MEi:CogSci Conference 2012

Bratislava, Slovakia

MEi:CogSci Middle European
Interdisciplinary Master Programme
in Cognitive Science

Welcome!

Dear Coxies, dear MEi:CogSci partners and friends, dear guests!

This is the sixth MEi:CogSci Conference, the second in Bratislava. We want to express our gratitude to the University of Bratislava, particularly to Igor Farkas, Jan Rybar, Martin Takac and Kristina Rebrova, who made it possible that we can be here again.

We want to thank our invited speakers, Susanne Reiterer (Vienna), who will open the conference with her keynote, as well as Boicho Kokinov (Sofia), Urban Kordes (Ljubljana), Marijan Palmovic (Zagreb), Laszlo Ropolyi (Budapest) and Emil Visnovsky (Bratislava) for their contributions.

Printing of the proceedings was sponsored by the University of Vienna.

Last but not least we thank the Coxies, who will present their projects and theses. You will make this an interesting and joyful event!

Thank you all for coming! Enjoy the sixth MEi:CogSci Conference!

Elisabeth Zimmermann
Sebastian Günnel
Brigitte Römmer-Nossek

Friday June 22, 2012

09:00 – 13:00	WORKSHOPS Boicho Kokinov: Analogy and Cognition (I-23) Urban Kordes: Drawing a map of one's Experience (I-9) Laszlo Ropolyi: On the foundations of cognition and communication (I-32) Marijan Palmovic: Exploring language processing with ERP (M-126)
13:00 – 14:00	LUNCHBREAK
14:00 – 15:00	Welcome Keynote: Mezzofanti's secret. A large-scale investigation into second language pronunciation aptitude in the light of neuroimaging and psychology *Susanne Maria Reiterer*

	Track A (Language) Session Chair: Marijan Palmovic	**Track B (Cognition in Context)** Session Chair: Olga Markic
15:05 – 16:15	Processing of words and pseudo-words in patients with dementia *Katarina Marjanovic*	The effect of the harmonic context on the perception of pitch class *Anka Slana*
	Language and Perception: The impact of congestion language modality for differentiating relational categories *Barbora Minarikova*	Searching for a Strategy of Monopoly Game using Cognitive and Artificial Intelligence Approach *Robert Kotrik*
	Study of an annotation scheme concerning spatial information from text corpora *Cynthia Niggel*	In the quest of assessing legal and moral responsibility: A cognitive science perspective *Cristina Siserman*

16:15 – 16:40	COFFEE BREAK
16:40 – 17:10	Invited Talk: Brain and culture (On the pragmatist philosophy of mind and neuropragmatism) *Emil Visnovsky*

	Track A (Arts and Cognition) Session Chair: Markus Peschl	**Track B (Modes of Thinking)** Session Chair: Toma Strle
17:15 – 18:25	Eyetracking on paintings *Mateja Lesar*	The Temporality of Innovative Thinking Ontological Reflection on the Structure of innovative – contemplative Thought Process *Wolfgang Hörleinsberger*
	Communication in exhibition spaces *Zala Kurincic*	Meditation and the Brain. The Impact of Long-Term Meditation on Attentional Engagement *Rene Seiger*

	Adaptive Gesture Recognition System, transforming Dance Performance into Music *Evaldas Jablonskis*	EEG mu rhythm desynchronisation: an electrophysiological evidence for mirror neurons activity *Jan Silar*
18:30 – 19:00	Invited Talk: Mechanistic and Non-Mechanistic Paradigms in Cognitive Science *Laszlo Ropolyi*	
19:00 – 20:00	POSTER SESSION	

Saturday June 23, 2012

09:30 – 10:00	Invited Talk: Analogy and Cognition *Boicho Kokinov*	
10:05 – 11:15	**Track A (Emotions)** Session Chair: Urban Kordes	**Track B (Learning)** Session Chair: Igor Farkas
	Interaction of emotions processing and olfactory perception *Peter Pruzinský*	Evolution of movement control of a mobile robot in an unknown environment *Filip Toth*
	Empathy and Prosocial Behavior across the Lifespan *Martin Freundlieb*	Estimating negative transfer of learning: adapting a competitive exclusion model and experimental validation *Sebastian Günnel*
	The Neuroimaging of Social Anxiety Disorder *Lora Minkova*	Cognitive Aspects of Designing Rule Based Dialogue Guidance in Educational Mathematical Assistant *Gabriella Daroczy*
11:15 – 11:30	BREAK	
11:30 – 12:30	POSTER SESSION	
12:30 – 14:30	LUNCHBREAK	
14:30 – 15:00	Invited Talk: Eye movements as a measure of language processing *Marijan Palmovic*	
15:05 – 16:15	**Track A (Body and Mind)** Session Chair: Elisabeth Zimmermann	**Track B (Applications, HCI)** Session Chair: Laszlo Ropolyi

	Listening to the multimodal orchestra of the senses: Vision inductively infers about real-world objects from haptic information *Dalibor Andrijevic*	Approaching user experience: moving between abstract and in-depth *Michael Glanznig*
	Vibrotactile Feedback Application to Increase Control in Virtual Reality Hand Prostheses *Cosima Prahm*	The importance of spatial conceptualization for cognitive load minimalization in graphical user interface *Milan Uhercik*
	Physical and cognitive performance changes caused by expectation of enhancement *Michael Kecht*	Communication platform for agents in heterogeneous environment *Michal Vince*
16:15 – 17:00	COFFEE BREAK	
17:00 – 17:50	**Track A (Cognitive Impairments)** Session Chair: Brigitte Römmer-Nossek	**Track B (Object Recognition)** Session Chair: Martin Takac
	Double effect of curiosity deficiency on memory impairment with patients suffering from dementia syndrome *Tina Stukelj*	Invariant object recognition using perceptron with convolution *Gregor Zatko*
	Investigation of differences in large-scale network connectivity between healthy and schizophrenia subjects related to cognitive control processes *Florian Gesser*	Testing the hierarchical neural network DBN in invariant object recognition *Milan Halabuk*
18:00 – 18:30	Invited Talk: Phenomenology of Thoughts *Urban Kordes*	
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Workshops & Invited Talks

MEi:CogSci Conference 2012
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Analogy and Cognition

Boicho Kokinov

New Bulgarian University

During the workshop experimental support or rejection of the AMBR model will be disussed. Depending on the interests of the participants this could include topics like:
• Context sensitivity of human cognitive processes
• Constructive memory
• Biases in judgment
• Unconscious analogies
• How emotions influence analogy-making
• Interaction between perception and thinking in the interpretation of ambiguous drawings
• Embodied cognition view on analogy

The students will participate in active discussions and will be involved in experimental design tasks to test the model predictions. This will include both group work and individual assignments encouraging them to relate the theory with their own research plans.

Exploring language processing with ERP

Marijan Palmovic

University of Zagreb

The workshop will introduce students to the ERP technique and its use in studying language processing. It will comprise of four major topics: the nature of EEG/ERP signal and how to measure it, analysis of the EEG signal- averaging, frequency analysis; components; and experimental paradigms used for language comprehension studies.

The nature of the EEG/ERP signal is an introductory topic; the students will be acquainted with the main theoretical and practical issues of measuring EEG/ERP signal using the hands-on approach. The off-line analysis of the signal will be discussed, as well with the obtained ERP waveform as the goal of the analysis. The components are the building blocks of any ERP research; however, there is no definition of a component that everybody would agree upon. Two main approaches will be discussed, the psychological and the physiological approaches. Finally, violation paradigm as the most important experimental paradigm in language comprehension studies with the ERP will be discussed as well as some other paradigms most frequently used in the literature (e.g. the oddball paradigm).

On the foundations of cognition and communication

Laszlo Ropolyi

Eotvos Lorand University in Budapest

The workshop will focus on some fundamental problems of cognition and communication. Its main methodological tool will be a philosophical analysis of the following concepts: representations, sign, information, knowing and knowledge, virtuality, openness, reality and virtual reality, communication, community, culture, individual vs. social cognition.

Certain elements of cognitive science, information theory, communication theory, theory of culture will be referred and analyzed.

In the representation of the subject matter of knowledge two essentially different strategies can be identified: the free and the bound (bound, non-free, connected, etc.) strategies. As an illustration the physiological vs. cultural representations can be mentioned. These different strategies have different boundaries (disabilities, limitations, etc.) and can be elaborated different mechanisms to transcend them. However, human beings can parallelly use both of these strategies, they can combine them. These "mixed strategies" of representation contain collections of components of the free and the bound strategies. Some aspects of these representation strategies will be shown.

Signs have a central role in every mechanism of representations. How can we understand the functioning and nature of the signs, taking into account that such scientific disciplines as semiotics, informatics, theories of communication, etc. apply also a concept of sign, but sometimes in really different meaning? Studying the representing beings - represented beings relations a philosophy of information can be disclosed. A hermeneutic philosophy of information will be proposed: information is defined as interpreted beings. In other words: information is created by interpretation. Knowledge: a special kind of information. Information: the whole sphere of knowing, including essential and contingent relations. Knowledge: knowing the causes (Aristotle) – a restricted sphere of knowing. Taking into account the „as if" characteristics of signs easy to see that the very nature of the information is virtual one.

A better understanding of the concepts of virtuality (and openness) can be based on the Aristotelian concepts of potentiality and actuality. Virtuality and openness can be interpreted as two sides of the inseparable coexisting potentiality and actuality. Applying these ideas it is concluded that it is necessary to supply the Aristotelian dualistic ontological system with an additional sphere, and besides the actual- and potential forms of being to bring into being a third form of being (virtuality) in which the actuality and potentiality coexist in an inseparable unit. Virtuality is a reality with a (non-absolute) measure, a reality which has no pre-given and absolute character, but which has a relative and undergoing measure. The concept of virtuality has a central role in the reformulation of reality concept: virtuality is not the reality, but just "as if" reality. The term virtuality is new, but its content is not: in a historical overview shows that during the history of philosophical thinking, considering the nature and features of reality, many fundamental characteristics of the (premodern, modern and postmodern) virtuality has been disclosed.

In spite of the widely accepted view, it will be proposed that the very meaning of virtuality (and reality) is not an individual, but a common product. According to the relevant philosophy of communication and culture human communities and cultures are created by communication using its formal and substantial dimensions. Every social existence is a fusion of coexisting communities and cultures and it is a fundamental requirement for any kind

of individual existence. As a consequence instead of individual cognition the social cognition has a determinant role in the process of cognition.

Extended use of representation technologies instead of material ones becomes the dominant factor in the reproduction of the social existence in the last decades and this shift creates changes on our concept of reality. Since all beings produced by representation technologies are virtual by origin, every component of our recent reality becomes more and more virtual including the communities, the individuals, and their knowing and knowledge as well. In conclusion some new characteristics of knowledge and cognition will be shown during the workshop.

Heim, Michael (1993): The Metaphysics of Virtual Reality. New York & Oxford: Oxford University Press.

Lombard, Matthew - Ditton, Theresa (1997): At the Heart of It All: The Concept of Presence. Journal of Computer-Mediated Communication 3(2): http://www.ascusc.org/jcmc/vol3/issue2/lombard.html (28 June, 2001).

Ropolyi, László (2001): Virtuality and Plurality. 167-187, in: A. Riegler, M. F. Peschl, K. Edlinger, G. Fleck, W. Feigl (eds.): Virtual Reality. Cognitive Foundations, Technological Issues & Philosophical Implications. Frankfurt am Main: Peter Lang.

Drawing a map of one's experience (An introduction to Experience Sampling and other approaches of phenomenological inquiry)

Urban Kordes
University of Ljubljana

We will briefly survey the basic ideas behind the phenomenological inquiry: Why we need to investigate our lived experience? (Don't we know all there is to know already?) What kind of data we get out of it?... How? The basics of phenomenal data gathering techniques will be discussed.

Main part of the workshop will be dedicated to experience sampling method. We will discuss and try both versions: qualitative, dialogical *descriptive experience sampling* (DES) and quantitative, ready-for-smartphone-app version called simply *experience sampling* (ES). If opportunities will allow, we will make a small inquiry, testing the amount of mind wandering of conference participants.

