop architecture of universal agent capable of learning how user organizes his data in given hierarchical or nonhierarchical system based on contents in order to facilitate user to choose the best path or tag for given piece of data through which it can be accessed later more easily.

In design I used three level architecture which roughly parallels three stages of information processing in human brain. External condition is first recorded by receptors and sensory organs and transferred to correct part of brain – to primary cortex specified for given kind of stimulus. Unimodal primary and secondary cortex then analyse domain specific sensoric input. They often contain various kinds of feature detectors. Finally input from all domains is integrated in polymodal associative cortex. Similarly my architecture consists of skeleton with three sequential levels. First of all, type of data is detected, proper reading procedure is selected and piece of data is divided into modal channels – textual, visual, sound, etc. Then each channel is processed by channel specific feature extracting module. Finally features from all channel modules are collected and categorizator module is employed to get the final categorization.

Skeleton consists of definition of interfaces between these levels as well as of control mechanism over the whole process of categorization and learning. For purposes of this project only static nonevolving modules are used. Later, competition between same-purpose modules can be implemented, evolution of modules, exchange of modules between different agents and so on. Initially one module for each level is developed – reader of text files into textual channel, analyzer of textual channel based on word frequencies, and categorizator based on discrimination criteria. Practically, agent is adapted to be used as plugin into web browser suggesting where to save downloaded file.

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Human behaviour in a potential courtship situation

Katharina Koch

If man and woman meet each other the first time different nonverbal patterns of courtship behaviour can be observed. In this study we investigated, which patterns are typical, if a man or a woman is interested in the interaction partner. Here, I report findings of an experimental observation, where mixed-sex dyads were unobtrusively videotaped while waiting for an experiment.

Our hypotheses are based on the “Parental investment and sexual selection” theory by R.L. Trivers (1972). According to Trivers parental investment means any investment by the parent in an individual offspring that increases the offspring's chance of surviving (and hence reproductive success) at the cost of the parent's ability to invest in other offspring.

According to Trivers the sex which has the largest investment in lactation, nurturing and protecting the offspring will be more discriminating in mate choice, and the sex which invests less in offspring will compete for access to the higher investing sex.

In humans, females have the higher investment, leading to female choice and male-male competition.

Based on this theory we expect that men show more often direct display behaviour with increasing frequency when interested in a woman. In contrast to that we expect that women are more “careful” and show less direct signals if they are interested in a man. Moreover we expect that women show increased protean behaviour and that the probability of negative signals is higher.

We hypothesize that the following behaviour pattern can be observed if a man or a woman is interested in the other sex (see references):

- 1.) auto manipulation (Grammer et al. 2000; Renninger et al. 2004)
- 2.) Head akimbo (e.g.. Grammer 1990)
- 3.) Laughing together (Eibl-Eibesfeldt & Grammer 1990)
- 4.) space maximization (Renninger et al. 2004)
- 5.) Hair flip (explorative)

Methods:

We unobtrusively videotaped seven minutes of interaction of 84 mixed-sex-dyads in a waiting room situation (25.4.2008 – 5.5.2008) at the Biocenter in Vienna. Participants filled out a questionnaire before (PANAS) and after (SOI, NEO-FFI, interest in the partner) the interaction.

The annotation of behaviors was carried out by means of the computer program “Observer” by Noldus. Within this program the video tapes can be played-back while the behaviour pattern are coded. The videos were analysed by a focal sampling and continuous recording. Reliability analysis showed an intra-observer reliability of a Cohen's Kappa of 0.74-0.92, and an inter-observer reliability of a Cohen's Kappa of 0.57-0.7. Fleiss (1981) considers a kappa of 0.60-0.75 as good and >0.75 as excellent.

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Early Stages of Implicit Sequence Learning

Ferenc Kemény & Ágnes Lukács

Implicit Learning is accidental learning of complex information without explicit access to the representation. Implicit learning is one of the central notions of cognitive psychology and cognitive science. Language acquisition is a type of implicit learning, since it takes place incidentally and conscious access is hardly available on the procedures that lead to proper language use. Language is linked to implicit learning not only through language acquisition: language impaired and dyslexic subjects show performance similar to that of patients with basal ganglia malfunctions like Parkinson's disease and Huntington's disease (eg. Knowlton, et al, 1996).

Implicit learning has most widely been viewed as a coherent and robust system (Aslin et al, 1999). The question of the presentation is whether implicit learning takes place based on perceptual or motor information, whether the acquired representation consists of low-order superficial features or higher order (abstract) sequence information.