Mezzofanti's secret. A large-scale investigation into second language pronunciaton aptitude in the light of neuroimaging and psychology

Susanne Maria Reiterer

Centre for Language Learning and Teaching Research (FDZ) at the Faculty for Philological and Cultural Studies, University of Vienna
& Department of Neuroradiology, MR research group, University Clinic Tübingen

An unanswered question in adult language learning or late bi and multilingualism is why individuals show marked differences in their ability to imitate foreign accents. While recent research acknowledges that more adults than previously assumed can still acquire a "native" foreign accent, very little is known about the neuro-cognitive correlates of this special ability. We investigated 140 German-speaking individuals displaying varying degrees of "mimicking" capacity, based on natural language text, sentence, and word imitations either in their second language English or in Hindi and Tamil, languages they had never been exposed to before. The large subject pool was strictly controlled for previous language experience prior to magnetic resonance imaging. The late-onset (around 10 years) bilinguals (second language learners) showed significant individual differences as to how they employed their left-hemisphere speech areas: higher hemodynamic activation in a distinct fronto-parietal network accompanied low ability, while high ability paralleled enhanced gray matter volume in these areas concomitant with decreased hemodynamic responses. Auditory working memory largely predicted the direct speech imitation skills in case of Hindi imitations, whereas empathy plus phonetic coding ability taken together were the best predictors for the imitations in second language English. The hemodynamic activation patterns (fMRI) were also different in the case of the English pronunciation, the L2 with many years of experience. Finally and unexpectedly, males were found to be more talented foreign speech mimics.

Brain and culture (on the pragmatist philosphy of mind and neuropragmatism)

Emil Visnovsky

Comenius University in Bratislava

The lecture will provide an overview of the key ideas of understanding of mental life in pragmatist philosophy (Peirce, James, Dewey, Mead, Quine, Rorty, Putnam) and the outline of contemporary theories of embodied (M. Johnson) and extended (A. Clark) mind developed within the pragmatist framework, as well as of current „neuropragmatism". The focus will be on the relationship of brain (mind naturalized) and culture (mind linguistically constructed).

Mechanistic and Non-Mechanistic Paradigms in Cognitive Science

Laszlo Ropolyi

Eotvos Lorand University in Budapest

According to a widely accepted view cognitive science was produced by the "cognitive revolution" which had taken place in the 1950-1960 years. There are many recollections on the revolutionary feeling of that age e.g. in Miller and Boden (2006), and several interesting attempts to characterize the intellectual changes. But how is it possible to identify the cognitive revolution?

Moreover, if we have a scientific revolution, then in a Kuhnian framework – perhaps – there can easily be identify a paradigm shift. But the problem is that we can not speak about revolution within cognitive science, and a related paradigm shift - without an existing discipline. So the cognitive revolution was perhaps a revolutionary change of something else. There is a candidate: "If there was a cognitive 'revolution' … it consisted in the overthrow of the core assumptions of behaviorism" (Boden 2006). Miller also reported on the fundamental significance of cognitive revolution in psychology in the formation of cognitive science. However, accepting these suggestions it is not really clear why and how did these revolutionary changes in psychology influence the state of so many another disciplines and get a leading role in the formation of an integrated theory of knowledge.

Otherwise, observing the simultaneous appearance of significant changes in many different disciplines, it is natural enough to suppose revolutions in linguistics, computer science, anthropology, etc. In this case cognitive revolution could be characterized as a complex of simultaneous revolutions. However, instead of such a parallel revolutions – perhaps – would be better to speak about significant changes within a more universal context, of which has simultaneous and parallel impact on many scientific disciplines and even the interrelations, separations, and integrations of disciplinary matters. First of all philosophical or cultural views can have such universal impacts. It is possible to identify a universal paradigm shift within the Western culture (or philosophy) leading to the emergence of more specific paradigms within scientific disciplines: the modern-postmodern shift generated those "simultaneous revolutions" of which a collection should be considered as cognitive revolution.

A significant expression of the modern-postmodern paradigm shift is the mechanistic-non-mechanistic paradigm shift. The modern/mechanistic paradigm and the postmodern/non-mechanistic paradigm in cognitive science represented e.g. by computationalism and connectionalism. The postmodern turn does not destroy the modern paradigm, just creates alternatives. So, the cognitive revolution produced a non-modern and non-mechanistic science. In other words: cognitive science has a basically postmodern nature. Both mechanistic and non-mechanistic paradigms have role in cognitive science, but none of them have an exclusive one.

Boden, Margaret A.: Mind as Machine: A History of Cognitive Science. Volume 1&2. Clarendon Press, Oxford, 2006.
Dupuy, Jean-Pierre: On the origins of cognitive science: the mechanization of the mind. MIT Press, Cambridge, Mass. 2009.
Gardner, Howard: The Mind's New Science. A History of the Cognitive Revolution. Basic Books, New York, 1985.

Analogy and Cognition

Boicho Kokinov

New Bulgarian University

In this talk analogy-making is viewed as central for human cognition. On the bases of the DUAL cognitive architecture and the AMBR model of analogy-making it will be demonstrated how the same mechanisms used for analogy can also model cognitive processes such as memory, perception, and judgment. This will allow for an integrated view on human cognition and understanding the interactions between various processes.

Eye movements as a measure of language processing

Marijan Palmovic

University of Zagreb

Eye tracking has established as a valuable tool in language processing research due to its simplicity for use, multidimensionality and precision. Today, the technique is completely non-invasive; the devices are usually based on an IR lamp and camera with the appropriate software. There are two major groups of experimental paradigms for language processing research with the eye-tracker. The first group comprises of reading paradigms. They make a good use of the fact that reading is a well structured sequence of saccades and fixations. Generally, the range and the direction of the saccades (forward vs. backward eye movements) are related to the particular difficulties within the text (e.g. the increased number of back-saccades onto a particular word represents some difficulty in processing the word or the structure the word belongs to), while the duration of fixations is thought to correspond to the lexical retrieval processes.

Reading paradigms also make use of larger texts. They reveal the typical pattern of reading, especially the range of the saccade that brings the eye to the beginning of the new line. The range increases with age; the younger readers often undershoot. Therefore, this paradigm can be used for developmental studies or as a help in diagnostics. The text can be varied in difficulty or some graphical features.

The second way of exploring language processing with the eye-tracker is the "listening paradigm". It is based on the "eye-mind hypothesis" stating that the eye looks at what the mind processes at that moment. The simplest question that can be answered using this paradigm is the question of the reference: what is a reference of some linguistic unit. In one such study we explored the reference of a pronoun in a sentence preceded by a sentence with two characters doing something. In this respect Croatian is particularly interesting being a pro-drop language.

If a reference is not available at a certain point in a sentence (e.g. when a verb is encountered by the listener) the gaze goes to the next available referent; in this case we talk about the anticipatory gaze. We have studied anticipatory gaze as representing the build up of a syntactic structure ahead of what is heard at a certain point. A comparison between children with typical language development and children with Specific Language Impairment (SLI) shows much lesser reliance on the syntactic information in the SLI group.

In short, a number of different paradigms that are available for the eye-tracking allow for language processing studies that are simple to perform, but offer a number of new dependent variables.

Phenomenology of thoughts

Urban Kordes
University of Ljubljana

Thoughts are among most common modalities of experience and yet, they are poorly researched. Cognitive science's recent "discovery" of default mode networks and mind wandering has rekindled interdisciplinary interest in this area. Lecture will present recent phenomenological insights as well as some pending questions concerning thoughts, thinking, communication and (only very briefly) language.

Some most common and most interesting modalities of experience of thoughts will be presented (no, we don't all experience thinking the same way!) and some pressing questions raised: Are thoughts one distinct class of phenomena or is it just a folk psychology term for a spectrum of very different experiences? Do we necessarily think in language?

The lecture will conclude with an attempt to connect phenomenological insights with other areas of cognitive science, mostly neuroscience and education.

Talks

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Adaptive Gesture Recognition System, transforming Dance Performance into Music

Evaldas Jablonskis
University of Vienna

Introduction

Gesture recognition is an attractive, but still scarcely researched area of artificial intelligence. It is relatively easy to track a human body and detect gestures, but the complexity of it's processing is comparable to voice or handwriting recognition. Dance consists of many sophisticated rhythmically repeating gestures. The recognition of dance gestures would open wonderful possibilities for human-computer interaction, art performance, and training in creative skills or therapy. This thesis is going to apply the recognition of dance gestures to music performance. The music shall be created based on dancer movements, reversing the traditional music-dancer interaction.

The gesture recognition system has to work intuitively, enabling real-time interaction with a dance performer, so that both could adapt to each other fluently. Therefore, the thesis will use the tools of artificial intelligence (adaptive machine learning algorithms), the knowledge of cognitive science (embodied cognition, connectionism) and psychology (multi-sensory perception, recognition memory). Artificial neural network, inspired by neuroscience, is one of the classification algorithms to be tested for gesture recognition [3].

Methods

The gesture recognition system should have this processing chain [1]: Input, Feature Extraction, Segmentation, Classification, Post-processing, Output. The thesis should answer the following questions:

Input. What is the best way to get the signal from Microsoft Kinect device, informing about the position of the body parts? There is a choice of several drivers and software applications able to do it, but non of them are perfect. Microsoft Kinect SDK will be used if possible, because it's officially released for Kinect device and will be supported in the future by Microsoft.

Feature extraction. Should the dimensionality of the data or the number of samples be reduced? What kind of features should be extracted, if used instead of the raw data - the coordinates and the rotation of the skeleton joints? Different machine learning algorithms - e.g. Vector Quantization, Principal Component Analysis, Symbolic Aggregate Approximation, K-means Clustering - require different data formats to process [2]. Vector Quantization algorithm will be used to reduce the number of samples.

Segmentation. How the system will identify the beginning and the end of a continuous gesture? There are several ways to segment a gesture: Trigger Keys, sliding Window, Activity Detection, Musical Segmentation Cues. The system also could "trim" a gesture by (1) rhythm - on every beat or every 4th beat, or by (2) repetition - when the gesture closes in the loop. The simplest way to segment a gesture seems to be "trimming" a gesture by the rhythm.

Classification. How the gestures should be assigned, remembered and recognized? There are several machine learning algorithms, usually (and claimed to be successfully) used for gesture recognition: Hidden Markov Models, Artificial Neural Networks, Support Vector Machines, Dynamic Time Warping, State Machines, Particle Filters, K-nearest Neighbor Classification. The algorithm has to be multi-class (recognize several gestures), adaptive (learn recent gestures), real-time (for live performance) and require short training. Dynamic Time Warping is the simplest (thus the fastest) algorithm for recognition of rhythmic gestures. Hidden Markov Models, Support Vector Machines and Artificial Neural Networks will also be tested.

Post-processing. How the system could assist a dancer to make a better music? The system should observe the music being performed and start the right tracks in the right time. Output. How the music tracks should be triggered? Music creation software (like Ableton Live) will be used, which would get the signal from the system.

Expected results:

The gesture recognition system is still under development. The success depends on the expectations, that: a gesture in the continuous movement of a dancer can be identified "trimming" it by the rhythm (e.g. every 4 beat); there is a recognition algorithm, which would require few training examples to train the model to recognize a gesture, short time to analyze and recognize a new gesture, to update it's model later (at the recognition mode) with recently observed and recognized examples; human dancer is capable to adjust to the recognition system and change the movement pattern so that the system has enough time to recognize new gestures and trigger new music tracks in time (at the right rhythm-point). I anticipate, that: arithmetical algorithms (like Dynamic Time Warping) will be more efficient than "brain-like" algorithms (like Artificial Neural Network); adaptive algorithm (learning recent, already recognized gestures) will make shorter or even eliminate training phase; a human dancer will be able to quickly adopt the system for music performance, if he/she gets informative auditory and visual feedback; the music performance can be improved, if the system is able to predict dancer's future gestures.

Discussion

My personal interest writing this thesis is to learn to use machine learning algorithms for human-computer interaction. The ultimate goal, which exceeds the scope of the thesis, is to build an application, which would seamlessly recognize dancer's movements and transform it into music - without any training and with little effort of a human dancer. This thesis should be the foundation to implement this goal.

After the thesis, the following questions have to be answered: are there better way to "trim" gestures from continuous movement in the gesture segmentation stage (e.g. it could be done by repetition - when the gesture closes in the loop)? Could there be a gesture prediction stage, when the system starts playing a music track at the beginning of the new gesture to avoid lag (e.g. the last moments of the last gesture could indicate the intention to start a new gesture)?

The developed system could be applied by researchers of human perception (e.g. how multi-sensory perception is organized, how embodied cognition helps to learn and adapt), researchers and developers of human-computer interaction systems (e.g. how full body tracking enhances AI agent's ability to understand and predict human's actions), developers of video games (e.g. for party entertainment), art and music performers (e.g. for realtime creation of visuals and sounds).

[1] Gillian N.E. (2011) Gesture Recognition for Music Computer Interaction. PhD thesis, Faculty of Arts, Queen's University Belfast.
[2] Kiran M., Chan Ch.S., Lai W.K. et al. (2010) A Comparison of Posture Recognition Using Supervised and Unsupervised Learning Algorithms. Proceedings 24th European Conference on Modelling and Simulation (editors: Bargiela A. et al.) ISBN: 978-0-9564944-0-5
[3] Maung T.H.H. (2009) Real-Time Hand Tracking and Gesture Recognition System Using Neural Networks. World Academy of Science, Engineering and Technology 50.

Cognitive Aspects of Designing Rule Based Dialogue Guidance in Educational Mathematical Assistant

Gabriella Daroczy
University of Vienna

The following thesis tries to relate the potential of an upcoming new generation of Theory-Prover based educational mathematics assistants with the potential of cognitive science, and also to meet the challenge to design a cognitive-friendly learning environment/dialogue system that is compatible with how the human mind actually works. The focus of the development is on a concrete case: simplification fraction in algebra.

We work with the education software ISAC, an educational mathematics assistant based on Lucas-Interpretation (LIP). LIP supports step-wise solving mathematics problems in science and technology by "next-step-guidance" (NSG),where the system can provide the next step. This is a novel technology developed at TU Graz and RISC Linz, indicates potential to proceed from reactive to active systems. Reactive systems are: Mechanized mathematics assistants (MMAs), Computer Algebra Systems (CAS) and Dynamic Geometry Systems: where the user provides input, and the system reacts with an output. This kind of behavior carried over to educational MMAs so far. Active systems provide more possibility for interaction with the computer. Designing the dialogue system based on cognitive aspects is a complex task, there are questions and aspects to be taken into consideration: how to provide individual answers (in a face-to face human teaching process, the teacher is able to provide individual answers for different students), how to deal with the social aspect of learning. The goal of the dialogue system is not to solve the mathematical task in the dialogue process, but guide the learner through the learning process, supporting individual learning strategies with showing strategies, hints, patterns.

To build a dialogue system first we have to identify the human way of thinking, the innate processes in mathematics, and try to answer how could we support the mathematical learning process in a computer based education scenario, like in the next-step-guidance system, ISAC. Understanding the thinking involved in the learning and doing mathematics, especially understanding abstraction is a key aspect to build education software.

Cognitive science is relatively new in the field of mathematics education. It claims, that mathematics is a stable product of adaptive human activities, developed through centuries, largely happening at unconsciouses level. Human, as also animals share some innate arithmetic, for example comparing small numbers, and many ideas are theoratized to be metaphoric (Nunez, 2010). However, mathematics is a human-made system based on our biological and bodily experiences, the ability to switch between different abstractions, and representations seems to be key in the learning process. Because of the above reasons, while designing the dialogue-system we focus on the followings: supporting individual learning and multiple representations, mathematics is fallible, and learning happens through trials and errors. The second part of the thesis deals with the concrete implementation of the dialogue system. The goal of this part is to find out if working with pre-defined error patterns is supported by the computer software ISAC, and if using them helps the learning learning process.

However, connected to misconceptions the notion of error patterns is not new in mathematical education, we define them only as typical sets of errors, using for different system responses.

Providing solution strategies, or hints to solve the problem, and also presenting parts of the next step to the learner is a also new insight. Mathematics is partly cultural, and influenced by the language, supporting individual way of thinking with multiple strategies (in our concrete case with reacting on error patterns, giving hints) is a very important point, because each learner has a different knowledge level, and different experiences. We try to support individual way of thinking with

multiple strategies by accepting all correct answers to the step in the problem class. Learners possess different knowledge level, this is supported for all steps in calculations within a selected problem class. For example fraction belong to algebra, and are number made up of other numbers. Simplifying fraction might be a difficult problem for the learners, and can have different representations: division, proportion, simple number. Secondly we try to support, that human cognitive system, and also mathematics knowledge is fallible and learning happens partly through trials and errors, also by patterns, with responding group of predefined error patterns. Open question of the thesis is how we can support the bodily based learning process.

As an implication cognitive science successfully derives practical advice for the design of learning scenarios, also for mathematics, and also plays a prominent role in the design of educational software. Later, based on this work, it would be also possible to create user-models, and develop a more effective dialogue system between learner and computer. Developing and designing the concrete dialogue system in ISAC involves computer science and rule based-system, focusing on interdisciplinary aspect, connecting human cognition with concrete computer application in a real time human-computer interaction. However, realizing embodiment is the question of future, using a computer software in education just enables the possibility to response at individual learning strategies.

[1] Alan Krempler and Walther Neuper. Formative assessment for user guidance in single stepping systems. In Michael E. Aucher, editor, Interactive Compute Aided Learning, Proceedings of ICL08, Villach, Austria, 2008.
[2] Juhani Tuovinen John Sweller Slava Kalyuga, Paul Chandler. When problem solving is superior to studying worked examples. Journal of Educational Psychology,93(3):579–588, 2001.
[3] Núñez R. (2007). The Cognitive Science of Mathematics: Why is it relevant for Mathematics Education? In R. Lesh, E. Hamilton, & J. Kaput (Eds.), Foundations for the Future in Mathematics Education (pp. 127-154). Mahwah, NJ: Lawrence Erlbaum Associates.

Approaching user experience: moving between abstract and in-depth

Michael Glanznig

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In Human-Computer Interaction (HCI), the focus has been traditionally on performance and functionality, called usability. Only recently the concept of user satisfaction has been brought from a mere addition to usability into the centre of the focus. It has been transformed into the notion of user experience, which comprises more than user satisfaction. This opened up a new strand of HCI research. This strand is not well defined yet and under rapid development. Despite discussions whether user experience encloses usability or vice versa ("old wine in new bottles") or criticising engineering as still clinging to functionalism there is also a vivid discussion in progress how to approach the design for or the evaluation of user experience. Or to put it differently, how the phenomenon should be researched. There are at least two approaches that are competing and are viewed by their proponents as more or less opposing. One philosophy of thought is based on cognitive psychology and tries to model (abstract) user experience. The other one is based on phenomenology and ethnography and uses descriptive and dialogical (in-depth) methods. Although some (e.g. [3]) emphasize the need for a unified view in researching user experience there is no method yet that would provide such a view. The question remains open if it would be desirable to have one.

In the abstract approach considered here Marc Hassenzahl [2] uses James Russell's account on emotional experience, hierarchical goals and related action theories to develop his own model of user experience, which allows the classification of product attributes on a hedonic (emotional) and pragmatic (task-oriented) dimension. For his account Hassenzahl stays heavily grounded in psychological research and its methods while also hinting at a possible extension with in-depth approaches. In their (competing) in-depth approach Peter Wright and John McCarthy [1] use John Dewey's pragmatist philosophy of experience and Mikhail Bakhtin's account of dialogue as grounding to develop their approach towards experience centred design, which emphasizes rich descriptions and dialogue between users and designers. Both accounts start from the same premise. That is, it is not enough to focus on performance only. This is basically what usability did so far. Furthermore, user experience is not very different from experience in general. Admittedly, this is not so difficult to agree on. Then they go on and develop quite different approaches, although there is overlap. On its own each method has issues in terms of applicability, validity and reliability. For example, the in-depth approach is hard to grasp and difficult to use in practice. There are problems with repeating studies and experiments and generalizing results or in other words, problems with reliability. On the other hand, the abstract approach tries to model user experience and can therefore be questioned in terms of validity or if the phenomenon is correctly measured.

The aim of this thesis is to use two methods, abstract and in-depth, to evaluate user experience for a specific interactive technology (a web based real estate search engine). The results of this evaluation study are to be discussed and compared from methodological, epistemological and application viewpoints. Sometimes both philosophies of thought are already implicitly and in parts used together in the design process. Despite that, I am not aware of a review on complementary use of the two approaches. I believe that it is possible to use both together, the level and degree of possible overlap has to be explicated. Both approaches could complement each other in such a way that the individual weaknesses are covered. In other words, does the combination of both approaches add additional value to the evaluation compared to the usage of only one? However, one has to be careful here. It is not clear if a combined method is fruitful, that means if it is beneficial and practical. In addition, there are also some epistemological problems. Two different bodies of knowledge are used together, so one has to be careful which conclusions to draw from this combined use. Furthermore, both philosophies of thought are characterized by a certain attitude or position towards doing science. Here the question is if this attitude is inherent in the method or if the methods can be used together with the same attitude.

The specific methodology for the evaluation study has still to be devised. It will consist of experience sampling, interviews and questionnaires. Participants have to be selected carefully. They should be interested in the product (e.g. are searching for a flat). Preferably, there will be no fixed tasks that have to be carried out by participants, but that depends on the available functionality of the prototype. For the abstract approach participants will have several encounters with the system and afterwards have to fill out a questionnaire (e.g. AttrakDiff), which is also able to capture evolving user experience. In the in-depth method participants will be able to provide ethnographic data through a modified experience sampling method and their user experience will be explicated through consecutive interviews, which also captures evolving user experience and in addition allows for a deeper level of involvement with the system. Important expected results are how feasible and time consuming the chosen methodology is in practice and which type of data or which findings are most helpful and insightful for the stakeholders of the project. Regarding epistemological implications there will be certainly findings about the type of knowledge that is generated by each approach and how these two types can be integrated with each other.

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In the quest of assessing legal and moral responsibility: A cognitive science perspective

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Motto: Actus non facit reum nisi mens sit rea (i.e. the act does not make a person guilty unless the mind is also guilty)

During my studies in law I was often reminded that "jus est ars boni et aequi" (i.e. law is the art of what is good and fair). Unfortunately, many examples from all around the world show that this is not always the case. Because of the irreparable consequences that an unfair sentencing can generate for an individual, law has to end being only an "ars" and become a proper "scientia" that uses scientific and reliable tools. Therefore, in the quest of assessing the legal and moral responsibility of an individual, cognitive science methods and tools, if used correctly and in a reliable way, can be of invaluable significance. The current legal systems rely on the retributive premise, which implies that people freely choose their actions and should be punished accordingly. However, recent research shows that this position opposes the growing neuroscience evidence according to which moral actions are premeditated by structural features of the brain that are determined [1]. Because of this aspect, a great number of questions has been raised in the scientific, philosophical and legal community regarding the degree to which individuals can or should be held responsible for their actions.

In the last three decades, due to new developments in neuroscientific methods (fMRI, PET, MRI etc.) cognitive scientists and neurologists have brought up a series of scientific issues which have been perceived as challenging the existence of free agency in five of its dimensions: initiation of action, intention, decision, inhibition and control as well as phenomenology of agency [2]. One of the first studies, which claimed that individuals may not possess free will, originates in the experiment performed in 1983 by Libet, who argued that the brain decides to initiate an action at a time before there is a subjective awareness that a decision has taken place [3]. In 1999 Wagner added that the real causes of human actions are unconscious and therefore it would not be surprising that decisions may arise before an individual is actually conscious about them [4]. This series of claims was sufficient to stir the scientific community and consequently, in 2011 Haynes, claimed that human intentions can be predicted. He showed that the information that aided the prediction of the intention was available 5-7 seconds before the decision was made and was accurate up to 60% [5]. These empirical studies gave rise to some major concerns. The most serious implication is that without free agency there would be no longer a fundamental basis for moral responsibility or legal culpability, i.e. no one would deserve punishment for breaking the law or blame for immoral behaviour. Since on a conceptual level free agency is the ultimate condition for moral and legal responsibility, a no-free-will attitude presupposes the change of the entire basis of legal systems. But are there enough reasons for this shift to take place?

The objective of the present study is to analyse in an interdisciplinary manner (neuroscience, cognitive psychology, philosophy of science and philosophy of law) the way the neuroscientific developments in the field of free agency interact with law and their potential effects on the legal systems. The study addresses theoretically and empirically two major questions. Firstly, it aims to establish whether there is at present sufficient scientific research to support the idea that free agency has been challenged by the advancements in neuroscience and secondly, by recurring to legal professionals' intuitions, to answer some subsequent questions regarding the degree of responsibility of individuals suffering from brain malfunctions. To what degree can one affirm that their brain processes stand behind their decisions? Are the neuroscientific methods reliable enough to show this aspect?