The method of the studies introduced is a traditional implicit sequence learning task: the Serial Reaction Time Task. The original SRT task is a simple reaction-time task in which a circle can appear in four different locations, and the task of the subject is to press the button corresponding to the given location. The appearance of the circle is not random, it follows a determined or probabilistic sequence. The reaction-time decreases as the sequence appears, and increases if the sequence disappears or alternates (eg. Nissen & Bullemer, 1987; Song et al, 2007, Robertson, 2007).

This task has been modified in several ways in order to find out the answers for the questions in focus. We found that there is a difference in probabilistic and deterministic sequence learning, the former is less, the latter is more reliant on perceptual information. Higher order learning does not seem to take place in the early stages of learning.

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A Genetic Bases for Mental and Cognitive Retardation

Mehrdad Farahmand

Fragile X syndrome (FXS) affects approximately 1:4000 males and 1:8000 females worldwide. It is the most common known monogenetic cause of mental retardation. The syndrome is characterized clinically by mental retardation with notable deficits in language and executive functions. Behaviorally, the patients often have problems with hyperactivity, and about 20% of patients meet DSM IV criteria for autism. Additionally, about 20% of FXS males develop seizures during their lives.

Although neuropathological studies reveal few consistent gross morphological changes, FXS patients have an increased number of long, thin dendritic spines. Elongated spines are normally present during development, but in FXS they persist into adulthood despite neuronal numbers and density within the neocortex.

FXS normally results from the expansion of a CGG repeat in the 5'-untranslated region (UTR) of the fragile X mental retardation gene FMR1. In normal individuals, this region contains 5 to 50 repeats with intervening AGG sequence and is relatively stable. In some cases, though, there is repeat expansion to an intermediate length of between 55 and 200 CGGs. These premutations are highly unstable over successive generations and tend to expand. Once the expansion reaches 200 or greater repeats the 5'-UTR and surrounding regions of the FMR1 gene become hypermethylated and histone deacetylated, resulting in chromatin condensation. These events prevent FMR1 transcription and lead to the absence of the fragile X mental retardation protein.

In addition to cognitive impairment, individuals with fragile X display a characteristic profile of behavioral and psychiatric difficulties. Most well-controlled studies demonstrate that persons with fragile X are at increased risk for particular maladaptive behaviors, including hyperarousal, social anxiety and withdrawal, and attention problems. In males, these behaviors include social deficits with peers, abnormalities in communication, unusual responses to sensory stimuli, stereotypic behavior, social avoidance, gaze aversion, inattention, impulsivity, and hyperactivity. Young girls with fragile X also exhibit maladaptive behaviors, including problems with depression, social withdrawal, and hyperactivity; however, these symptoms tend to be less severe than in boys with fragile X. Consequently, individuals with fragile X are at increased risk for psychiatric disorders, most notably anxiety, mood, and attention deficit/disruptive behavior disorders. Furthermore, many behavioral characteristics of children with fragile X are similar to those of children with autism. The proportion of persons with fragile X who meet criteria for autism is estimated to be 7% to 25%. Although this overlap is not high, children with fragile X who do not meet diagnostic criteria for autism nevertheless demonstrate autistic-like behaviors such as stereotypy, avoidance of eye contact, social shyness, perseverative speech, and tactile defensiveness.

Early Reading Methods of Elementary School Children

Martin Rakovský

This work focuses on various methods of reading taught to and used by children at elementary school. Basically, we can divide these methods into two groups – explicit and implicit. The first group of methods involves *synthetic phonics* method, which first matches graphemes with phonemes and then blends them together to achieve full pronunciation of whole words. Implicit methods involve the *global method*, which focuses on recognizing and reading the whole words as basic elements of language and is similar to reading of logograms. There are several arguments for teaching each of these methods. Research shows that late reading methods of adults are predominantly global, that's why this method should be taught also to children from the beginning [3]. Reading is defined as a construction of meaning and not as the result of a preliminary decoding process [1]. Global method insists on understanding the meaning of words, whereas synthetic phonics method may slip back to simple pronouncing of syllables without understanding. On the other hand, global method is worse in learning rate and is much more memory capacity dependent.

This work doesn't show, which method is better, it only tries to figure out if there are any children in Slovak elementary schools, who develop the global method of reading. The synthetic phonics method is generally taught in Slovakia, so probably most children will use this one. The distinction should be then visible when reading pseudo-words (random combination of graphemes/syllables that appears to be an actual word but has no meaning). Reading a pseudo-word should take more time than reading a normal word, when reading with the global method. Children reading with synthetic phonics should not show any evident differences when reading normal or pseudo-words.