By accepting that our brain features are determined, one may envisage that individuals cannot be held responsible as they cannot control something that is predetermined. In

this light, since all behaviour is caused by the brain, it can be potentially excused. This may be a way to look at things, but is it in fact the desirable one? My hypothesis is that the new advancements in neuroscience have not affected the general view of free agency, but have only increased our understanding about neural networks and generated a more mechanistic view on free agency. Furthermore, despite the promoted deterministic view, humans are still free agents and therefore, the fundamental criterion for the ascription of responsibility should be the individuals' general capacity for rationality. Assuming that philosophical determinism (which is not to be confused with mechanism) poses a theoretical threat to free agency, concurrently, compatibilism (according to which free agency and determinism can coexist without being logically inconsistent) provides a satisfactory account for responsibility and hence for the stability of legal systems. Since I believe that compatibilism might represent a way out in this long debate, my intention is to support this claim with the results of an empirical study meant to examine the intuitions of legal practitioners regarding the way free agency is supposed to have been challenged by neuroscientific advances.

The empirical study targets legal practitioners (lawyers, judges and prosecutors) from different countries in Europe. The method used is a questionnaire, which comprises two parts that assess the consistency between the general beliefs of the participants and the way they use (or not) these beliefs in practice when determining the legal and moral responsibility of individuals. In the first part, the participants have to evaluate a series of statements, which measure their general attitude towards science, their views on religious, biological, environmental and social determinism, as well as the interaction between brain/mind and age, on one side, and free agency on the other side. In the second part, the participants are presented with five neuro-legal cases in which they assess the responsibility of the defendant, determine the treatment or type of punishment, which is to be applied to the defendant and, if applicable, decide on the duration of imprisonment in years that the defendant should receive. These cases are meant to test the trust, which the legal practitioners put in neuroscientific discoveries and the extent to which they are willing to admit them as evidence when assessing legal and moral responsibility.

Since the study is currently in progress, the results are only partial and will be available only at a later stage. However, my expectations are that this empirical study will support the thesis of the paper, according to which the majority of legal practitioners hold a compatibilist view, which reconciles the idea that some of our brain functions may be determined with the acknowledgement that humans have the capacity to choose a course of action from various alternatives. I also expect that, because of the remaining gap between science and law, legal practitioners are not yet prepared or maybe convinced enough of the necessity to accommodate some of the tools provided by cognitive science in the legal practice. The study has a wide spectrum of application as it is addressed to both cognitive scientists and legal practitioners. The theoretical parts support the idea that scientists have to find a way to make their discoveries acknowledged while making sure that the information they disseminate to the public is completely valid and accurate. At the same time, the study urges the legal practitioners to consider reforming legal systems in a way more person-oriented rather than punishment-oriented while using the existing neuroscientific tools in a way that would "humanize" the legal systems and not as a means to create differences and extreme positions like arbitrary incrimination or full exoneration on the premise such as "my brain made me do it".

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Interaction of emotion processing and olfactory perception

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For a long time, the scientific community looked at human's olfaction as a rudimentary sense, which has no significant influence on everyday living and decision making. At least since Linda Buck and Richard Axel identified first 18 members of the olfactory receptor gene family (the biggest one in human genome) is the importance of olfaction for humans no more deniable. The olfactory system is unique among sensory systems in communicating directly with the cerebral cortex without first relaying in the thalamus, although reciprocal relays do exist via the dorsomedial nucleus of the thalamus between primary and secondary olfactory cortical structures. Functionally, odor intensity is associated with amygdala activation. Phylogenetically, the medial amygdala is the older one and evolved from the olfactory system to extend its threat-detection capability to other sensory modalities [LeDoux 2007].

The main dimension of a multidimensional odor experience is valence and, thus, is likely to influence mood such as pleasant odors tend to induce positive moods, whereas unpleasant odors tend to induce negative moods. Odors produce effects on cognition and behavior that are similar to those produced by emotional stimuli. Odors can provoke changes in physiological parameters, such as heart rate or skin conductance, which are directly involved in the emotional response. These effects are usually interpreted as an interdependence of olfaction and emotion on overlapping neural systems [Chrea et al. 2009].

The influence of implicit emotions processing on the intensity, the next dimension of an odor, was also confirmed with the results of the behavioral study. 189 students of medicine (133 females age range 19–29 years, mean 22.6 years, 56 males age range 19–26 years, mean 22.3 years) participated in the study. The objective of the study was to find out how processing of implicit emotions modulate the perception of intensity of an odor. I proposed that activations of amygdala via audiovisual stimuli should correlate with subjective growing of perceived intensity of an odor probe, which was still of the same concentration. The results showed a significant evidence of emotions processing influence on subjectively perceived intensity of an odor, suggesting that activation of amygdala correlates with increasing perception of intensity of an odor. The neural representation of affective space into more primary intensity and higher-order valence components is compatible with the notion that the amygdala supports low-level (intensity) stimulus-driven processing. These findings dovetail nicely with appraisal theories of human emotions, which emphasize that affective responses are not a simple reflection of the intrinsic quality (positive or negative) of a stimulus, but rather result from interactions among the person, the situational context and the stimulus [Lazarus 1991]. An idealized computational component model of appraisal theory of emotions, which formalizes this theory, was used to show how an odor theoretically fits into this concept. This concept will be useful for a cognitive agent with implemented E-nose (artificial neural network coupled with artificial chemosensors).

Because of the multidimensionality (valence, intensity, familiarity etc) and endless number of odors perceivable by humans, the definition of an odor is still unclear. I am using psychological experimental methods (behavioral study) and neuroscientific findings of functional physiology of the brain to show that common way, how the scientific community look at emotions can be a way how to look at olfaction. Conversely studing of olfaction processing is beneficial for better understanding of emotions processing.

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Evolution of movement control of a mobile robot in an unknown environment

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The research into mobile robotics has been receiving more and more attention recently. To study various approaches to control, cognitive science uses various methods. A lot of effort is put into the development of autonomous intelligent behavior for robots, especially for use in an unknown environment (Kala et al., 2009). The goal of this work is the implementation of a learning mechanism for a mobile robot based on a mix of a genetic algorithm and reinforcement learning, which can based on sensor data, enable the movement of a robot in an unknown environment. The advantage of this system is that it enables the autonomous definition of its behavior. A simulation environment was created for this system in which a virtual robot can move. This model is based on an actual existing prototype. The project uses machine nature-inspired algorithms that equip the agent with a very important ability - the ability to learn (Engelbrecht, 2007). This creates a significant need to motivate the mechanism, from which we require certain knowledge, correctly. In the theoretical part we provide a walkthrough through some related work as well as used methods. The designed learning mechanism was successfully implemented in a simulated model and in the end we successfully used it in a real world environment. We are thinking that, psychologists may find inspiration in the LCS model that is using a kind of analogy making based on evolutionary principles to form new strategies and behavior policies. And also, engineers may find interest in using the unconventional nature-inspired algorithm for robot control. For mobile robot navigation we are using Learning Classifier System (LCS). "The Learning Classifier System algorithm is both an instance of an Evolutionary Algorithm from the field of Evolutionary Computation and an instance of a Reinforcement Learning algorithm from Machine Learning" (Brownlee, 2011). There are many different types of LCS. The two main approaches to implementing and investigating the system empirically are the Pittsburgh-style and the Michigan-style. Our robot is using XCS (accuracy-based classifier system) version of Michigan-style Learning Classifier. In this work we have analyzed real and simulated environments from the point of view of carrying out our experiments in the area of cognitive robotics. We have decided to implement our first experiments in simulation environment. Due to our interest to implement XCS algorithms to the real mobile robot, it's essential to use real simulation environment and save certain kind of similarity between simulation and the real environment. Commercial or free simulators are on the high level, but also they have some disadvantages which, in our case, cause we cannot use them for this purpose. Due to this reason our own simulator has been created, which genuinely emulates real mobile robot with given attributes.Simulator with LCS is application for the robot simulation, its movements in certain area, among obstacles such as triangle, square and circle. It is possible to control robot automatically (LCS) or manually. In the users part of simulator the eight values of distance sensors and actual position of the center of mass of robot are displayed. Further, it is possible to set multiple attributes of the robot such as speed, diameter of motion round the circle, safety mode, reward for the distance from the goal, sanction for unsuitable actions, adding obstacles, delete them or move them. The designed algorithm allowed a real robot to learn to navigate in an unknown environment, learn the principles of collision avoidance and it exhibits significant learning properties. We conclude that the used algorithm is appropriate for this type of task.

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Double effect of curiosity deficiency on memory impairment with patients suffering from dementia syndrome

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Introduction
The number of people suffering from dementia syndrome is likely to double every 20 years, thus leading to over 80 million diagnosed people by 2040. Memory impairment is one of the main deteriorations within this syndrome and curiosity might have double effect on it Based on available studies and theories I tried to clarify possible double effect of curiosity on dementia progression. Better understanding of relation between curiosity and dementia progression could serve as a promising ground for further development and implementation of available treatments for patients suffering from dementia syndrome.

Background
Curiosity is not merely the desire to learn new information, but can also be described with concepts like exploratory behavior, sensation seeking or motive force to order reality. Curiosity can also be presented as natural human tendency to make sense of the world or as motivation to master one's environment (Byman, 2005). Low curiosity can, according to this view, hinder the desire to understand and manage the intrinsic and external set of stimuli that influence one's life. Concepts like curiosity, motivation and interest overlap in several characteristics, and all originate in the same system, which is the basic motor for the individual energy to act (Hari and Kujala, 2009). Though they differ to some extent in their behavioral expressions it is hard to make clear distinction between them, which makes it even harder to differentiate among their consequences. Dementia syndrome can be characterized as decline in memory functioning, accompanied with impairment in at least one other cognitive ability. A number of studies investigated the effect of curiosity on learning and memory performance with population of children, adolescents and young adults, however not much in this field has been done with population of older adults. Additionally, numerous studies showed correlation between dementia progression, specially memory impairment, and depression or apathy. Depression and apathy are very common symptoms appearing in dementia and differentiation between both is not a simple one, though we can see difference in some behavioral expressions and involvement of different dopaminergic agents. Several reports have been made on pharmacological treatments being appropriate for depression treatment, but having opposite impact on the presence of apathy, and vice versa (Tagariello et al., 2009). Additionally can depression be seen as one of the risk factors for dementia and has reciprocal effect with dementia progression, both in the domain of speed and the volume of the impairment (Korczyn and Halperin, 2009).

Model
In my model I dissected influence of curiosity on dementia progression into two effects – first is direct impact through learning and second mediated by emotions.
1. Causal effect – curiosity & learning
Desire to learn and know has strong influence on our learning process and thus on memory functioning. Information-gap theory claims that the main point of curiosity is the desire to fulfil the gap between what one knows and wishes to know, hence the higher is curiosity, stronger is the desire to reduce the discrepancy in information gap of our knowledge and learn something new. Cognitive process theory of curiosity gives emphasis on the process of creating, maintaining and resolving conceptual conflicts in order to master one's category system (Byman, 2005). Maintaining information means understanding and remembering it, hence involving our memory system. High curiosity and interest can generate positive effect, which results in facilitation of knowledge acquisition and cognitive performance. Lack of curiosity decreases the desire to learn and explore, hence influences our memory functioning and increases the progression of memory impairment.
2. Causal effect – curiosity & emotions
Loss of interest is one of the basic symptoms of depression. One of the theories proposed interest to be a motivational variable that links affective and cognitive component of

motivation. To develop the idea further, we can use Beswick's concept of intrinsic motivation as a synonym for curiosity and hence the correlation of loss of interest, motivation and curiosity to the depression (Byman, 2005). To continue we can define apathy as "lack of motivation not attributable to decreased level of consciousness, cognitive impairment and emotional distress" and can dissect it into three main components – behavioral, cognitive and emotional, with all three components having strong effect on performance of our memory system (Tate and Unit, 2009). Low or even absent state of curiosity, interest or motivation can lead to negative emotional states (i.e. depression or apathy) which further accelerate the progression of dementia.

Discussion

Number of studies has been done in the field of brain plasticity, showing evidence on efficient recruitment of particular brain regions. Several studies claimed similar effect with dementia patients, therefore further development of cognitive treatments and therapies could lead dementia patients to effectively activate compensation mechanisms in our brain. Because the majority of researches in the field of curiosity have been done with young population I believe some further studies with adults are needed to reveal the full potential this construct has on our performance even in an adult life. With better understanding of correlations between curiosity, memory, emotions and dementia progression we could use curiosity as a trigger to stimulate usage of our memory system and improve our emotional states, which coul slow down the progression of dementia.

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Language and Perception: The impact of congestion language modality for differentiating relational categories

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Introduction

Language has a very essential role in human cognition. Numerous studies refer to its necessity for certain types of cognitive tasks. These tasks can be various – combining information of different types (Hermer-Vazquez, Spelke, & Katsnelson, 1999), sorting objects by one specific property (Lupyan, 2009) or thinking about minds of others (Newton & de Villiers, 2007).

We are interested in the role of language in categorization of visual stimuli. Although many organisms are capable of categorizing input on the perceptual or associative basis without any use of language, higher order relational and analogical categorization may require encoding into other modality – association with verbal label (Zentall et al., 2008).

Previous studies

Young & Wasserman (1997) studied relational category formation in pigeons. They showed them arrays of 16 icons that were either "same" or "different". The task of pigeons was to make a distinction between these two states. Pigeons achieved high level of discrimination and generalization. However, when presented with mixed or reduced input, pigeons answered according to perceptual variability of the input array (e.g. there were just 2 different icons in the array and pigeons repeatedly chose option "same"). On the other hand, human intuitive answer would be to treat the arrays categorically based on theory: They are either "same" or "different". In order to do this, the animal has to be able to judge the relations between the icons.

This phenomenon can be explained by the Shannon's Information theory (Shannon, 1948). This theory understands the diversity of categorical variable - the entropy - as a number of information bits that are necessary to identify each item. It means that 16 identical items have entropy of 0.0 bits, because there is no variability and 16 different items have entropy of 4.0 bits because there are 16 different categories. The entropy decreases in mixed or reduced arrays. These are arrays with mixed icons (e.g. 4 same icons and 12 different icons) or arrays with less than 16 icons. E.g., just two different items in one array have entropy 1.0, which is closer to entropy 0.0 than 4.0. In this case, pigeons discriminate two different icons as "same".

Young & Wasserman (2001) later ran a similar study on human subjects. They found out that there were two distinctive clusters of subjects in their behavior.
• 80% of subjects treated the arrays categorically (as either "same" or "different") while
• 20% of the subjects behaved similarly to the perceptually based answers of pigeons. One of the proposed explanations is that "the categorical discrimination may have been mediated by the use of previously learned linguistic labels for the displays" (Young & Wasserman, 2001).

Our study

We were inspired by Young & Wasserman's experiment and created a similar experiment by using a web application. We focused on several research questions and splitted our project to two parts:
1. In the first part, we replicated the original experiment of Young & Wasserman (2001) with human subjects. We expected 20% subjects will not treat the arrays categorically, but according to perceptual variability.
2. In the second part, we tested the hypothesis that verbal labels might facilitated categorical discrimination by replicating the experiment using verbal shadowing (used in studies such as Hermer-Vazquez et.al, 1999) as a secondary task to impair immediate performance of phonological loop. We expected that overloading the verbal modality could shift the distribution of clusters towards perceptually based discrimination.

Procedure

Both parts use the same web application. The application consists from two parts: training

and testing. The training period comprised 50 trials and participants learned to determinate „same" or „different" 16 icons arrays. After the 50 training trials, the testing period began. The session continued withou noticeable change, but testing arrays (reduced and mixture) were randomly interspersed among the training arrays at a relatively low rate. In part two of our experiment (part with verbal shadowing) subject will have to listen to some text, repeat it word by word while performing the original task.

Results

In our research successfully participated 119 respondents with the average age of 24 years. In first part of experiment (without verbal shadowing) were 73 subjects and 46 subjects were in part with verbal shadowing. In first part we successfully replicated original experiment, but we obtained different results (by comparison with original experiment). In second part our results show that verbal repetition has no significant impact on respondents capability of distinctive categorization, but has a direct effect on the reaction time needed for decision making. Our hypothesis has not been proven, but our study has some cognitive benefits. However, experiment should be repeated to confirm our claim.

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The power of placebo

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Introduction
Placebo effect has been most often studied within the context of patient population or used as the control condition in studies of treatment efficacy. In the recent years it has been repeatedly shown that many of these placebo conditions are actually physiologically different from the no treatment condition, revealing therapeutic effects in treatment of pain, Parkinson's Disease and Alzheimer [1] . " The study of the placebo effect, at its core, is the study of how the context of beliefs and values shape brain processes related to perception and emotion and, ultimately, mental and physical health." Benedetti et al state on this very interdisciplinary field of research [2]. The present ongoing study, inspired by the study design used by Pollo et al. in 2008 [3] aims to improve current understanding of placebo effect mechanisms in healthy population. To do so, we chose a combined interdisciplinary approach by analyzing changes in 3rd person perspective measures of physical and cognitive performance induced by the expectation of the subjects. Preliminary and partial data are summed up here.

Methods
University students (n=25; age 21.7 ± 2.3) of both genders (F/M=1,1) signed the informed consent to participate in a study employing short tests of physical (maximal hand grip force, maximal leg extension work performed in 1 minute) and cognitive (three-stimuli auditory oddball test with silent counting) performance. Subjects scheduled two experimental sessions at least three days apart at the same time of day. During each visit two measurement runs were separated by a brief intermission during which an effervescent tablet of vitamin C dissolved in water was administered and announced either as "a stimulant" or a "control" beverage. Subjects were told that stimulant effects vary with individual susceptibility and might be accompanied by a transient calorigenic effect. During the session EEG, EMG of hand flexors and ECG recordings were collected in a computer aided ePrime task paradigm. Perceived test difficulty and presence/intensity of side effect were also recorded.

Hypothesis
Placebo and control sessions of the same participants are expected do differ significantly both in physiological and cognitive measures. In detail, we hypothesize that:

1. There is an improved performance in both hand grip and leg workout in the placebo condition

2. The EEG P300 event related potential component in the placebo condition varies significantly in latency and amplitude from the control condition

3. The physiological measures EMG and ECG also vary significantly from each other within the subjects in both conditions, further supporting the induced physiological difference.

Results
Preliminary results showed significant effect of enhancement expectation on total leg workout (p=0.0011) but not on maximal handgrip force (p=0.236), revealing an objectively measured placebo effect on motivation dependent performance endurance but not core muscle strength.
The cognitive results are still in analysis

Discussion and Future outlook
Obviously, the preliminary results vary in significance and hence raise the question how there can be an expectation effect in leg workout but not in hand grip performance. The answer to that remains still unclear. A possible explanation could be the nature of the tasks. Leg workout might be more affected for being also related to endurance whereas the maximum isometric force in handgrip could be less affected by the individual motivation of the subjects.
Results of EEG EKG and EMG analysis will present additional insight into possible mediating mechanisms of the measured effect, also for the first time into the cognitive domain.

There is plenty of possible applications for placebo, the former poor relation in clinical trials. Expectation effects increase treatment efficacy, be it with or without "active" drug components - sham treatments such as homeopathy, traditional chines medicine and acupuncture finally have received more neuroscientific justification. Pavlovian conditioning procedures can also be used to increase effectiveness of active drug components, stimulating a placebo co-response but also unconditioned expectation can lead to an increase of drug activity as Flaten et al already showed in 1999 with a muscle relaxant [4].

Finally, a personal application could be the method of autosuggestion, which also represents a tool for improving health and brain physiology.

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Listening to the multimodal orchestra of the senses: Vision inductively infers about real-world objects from haptic information

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During binocular rivalry each eye is presented different visual stimuli, resulting in a perceptual conflict situation. For instance, when an horizontal grid is presented to the one eye while the other eye sees a vertical grid, the consciousness will select stochastically either the one object or the other. As the time passes, the exclusive dominance will be challenged so that the other object gets selected, leading to an alternating dynamics of perceptual switches. This phenomenon has been used to study a multitude of psychophysical questions and to reveal the dynamics of visual cognition and the neural mechanisms of perception [1].

In cognitive science, recent development towards an embodied cognition view stresses a more action- and context-dependent perspective on the organization of perception. The notion here is that perception is primarly a process for the coordination of an organism's activity in the environment, which lead to the concept of perception-action-cycle. This approach is not only significant for biology, neuroscience and cognitive psychology, but also for the field of robotics and human-machine-interaction. Activities of primates, like grasping, jumping or exploring are well coordinated sensorimotor patterns which consist of perceptual coincidences from different sensory modalities which are taken to further compute proper actions. Thus, a well concerted, and bidirectional interplay is needed between the different sensory modalities and between the senses and the motor apparatus. Subsequently, the enactment of objects via sensorimotor contigencies objects rise to the emergence of concepts, for which there is evidence in higher cortical areas, like the inferotemporal cortex [1]. Due to Hebbian learning, objects with which we interacted should be present in a sensory crossmodal memory. As Beets et al. (2010) pointed out, directed action coordinates available sensory information into action serving percepts [2]. While their work pointed to an direct action-perception interdependence, this work investigates how multimodal conceptual information stabilizes rivalling visual percepts. Of significance in this human psychophysical study is that real-world objects will be used as visual and haptic stimuli which are common to everyday interactive experience. This contrasts the more abstract and schematic nature of stimuli of some previous investigations where bottom-up processing of multimodal stimulation was enforced instead of top-down object semantics [3, 4].

What happens with two competing percepts (e. g. tennis ball vs. cellphone) during binocular rivalry when one of those real-world objects has to be enacted interaction with hands? This question will be answered with two experimental approaches. During both experiments the perceptual switches will be reported verbally and physiologically with eye-tracking.

In the first session, the haptic object will be given to the subject prior to the binocular stimulation. Here it is hypothesized that touching and recognizing an object introduces priming and hence a strong expectation bias in the visual domain due to previous somatosensory semantic activation. This will lead to a very quick, clear displacement of the rivalry towards the corresponding visual object. The rivalling visual object will be neglected most of the time. In the second session, the haptic object will be reached after a subject receives the binocular input. Here is expected that additional haptic information resolves the sensory competition in favor of the touched object, because the concept gets activated in the visual domain. Einhäuser et al. (2008) showed that pupil diameter can serve as a objective measure for perceptual switches, whereby each new percept selection is accompanied by a pupil dilation [4]. The experimental approach will be conducted with a mirror stereoscope which will directly project two object images from two monitor displays. An eye tracker (EyeLink 1000) will be utilized to measure the pupil dilation dynamics and the eye movements respectively.

To describe the temporal development of the percept selections, the independent variables are pupil dilation, perceptual switch frequency and the duration of the percept stability. In both sessions, it is expected that the percept switching frequency will be lowered leading to longer intervals of percept stabilization.

In case the hypotheses are veryfied, the work would suggest that the multimodal object recognition leads to disregarding of available additional perceptual information which conflicts the already integrated visuo-haptic evidence. It would mean that concept activation can influence the processing of available perceptual information in a top-down fashion. Since the binocular percept suppression is an active process [1], this implies that in order to create perceptual reality, the brain-body-system operates with inductive inference based on relevant and sufficient, instead of fully available sensory evidence.

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The effect of the harmonic context on the perception of pitch class.

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It has been widely accepted, that context is important as to how we perceive things. This has been extensively studied especially trough visual perception research and often connected with visual illusions. However, scientific understanding of how context affects auditory perception is quite limited. The study will focus on whether perception of pitch class is context-dependent - that is, whether the perception of pitch class is affected by the harmonic context. Pitch consists of two components: pitch height, which defines a position of a tone on a continuum from high to low, and pitch class ("tone chroma"), that defines the position of a tone within an octave (Shepard, 1964). Pairs of tones that have the same pitch class form intervals of unison (pitch height is also the same) and octave. The fundamental frequencies of octave tones stand in a ratio of 2:1. Tones that have the same pitch class are standing in close spatial proximity (Shepard, 1964) and are judged as closely similar in musical context (Deutsch, 1982). Pitch recognition judgments in sequential settings have been found to be vulnerable to a variety of influences (Deutsch, 1982). It was shown that a harmonic and melodic context influences the perception of a pitch (Deutsch, 1974; Deutsch, 1982). In Western popular music a leading melody is generally accompanied with a harmonic context that contains common chord progressions. So far, very little research has been published on how different chord progressions influence perception of pitch class, which is the goal of the proposed study.

In the experiment, different sequential intervals (intervals that are formed from tones with the same pitch class and intervals that are formed from tones that differ in pitch class), consisting of a 1st and a 2nd probe tone, will be presented under two conditions: session A) without harmonic context, session B) with harmonic context. Subjects (20 musicians – academic level of training; 20 non-musicians – less than 2 years of formal training) will be asked to determine whether the first and second probe tones present the same pitch class or not. Reaction times and error rates will be measured.