The test group of children consisted of 40 children from 7 to 10 years old, involving the second and third grade of elementary school, from which 24 were females and 16 were males. They were tested by reading 50 words, from which 30 were normal words and 20 were pseudo-words, while measuring reaction time (the duration from onset of the word on screen to pronouncing the last phoneme of the word).

The results have shown that there actually are some children who implicitly develop the global method of reading, or at least are able to read some words as a whole without the need to synthesize the word from graphemes/phonemes. Test words could also be divided into groups by the likeliness of being read globally or synthetically. Frequent words (like “ice-cream”, “airplane”) were mostly read globally. Surprisingly, also some pseudo-words (“drust”, “delan”, “svoľge”) appear to be read globally. However, most of the pseudo-words demanded synthetic reading by and produced much more errors. There were also some normal words which were unknown to most of the children and therefore demanded synthetic reading. Sex differences were also found - boys read quicker than girls. This may be caused by the synthetic method, which makes boys read faster [2]. The experiment has also shown that girls read more globally. Therefore the “non-global” words could make the overall speed of reading of girls worse.

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Architecture for Universal Knowledge-based Agent (UKA arch.)

Michal Certicky

As a knowledge-based agent, we understand an entity (in our case artificial), perceiving it's environment through sensors and acting upon that environment through effectors, which in addition accumulates the knowledge about the environment and uses it in the reasoning process [1]. UKA architecture differs from common approaches by it's universality and original agent's motivation.

Universality of an agent is understood as the ability to act in various environments and to accomplish wide array of tasks, with only minimal modification of it's program. The key to building such universal program is modularity. Inspired by modular theory of cognition [2], UKA architecture is designed as a multi-agent system, where several sub-agents are executing independent cognitive processes, what results in the emergence of intelligent behaviour. From this set of sub-agents, only two are environment-specific (sensory and effector sub-agents), while others are independent on agent's environment (e.g. planning or induction sub-agent). These sub-agents are running as a separate programs (possibly on several different computers), communicating with each other and modifying the knowledge base. As a knowledge representation language we have chosen the first-order logic, which enables us to easily perform deductive and inductive inference, possibly using the external tools (ASP solver^{*}, ILP system^{**}, etc.). The set of these sub-agents is not strictly given, but in every implementation, there must be the sensory and effector sub-agent, which are the only ones with access to agent's hardware (sensors and effectors). Others are performing single cognitive process, like planning, generation of agent's goals, hypothesis generation, inductive inference...

* ASP stands for Answer Set Programming, which is a certain paradigm of logical programming. ASP solver can be effectively used in deductive and planning tasks.

** ILP means Inductive Logic Programming and ILP system is capable of automated inductive generation of hypothesis from set of observation and background knowledge.

However, this approach still doesn't ensure the capability to perform numerous different tasks. Common approach in agent-oriented programming is to design an agent just for one (or more) unique task(s), but our ambition is to more closely model living agents' motivation. The main difference is, that our agent in fact does “what it wants” and generates its goals dynamically, according to Aldefers ERP theory [3] applied to robotics – its needs are in 3-level hierarchical model (Existence needs - highest priority, Relatedness needs – middle priority and Growth needs - lowest priority).

Goal-generation sub-agent generates the set of goals (leading to satisfying these needs) with assigned priority.

Planning sub-agent generates the plans (sequences of actions) for each of these goals and passes it to effector sub-agent, which performs it. To make an agent do what we want, we simply pass it the information that we wish something to be done. Fulfilling our order is one of agent's relatedness needs (middle priority). Example of agent's existence need is energy recharging or assuring the safety of its hardware. Growth needs are represented by agent's knowledge expansion.

This approach is indeed interesting for the academic research, as it focuses on modelling of the human's cognitive functions, and I believe that it can (to some extent) also be applied in practical robotics after solving eventual computational complexity issues. However, the complete realization of such universal agent is at this moment beyond limits of an individual short-term project.

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Lateralized executive functions in memory retrieval

Mónika Albu & Mihály Racsmány

Abstract: Our study was designed in a way to contrast hypothesis of two dominant theory of PFC' role in retrieval processes. The so-called “systematic – heuristic” hypothesis states that left PFC is more involved in systematic retrieval, while right PFC more active in heuristic retrieval. The “production- monitoring” hypothesis proposes that left PFC is primary involved in semantically guided production of information, while right PFC is more involved in monitoring processes. Involving frontal and temporal lobe patients with left or right-sided lesions, we used ten different recall and recognition tasks loading differentially processes of production and monitoring, and also of analytical and heuristically processes. The results support the assumption that “production- monitoring” hypothesis is more appropriate in explaining the effect of frontal lobe lesion on memory performances, while the heuristic-systematic hypothesis is suited to explain the effect of temporal lobe lesions in episodic memory.

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