Experiment s:A) Without harmonic context - baseline Stimuli will be presented in the following order: 1st probe tone, silence, 2nd probe tone. To reduce the number of possible combinations and to simplify the design of the study, the two probe tones will form the following two combinations: C-C, C-G. The first combination (C-C) is therefore formed from tones with the same pitch class, whereas the second combination (C-G) is formed from tones that differ in pitch class by a distance of a perfect fifth. Probe tone combinations are the same as the ones in session B, because this part of experiment will serve only as a baseline. B) With harmonic context Stimuli will be presented in the following order: 1st probe tone, silence, 1st probe tone accompanied by the 1st chord, silence, 2nd probe tone accompanied by the 2nd chord. In the same way as in session A the two probe tones will form the following combinations: C-C (the same pitch class), C-G (different pitch class). Chords accompanying probe tones will form all the combinations between chords where the tone C appears as a root, third or a fifth of the chord (C maj, Ab maj, F maj, C min, A min, F min) and chords where C and G tone appear as a root, third or fifth in the same chord (C maj, C min).

We expect that the context will highly affect the perception of the pitch class, as specified further on. 1. Error rates and reaction times will increase when the probe tones are presented with a harmonic context in comparison to cases where they are presented without harmonic context. 2. When two probe tones of the same pitch class are placed in a different harmonic context, error rates and reaction times will increase in comparison to when they are placed in the same harmonic context (based on Deutsch, 1982; Deutsch, 1974). 3. When two probe tones whose pitch classes are not the same (separated by a perfect fifth) are placed in the same harmonic context, error rates and reaction times will increase in comparison to when they are placed in a different harmonic context (based on Deutsch, 1982). 4. When two probe tones belonging to the same pitch class are placed in a different harmonic context, with one probe

tone accompanied by a major chord and the other by a minor chord, error rates and reaction times will increase in comparison to when both chords accompanying the probe tones are major or minor. 5. When the chords accompanying two probe tones whose pitch classes are not the same (separated by a perfect fifth) shift in parallel with them, so that the relationships between the probe tones and their accompanying chords are preserved, error rates and reaction times will increase in comparison to when the relationship between the tones is not preserved (based on Deutsch, 1974). In addition we expect that musicians will in general have shorter reaction times and will make fewer mistakes, and that the impact of the harmonic context will be less significant. The results of the research will provide a new understanding on how context affects our perception. Furthermore, the results can be applied to the music education, especially in the ear-training programs (interval recognition training when they are placed in a harmonic context).

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Empathy and Prosocial Behavior across the Lifespan.

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Considering empathy as a construct to account for a sense of similarity in feelings experienced by the self and the other (shared representation hypothesis), this study will effectively follow the three component cognitive affective model, which divides the phenomenon of empathy into *a) the ability to discriminate and accurately label the feelings of other's (emotion recognition), *b) the complex mechanism to change the point of view between the self and the other (perspective taking) and *c) the ability to adequately respond to the perceived emotional stimulus by another (affective responding) [1]. As most of these components have been tested primarily on infants or young adults, it seems immanently important to extend the already acquired data to older age groups in order to capture a more representative picture of modern societies. This study will take such a comprehensive outlook by having recruited N=500 participants in different age groups from 25 to 75 years. Embedded in the framework of this project, the particular contribution of the author was to focus on the affective response part of the above sketched model. More specifically, it has been suspected that an empathic experience can lead to feelings of sympathy (concern for the other) or personal distress (concern for the self), thereby triggering two different motivational states and -assumingly- behavioral outcomes [2]. To further test this hypothesis, the conducted experiments are designed in a way so that these motivational differences are successfully divided at their joints. For this purpose, participants have been exposed to short video clips showing patients undergoing a palpably painful medical treatment. After each clip, extensive self reports were gathered from the participants (e.g., subjectively rated uncomfortableness and willingness to give help in such a situation vs. shifting one's attention). In addition, a wide range of psychometric questionnaires (covering empathy, emotional contagion and prosocialness) would then augment the data to ultimately elicit the intensity (strong/weak) and focus (self/other) of the empathic experience. Allowing for a uniform distribution, probands were recruited in ten natural groups (two sexes X five age groups) , starting off with subjects between 25 and 35 years to subject groups that were 65 years and older. Important to mention, exclusion criteria were set in a way so that only healthy/normal functioning probands would be included in the sample (e.g. Mini Mental State >25).

At the current stage, the data analysis of the entire project is still due. But generally, the author speculates to find that the degree of empathic concern will positively affect prosocial behavior. Crucially, there are contradictory claims as to how age modulates that link; on the one side, elderly people certainly acquired a lot of experience in figuring out and reacting to emotional stimuli –which indubitably makes them proficient in social commerce. However, developmental research has also shown that advanced age leads to successive deterioration of frontal structures in the brain, thus causing difficulties in cognitively demanding tasks. Finding out more about this complex interaction (growing old => becoming an emotive expert vs. inevitably becoming incapable of affective sharing) will help to organize adaptive environments for modern societies with turnaround population pyramids. On a different note, the author is interested to find out, whether the project will elicit general sex differences in the domain of empathy and prosocialness, as this is still debatable from the current literature [3]. The central focus of this study will thus be to three–folded: *1) finding out whether there any general sex differences in performing empathy related tasks; *2) scrutinize to what extent (and more specifically: in which of the above sketched subclasses) the multilayered phenomenon of empathy poses difficulties for aging populations; and finally *3) investigating whether there are any interaction effects between empathy, sex and age.

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Study of an annotation scheme concerning spatial information from text corpora

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How is information that locates entities in space expressed in news article? Are those expressions universal; is spatial information expressed in the same way in various languages? Spatial information is defined as all expressions that account for locating entities in space. Topologicaly speaking, spatial information can be classified into three groups/categories namley,information about location , the motion (path and manner), and the frame of reference. A lot of such frameworks can be found in the literature. The main idea behind it, is to find a classification scheme that is an attempt to create a construct that reflects the representation of spatial information presented in natural language. Such a scheme is established through a formal analysis of the entities composing language, as well as the relations among them. In other words, the goal of establishing a classification scheme is an explanatory account of how the structure of language (seen as a system), the combination of the entities and the simple meaning of the entities can account for spatial information. This interest seems to be shared by two disciplines: cognitive linguistics and computational linguistics. Cognitive linguistics and in particular cognitive semantics try to find out how the meaning can be constructed from the structure of the language. It separates meaning into meaning-construction and world representation. The field of computational linguistics and in particular the sub discipline of ontology tries to make those categories available for the automatic extraction of spatial information in text, using also diverse models. There are a lot of different existing theoretical approaches in cognitive linguistics about the categorization and construction of spatial information: the first part of my project will be to make a short review of those linguistic theories. No systematic classification of those theories exists in the literature: I also aim to establish a classification based on the approaches token. The link in this analysis will consist in asking how those approaches considers languages (what it is nature and how can meaning be created?).

The second part of my project will consist of an evaluation of an already existing standard annotation scheme. This annotation scheme has been developed in a larger project concerning a Semantic Annotation Framework (Pustejovsky ad al., 2012). Its main aim is to provide an inventory of how spatial information is expressed in natural languages. Based on the classification of the cognitive theories established in the first part of the project, the second part will try to make some propositions about the classification used for this annotation schema. It will take into account the limits inherent to the automatic extraction from text corpora and the general guidelines that have to be used in order to satisfy the criteria for establishing an annotation scheme. The last part of my project will tackle the question of universality: can this annotation specification be used in other languages? Since the ultimate idea behind this annotation specification for spatial information is to become multilingual, and has so far only been tested for English corpora, an interesting point would be to test it for French copora. To this purpose, I will try the annotation scheme on a French news article using an existing annotation tool (UMA Corpus tool). As this is the beginning of the project, there are none existing results at this time. The final result will be a classification of the different approaches concerning language and meaning in cognitive semantics, the evaluation of the existing standard annotation scheme for spatial expressions, and finally testing the universality of application of this scheme. Since this project is at the interface between cognitive semantics and computational linguistics it aims to contribute to a better interdisciplinary work between the two disciplines.

The Temporality of Innovative Thinking Ontological Reflection on the Structure of innovative – contemplative Thought Process

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Obviously, world and cognition are a correlative unity. Due to their dynamic circularity, neither of them can be the source of new knowledge, innovative ideas. Therefore the only possible and logical source of new knowledge, except the involvement of super-terrestrial entities, seems to be this very same primordial unity of world and cognition preceding and underlying our rational distinction between knowing subject and known object. Modern science has widely neglected this fundamental realm, until recent attempts by a few Cognitive Scientists to reintegrate it. Francisco Varela calls this fundamental element of human existence the lived first-person experience and claims that it is the "blind spot" of our society (2001). Together with Natalie Depraz and Pierre Vermersch (2003) he made an interdisciplinary attempt to establish a method appropriately illuminating this "blind spot". Based on this research it is the aim of this paper to clarify the question: "What is the ontological dimension underlying the innovative thought process?" By combing phenomenological reduction, psychological introspection and spiritual meditation, they could successfully identify the general structure of such practices. This so-called "core cycle" of subjective experiencing consists of the three consecutive phases "suspension", "redirection" and "letting-go", potentially resulting in the birth of a virgin idea. This process-structure originates from the phenomenological concept of epochė, which means the bracketing of all our (non-)scientific knowledge, beliefs and theories about the world so far. This is equivalent to the first step – suspension. Thus, we open up a new (cognitive) space that should become the focus of our attention by

the act of redirection. If anything, the third step of letting-go could be called a mind-set: a curious openness of attentive patience towards the absolute freedom of future possibilities. This three-part process finalizes in an intuitive act of sudden fulfilment; the fragile emergence of new and innovative knowledge. Recent advancements in the areas of Knowledge/Innovation Management as well as Epistemology/Philosophy of Science provided further evidence for the validity of this structure. Furthermore, since it became clear that the third step (letting-go) unlocks an existential dimension, an ontological reflection got necessary and promising. My first methodological step consisted in a synoptic analysis of this field to identify the general characteristics of innovative thinking processes, as outlined above. Using this framework for the analysis of Heidegger's theory reveals equivalent concepts to the three steps of becoming aware "suspension", "redirection" and "letting-go". The "destruction" (Destruktion) which is directed towards the historical process of (inter-)subjective formation is comparable with the gesture of suspension. It releases oneself from commonplace, every-day solutions and opinions – in many cases prejudices. Thereby the thinking subject excavates traditional occlusions until a primordial givenness (facticity) is reached. Once the standardized ways of thinking are abandoned, an alternative choice of thinking about the world becomes necessary. This step, comparable to redirection, is called "resoluteness" (Entschlossenheit), denoting an intentional change from inauthentic to authentic being. The final transformation of letting-go is actually isomorphic to the first moment of Heidegger's threefold concept of "releasment" (Gelassenheit). Interestingly, this existential level seems to be a compressed repetition of the whole process structure: letting – go, the release-event itself and letting-come. Going through this most fundamental level of transformation demands an existential surrendering to possible future horizons. Contrasting the observable process structure with Heidegger's theory reveals marked similarities. Therefore it is reasonable to ask, how do Heidegger's concepts form a coherent and meaningful whole? The leitmotif connecting Heidegger's concepts of destruction, resoluteness and releasment is twofold in itself. The ontological possibility of

contemplative-innovative thinking relies on the abandonment of subjectivity – will and representation. Therefore this process consists of a stepwise liberation from being a subject for the sake of attaining oneself. The difference between intellectual and existential realm (letting-go or releasment) rests upon the total discard of voluntary thinking in favour of a frank acceptance. The paradox that this step can never be taken intentionally is the gate which must be passed for successfully undergoing this process. The second aspect for the meaningful unity of this process arises out of the first – the structure of human existence itself. Since the meaning of human being takes place in the threefold structure of temporality – past, present and future – subjectivity is similiarly structured. Therefore, I conclude that suspension, redirection and letting-go are three aspects of liberation from subjectivity as a temporally meaningful being, or the being of meaningful temporality. Subjective present, past and future are suspended in favour of the contemplation in a "deeper" pre-senc(s)e and dwelling therein.

Investigation of differences in large-scale network connectivity between healthy and schizophrenia subjects related to cognitive control processes

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Introduction

Schizophrenia is a mental disorder manifesting itself through impairments in various cognitive realms such as (self-)perception, emotions and memory performance. Investigation in the nature of the disease is taking part on various levels - from molecular to psychological approaches. Through the advent of modern brain imaging techniques another approach has emerged. The term of "disconnection syndrome" has been coined (Friston & Frith, 1995) building on the notion and empirical findings that schizophrenia is associated with disrupted neural circuits. Embedded in this theory-framework is a recent study investigating the performance of schizophrenia patients on a phonological delayed-matching-to-sample-task (J. Kim, Matthews, & Park, 2010) which aimed at further elucidating the relationship between cognitive components of working memory and brain activation patterns. The study shows that there are different neural activations in schizophrenia subjects and is suggesting that there is a "wider network of frontal and parietal regions" involved in the support of working memory maintenance. Working memory deficits are considered as a potential marker for schizophrenia. Combined with the aforementioned "disconnection theory" this opens up a broader perspective on the topic. In what way do the interconnections between brain areas responsible for working memory and others play a role in explaining the symptoms and underlying causes of schizophrenia. Connectivity analysis of functional brain imaging data is a appropriate framework of methods for this kind of questions. (Rowe, 2010).

Preprocessing

In order to process the data in a reasonable way the first step was to preprocess and transform the brain-voyager (http://www.brainvoyager.com) data in a adequate data structure. For this purpose the matlabtoolbox "BVQXTools" was used . The toolbox allows to access the proprietary data structure of the "brain voyager" software suit through Matlab and further processing. As an appropriate data structure for the subsequent analysis an 2D Array/Matrix representation has been chosen. For this the given 4D data gets unfolded into a row/column organization where each row represents a certain voxel with the columns representing the time-series over the time-range of the experiment. Column n is here the n-th time point in the experiment. Furthermore to be later capable of referring back to the coordinates in the original dataset a mapping has been computed while building up the 2D representation.

Analysis

To enhance the flexibility and ensure the unbiasedness a model free approach was chosen. Independent Component Analysis (ICA) as an unsupervised method was chosen for this task. ICA is a computational method for separating a signal into maximally independent components and can thus be used to detect functional networks in fMRI data (Calhoun, Eichele, & Pearlson, 2009). The FastICA Matlab package was used for this. FastICA is an ICA implementation using an fixed-point iteration scheme which has been found to be 10-100 times faster than conventional algorithms. In order to prepare the data for further analysis the data was variance filtered. By setting an empirical reasonable threshold (found out through investigation of the sorted histogram over all variances) rows which did not comply to this constraint where deleted out of the data-matrix. This "screening step" makes certain computations (e.g pairwise correlation of all voxels) more computational tractable as it dramatically decreases the dimensions of the data-matrix. In order to to be able to decide how many computed components should be considered for further processing the singular value decomposition (SVD) was computed on the variance-filtered dataset. After an examination of the result of of the SVD trough an visual heuristic (scree plot) this value was fed as an input-parameter to the ICA

algorithm. From the computed mixing matrix of the ICA algorithm each voxel was assigned to the component where the relevant coefficient is largest thus each component can be considered a temporally coherent network (Calhoun et al., 2009). Building up on this, distance-maps has been computed to measure how far the voxels of one component are off from each other using the 3D Manhattan-distance. The intention behind this is to have a metric which can be deployed as a measure on whether a voxel pair can be seen as in separate physical locations which is important to find clusters.

Outlook

From this basis there are several options on how to proceed on deeper analysis either through drawing from methods belonging to the "functional connectivity" approach or using methods from the "effective connectivity" approach which can shed more light on the underlying causal structures.

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EEG mu rhythm desynchronisation: an electrophysiological evidence for mirror neurons activity

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Mirror neurons are multimodal association neurons with motor properties, found in premotor and posterior parietal cortex, that increase their activity and fire not only during action execution, but also while observing [1] or hearing another individual performing the same or a similar action. These neurons have been originally discovered in the ventral premotor cortex of the macaque monkey [1]. Main cortical regions associated with mirror neuron system in humans are the anterior part of the inferior parietal lobule and the inferior part of the precentral gyrus plus the posterior part of the inferior frontal gyrus (IFG) and posterior part of superior temporal sulcus (STS) [1]. According to "direct-matching hypothesis" of action recognition which claims that individual can recognize actions performed by others by mapping the observed action also with auditory stimuli on his/her own motor representation of the observed action, mirror neurons play important role in imitation, empathy and also theory of mind [1].

Electrophysiological index of mirror neuron system activity is specific EEG oscillation called mu- rhythm [2]. Mu-rhythm is typical oscillation for motor rest and becomes suppressed and desynchronised during active movements and somatosensory stimulation [2]. Mu-rhythm is EEG rhythm with dominant frequency in 8-13 Hz and ~ 20 Hz bands [2]. Suppression of the resting mu-rhythm indicates that the underlying neuronal tissue has become more desynchronised, reflecting an increased processing load also of the mirror neurons [3]. With focus on previous knowledge of mirror neuron system properties and EEG mu rhythm characteristics, we created an EEG experiment, in which we proposed two hypotheses. In the first hypothesis, we claim that there is the highest mu power spectral density (PSD) during the relax condition and similarities of mu-rhythm PSD suppression in self motor movement and the same observed movement condition. Our second hypothesis claims that there are contralateral correlations in mu-rhythm PSD strength according to left/right hand in nonrest conditions and hemispheric differences in mu power also in nonrest conditions.

We performed several preliminary measurements, which served as indicators for selection of the most suitable nonrest stimulus in terms of mu suppression (mouse scrolling, cup grasping, painting and fingerwalk). Mouse scrolling arose as the most significant one, that pointed out better outlook for future experimentation. With the knowledge from preliminary results, we chose vertical index finger movement (tapping) as the most suitable stimulus for our main experiment, whose results should prove our hypothesis. We programed E-Prime application that was handling and projecting our stimuli across three different types of conditions. The first was observing simple motor movement (index finger tapping on the desk) of left and right hand. The movement was recorded and presented in short video. The second type condition was self motor movement (index finger tapping on the desk) of both hands. Third was motor relax condition. We were recording event related EEG signal for each stimulus using 32 active electrodes in international 10-10 placement and 2 VEOG and 2 HEOG electrodes. For nonrest conditions we recorded 5 sec. continuous chunk of data from stimulus onset, for rest condition it was 15 sec. from stimulus onset. We recorded data from group of 25 healthy adult participants, in age from 20 to 32 years, from which 14 were females and 11 males. After recording phase ocular effects correction according to EOG signal and lowpass and highpass filter were applied to all 32 electrodes. Few more noisy electrodes were filtered individually. Frequency-domain analysis was used for data evaluation. We used Fast Fourier Transformations to obtain PSD in 8-13 Hz and 15-25 Hz bands, which are mu typical bands. We made grand average of PSD for each participant for each electrode. These data used for statistical analysis.

In statistical analysis we wanted to show statistical significant decrease of mu PSD in

nonrest conditions. For averaged PSD over participants we computed the mean natural logarithm ratio of power in the mu frequency (8–13 Hz and 15–25 Hz) during the observation and the same self movement conditions, over the power in the rest condition for scalp locations over the sensorimotor cortex area. We focused on C3 and C4 electrodes because these cover the best motor area responsible for volitional index finger movement. T-tests comparing mu log ratio during observation and movement conditions to zero showed statistically significant suppression in both conditions. This finding supports our first hypothesis and also known literature, claiming that each "version" of the motor action – executed or observed leads to decrease of signal power, as a result of the mu rhythm desynchronisation, compared to the relax state. For our second hypothesis we computed the mean natural logarithm ratio of PSD in the mu frequency (8–13 Hz and 15–25 Hz) during the observation of index finger movement and the same self movement of index finger conditions, over the power in the same movement condition in contra- and ipsi-lateral scalp locations to obtain ipsilateral and contralateral mu power suppression value. T-tests comparing mu log ratio of ipsi- and contra-lateral views in both observation and movement conditions to zero showed statistically insignificant changes in both hemispheres during both conditions. These results are contradicting our second hypothesis. However, from this finding we can assume that mirror neuron system activity is not hemispherically differentiated for distinguishing left and right side movement, but rather approximate to distinguish and understand any kind of movement.

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The Neuroimaging of Social Anxiety Disorder

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Social anxiety disorder, or social phobia, is characterised by extreme emotional distress in social situations, caused by low self-esteem and the fear of being judged and criticised by other, often unfamiliar, people. Among the physical symptoms are blushing, sweating, heart racing, trembling, persistent nervousness, dizziness, nausea, and even panic attacks. Although individuals often recognise that the fear is unreasonable or excessive, they find it difficult to cope with it and tend to avoid feared situations, which can have great impact on their social activities and relationships, as well as on their normal personal routine, health, and occupational choice. Nowadays, SAD is considered the third largest psychiatric health problem worldwide, after depression and alcohol dependence (according to the American Psychiatric Association, 2000). Interestingly, it was not until 1980 that SAD was first officially recognised as a psychiatric condition [2]. Beforehand, other terms were used, such as social neurosis to describe extreme shyness. In some cases, social phobia was even mistakenly diagnosed as schizophrenia, for instance. In fact, SAD is comorbid with a number of other psychiatric conditions like depression, substance abuse or obsessive compulsive disorder and the diagnosis poses some problems.

The current master thesis project aims at addressing SAD as a complex and multi-facetted phenomenon that encompasses different approaches from various disciplines. The first part of the thesis will trace back how social anxiety has evolved, by engaging different views from the fields of philosophy, comparative biology, anthropology, neurobiology, psychology, and psychiatry. The second part will provide an introduction into the methodology of fMRI, which will pave the way to the last part of the thesis, focusing on an fMRI study conducted with SAD patients and healthy controls. The study will apply a modified emotional Stroop test similar to the one used by Blair and colleagues [1]. For the purpose of the current study, pictures of harsh and neutral faces will be used to test the hypothesis that amygdala is hyperactive during perception of angry faces, irrespective of attentional load in SAD patients relative to healthy participants [3]. Furthermore, the fMRI study will focus on the functional connectivity between the amygdala and other brain regions, suggesting a decreased prefrontal down-regulation during situations inducing social anxiety.

The overall objective of the thesis is to unify different views into one interdisciplinary model of social anxiety and put the theoretical considerations into practice within the scope of the experimental fMRI study. Furthermore, the fMRI study will consider the functional connectivity between the amygdala and other brain regions in order to validate a neurobiological network hypothesis of SAD. References:

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Testing the hierarchical neural network DBN in invariant object recognition

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Neural networks (artificial and non-artificial) are important part of recent cognitive science and are related to connectionist theory. They are very important part of computer based artificial intelligence. Neural network is an universal mathematical approach in study and modeling of learning process, adaptation process and artificial cognitive systems. The whole concept of interconnected simple units is based on the metaphor of human brain. They are biologically motivated mechanisms of knowledge acvisition and learning (applicable on different levels of abstraction). Many connectionists think that brain executes computations and that neural computing explain human cognition. Mainly we suppose that we can use neural networks to explain mental processes. Connectionism in artificial intelligence and cognitive science are considered as processes of parallel information processing. Artificial neural networks have important role in cognitive science, linguistic, neuroscience[3] and in controlling of different processes. In these wide spectrum of possible applications neural networks are not used only for modeling learning and adaptation. They are also used for solving a wide spectrum of different tasks and problems like object classification [2], speech recognition, financial forecasting and navigation. But one of the main purpose of studying neural networks is because their relation to human brain. In cognitive science and neuroscience the neural networks are part of basic theoretical methods which model the activity of our brain. In these two scientific disciplines are created basic connectionistic principles and is shown plausibility of neural networks for modeling different kinds of activities and aspects of human brain. One of the main purpose of studying artificial neural networks is finding the relation between implemented mechanisms (in interaction between neurons) and cognitive phenomena [3]. Connectionism represents important knowledge base which is able to interpret and explain different cognitive activities of human brain. This connectionist representation of human brain is plausible with our knowledge about brain structure and it is supported by information about brain physiology.

The purpose of this work is to test the ability of Deep belief network [1] in object classification problems. This model is a deep network with two phase training. The first one is unsupervised pre-training based on stack of Restricted boltzman machines. The second one is fine-tuning which uses back-propagation of error derivates. The motivation for using DBN was better performance in object classification task than classical feed-forward neural network. For high structured input data the back-propagation works better if the weights are initialized by DBN [1]. In this work are used two main image datasets for experiments. The first dataset is composed of pictures with 11 leaves classes. This dataset includes rotational, color, size and noise variability. The second dataset is composed of normal and abnormal faces. The goal was to train network to classify given images and to find the relationship among different network topologies, dataset parameters and final testing error. Based on my experiments I found out that unsupervised pre-training, which is used for weight initialization helps to achieve better classification performance than random weight initialization. The significance of this help depends on type of dataset. In faces dataset this help is bigger (6.8%) than in leaves dataset (1.1%). My experiments also confirm that a higher number of neurons and hidden layers increased classification performance. Overall the network shows quite good image classification skills and there is potential for real usage of such classification method in practice (e. g. portable cell phone application). However there are also many another methods like recently presented Multi-column Deep Neural Networks [2]. Especially this recent network is very encouraging. Based on the fresh results on image classification task like CIFAR-10 or MNIST Multi-column Deep Neural Networks achieved the best performance. This field of research is very interesting for the application in robotics industries and there is also huge potential for cognitive science, because these methods are inspired by biology and functionality of neural system.

Processing of words and pseudo-words in patients with dementia

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Processing of words and pseudo-words in patients with dementia In our study we are focusing on words and pseudo-words processing in patients suffering from dementia. One of the early problems of patients with dementia is difficulties with naming and word finding, something that suggests a decay of lexical representations. The aim of the study, based on the assumption that pseudo-words processing is a stage process, is to find out how this decay progresses and to find out at which stage difficulties occur in patients with dementia. We are going to approach this issue by using an acceptability task for words and pseudo-words, which violate various aspects of word formation in Slovenian language.

Background
In today's society, dementia has become a frequently diagnosed disease, which also affects language abilities of an individual. These language difficulties appear early in the disease course and can be observed in different forms of dementia. In Alzheimer's disease, for example, these difficulties can be observed in verbal fluency, naming – particularly of biological items, where semantic knowledge plays an important role – and also on discourse level processing [3]. In the present study we will focus on lexical level rather than discourse. We will investigate lexical representations and their decay by looking at single word processing of real words as well as of pseudo-words. Each language has its own word formation rules, which tell us how to form new words. For example, nouns denoting masculine agents can in Slovenian derive only from verbal base (e.g. plesalec "dancer", derives from the verb plesati "to dance": when building the word we add the suffix -lec to the base ples-). Of course, not all suffixes can be attached to all bases, thus word formation rules such as the one described above have to be followed when a new word is created [2]. If we do not follow these rules, we form a word which could phonologically sound like a word of a certain language, e.g. from Slovenian, but it is not part of its vocabulary – in this case we can talk about word formation violations. In the study we will focus on three types of violations: thematic, in which there are violations of the basic relationships concerning agent roles (e.g. *umiralec: somebody who is dying, *dyer), categorical, in which the lexical category of the base (e.g. verb or noun) is inappropriate (e.g. *avtomobilec: *car-er), and aspectual ones, in which specific word formation rules about verbal aspect are being violated (*preplavalec: (*verb, deriving from a perfective form of the noun swimmer). In terms of pseudo-word processing, we follow Libben [1], who suggested that processing of pseudo-words is a four-stage process. This was more recently upgraded by Manouilidou [2]. At first stage the scan of the string from left to right happens, during which all lexicalized substrings are being exposed (such as pre-plava-lec). Manouilidou adds that this is the stage at which all the non-words are being rejected. At second stage morphological computation takes place, at which interpretable structures are created from lexical substrings (pre-[plava-lec] and [pre-plava]-lec). According to Manouilidou, this is the stage at which pseudo-words with categorical violations are being rejected. She also adds that at this stage, before Libben's third stage, thematic processing of a word takes place. At the third stage an interpretation for each of these representations happens (in which the combination pre-[plava-lec] would mean someone who swims, while the combination [pre-plava]-lec would give no interpretation) and at the fourth stage, the speaker chooses between the interpretations (prefers pre-[plava-lec] rather than the second combination) [2].

Method
Stimuli: We have studied the rules of Slovene word formation for nouns denoting masculine agents (e.g, igralec "actor") and violated these rules in three levels, thus creating thematic, categorical and aspectual violations. We have also added a group of words for male agents (e.g. bralec "reader"), which do not violate these rules, and also a group of non-words, which do not violate the rules, but nevertheless still do not exist in Slovene language and which do not carry any meaning (e.g *dovina). In each group we have selected a

pool of 30 words, which were chosen according to their frequency, tested in the Corpus of Slovene language FidaPlus. The chosen stimuli will be first tested on a group of healthy participants, native speakers of Slovene, to observe whether they recognise them as being violations or ordinary Slovenian words. In this way we will form a group of words, which will first be presented to the control group and later also to the patient with Alzheimer's disease. Task: We will use an acceptability task, in which we will focus on the patterns of rejection/acceptance for the presented pseudo-words. At the same time we will also take into consideration the type of violation. We will show the participants the list of words and pseudo-words and ask them whether or not the presented word could be a Slovene word. Participants would have to respond by choosing YES or NO. In case of YES, participants would have to provide the word's meaning as well.

Expected Results

We expect the control group to show a continuum in the acceptance/rejection rates of pseudo-words, starting with massively rejecting pseudo-words with categorical violations and being more flexible in accepting pseudo-words with thematic violations (e.g. positive answers that the pseudo-word could belong to the Slovenian vocabulary). A different pattern is expected for the patient: we expect the patient to accept more pseudo-words as possible ones, thus, making more errors, since lexical representations will already be in decay and the patient will therefore exhibit difficulties at certain stage of the four-stage processing of pseudo-words.

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Meditation and the Brain. The Impact of Long-Term Meditation on Attentional Engagement.

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Intrduction

Meditation can be seen as a mental training, which supports the cultivation of a certain internal state in one´s own mind over a long period of time. This emotional and regulatory training has been developed for various ends, but gaining a state of well-being and emotional balance are two major aims, which should be reached through almost every meditative practice. A full range of meditation types exists, whereas the distinction between two major styles has been proven to be useful for scientific investigations: One type is called focused attention meditation (FA), where all attention is focused on a specific object. The other one, open monitoring meditation (OM), involves a non-reactive monitoring of the actual experience from moment to moment. Although, proper evidence if brain activity is altered systematically due to meditation is still missing, recent studies suggest that long-term meditation has an influence on brain activity in form of altered neurophysiological processes [1]. In this respect Cahn and Polich [2] showed that during one form of OM-meditation, called Vipassana, decreased automated reactivity and evaluative processing of task irrelevant attention-demanding stimuli occurred in contrast to the control state. More precisely, their results showed that the P3a amplitude, which is a subcomponent of the P300 potential, was reduced when a distracter tone was presented during meditation and that the reduction of this amplitude was strongest in participants, who practiced more hours of daily meditation. These findings support the hypothesis that long-term meditation can alter neurophysiological processes and that this mental training can induce plastic changes in the brain.

Aim of the study

The aim of this study is to investigate if these neurophysiological changes are also observable in more concentrative forms of meditation. One can expect that focused attention meditation leads to stronger alterations of event related potentials (ERP's) in form of a more decreased P3a amplitude during meditation when the distracter signal is presented. The reason for that is that this style of practice tries to remove the attentional systems even further away from the immediate surroundings, which should lead to a stronger decrease of the P3a component when the distracter stimulus is presented. Therefore, this study wants to show that during both types of meditation the P3a amplitude will be decreased relative to the control condition when the distracter stimuli is presented. Furthermore, we expect that the two different types of meditation will elicit different P3a component amplitudes, while the distracter is presented and the group of matched controls will exhibit no amplitude changes, while imitating a meditative state.

Methods

A so-called passive auditory 3-stimulus oddball task will be applied, which contains a frequent standard tone, an oddball tone and a distracter stimulus. The standard tone occurs to an extent of 70%, whereas the oddball and distracter tone appear 15% each time. All stimuli are presented passively and no task is imposed, which means that subjects will listen to the sounds without counting or any button press. These randomly presented stimuli evoke event related potentials [3]. The classical oddball paradigm, which contains only standard and target tones is often used to elicit a P300 signal and can be seen as a brain response to the presentation of an infrequent target stimulus. In this study a 3-stimulus oddball task will be applied, which entails an occurrence of a P3a component during distracter signal presentation and a P3b component during target stimulus presentation, respectively. It is hypothesised that the P3a component, which is of interest in this study, is an index for frontal neural activity produced by stimulus-driven attention mechanisms, whereas P3b is thought to be an index for temporal-parietal activity that reflects resource allocation that contributes subsequent memory processing. EEG data will be obtained by using a 128-channel ActiCAP and analysed in EEGLAB toolbox for Matlab. In addition to the measurements an extensive phenomenological questionnaire will be handed out to the participants to collect

valuable first-person data during the different recording conditions.

Procedure

20 long-term meditators coming from different meditation schools, but acquainted with both meditation styles and 20 age-matched controls with no meditation experience will participate in this study. To guarantee that meditators are able to perform both types of meditation and exhibit meditation experience of several years, questionnaires will be filled out before they actually participate in the study. During the EEG-recordings they will be asked to sit relaxed and straight on a chair with their eyes half open and their mouth closed in a sound proof and electrically shielded room. While their gaze is focused on a fixation cross in the middle of a computer screen, auditory stimuli from the 3-stimulus oddball paradigm will be presented randomly over the speaker system. The entire procedure consists of 6 different conditions, whereby during every condition phases of silence are interspersed with phases where oddball stimuli are presented. During the first condition subjects have to listen actively to the presented stimuli. Condition two should be equivalent to a mind-wandering state, where controls and meditators are encouraged to think about themselves or neutral past events. These two conditions last for 10 minutes each and are followed by the two different kinds of meditation. In the first meditation condition, which lasts 20 minutes, meditators will try to facilitate a focused attention type of meditation, which is induced by the focus on breathing. This condition is followed by an open monitoring type of meditation of the same length, where practitioners try to facilitate a non-reactive monitoring from moment to moment. Controls imitate a meditation-like experience and they are instructed to either observe their breathing during condition 3 or to go through the sensations of their body and observe them in a non-reactive manner. The following last two conditions 5 and 6 are equal to condition 1 and 2 but are presented in reverse order. After every condition precise questions about the phenomenological experience will be asked to enable a profound linking between the actual experienced state of consciousness and neurophysiological data referring to Francisco Varela's proposed research programme of neurophenomenology.

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Searching for a strategy of monopoly game using cognitive and artificial intelligence approach

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The purpose of this work is to find and describe a strategy in Monopoly game. The Monopoly game is one of the most popular board games and it is played across the whole world. In Monopoly game it is noticeable how people make decisions, how they create their own strategy, how this strategy is changing and how they can win the game. Especially the last point is very interesting, because there are no strategies about which we can say they are the best. Many researchers specialise in mathematical and statistical models of Monopoly strategy. They generally simulate Monopoly game on computer simulations and from that they make certain conclusions. Then there are a few studies focusing on behavioural aspects of players, which observe participants during playing Monopoly game or other similar board games. My intention was to join these two approaches together. In this work I observed players, their decisions in certain situations, their strategy during the whole game, their reactions, etc. I used different ways of observation methods: silent observation, participant observation and questionnaire observation method. I made an analysis of collected information and then I created a model of tactics. It means what players should and what should not do in certain situations of a game. Then I did investigation of literature, I used many resources, from board game studies over statistical and probabilistic models to economist studies. I offered an overview of possible strategies, which along with results from my observation, identify complex outlook of strategies in Monopoly game. According to this I have created a certain model of a global strategy which was a starting point for creating an artificial agent-player. I have implemented this model of a global strategy in combination with a model of tactics into the rule-based agent-player. In order to enable the agent-players to compete against each other I created a simulator of this game.

It was possible to improve the rule-based agent-player and therefore I applied two optimisations to the found strategy. I used an approach of genetic algorithms inspired by a natural evolution in order to find certain parameters, which I could only estimate to be in the found model of a strategy because the observations of participants and study of literatures did not offer me a complete knowledge of some important decision-making situations. The approach of genetic algorithms allowed me to find values for these parameters by evolving them. According to Whitley [1] genetic algorithms belong to a group of evolutionary algorithms inspired by nature. They imitate evolutionary processes, which are known from biology. The reason for the second optimisation was to specify the decisions of purchasing the assets from global perspective with respect to the whole state space of a game. It was done by the reinforcement learning approach in combination with neural network. The neural network allows a generalisation, it means to know how to decide in situations, which did not occur in the training process. According to Sutton & Barto [2] the reinforcement learning (1) brings a concept of reward and punishment, which in analogy with a human represents pleasure and pain. (2) It also brings a concept of judgement, which says how good or bad is a particular state from the perspective of a long-term evaluation of the environment. The using of artificial neural network has its origin in the activity of biological cerebral and neural structures and simulates a learning ability of understanding unknown processes. All of this was ended with a competition of these strategies and finding a winner agent-player whose strategy was the best. During observations I found out a very interesting fact. After first observation I realised the problem with original rules. The Monopoly game was created in 1933. Since that time millions of people all over the world have played it. And it is translated to many languages. The rules of original game have never changed. Everybody can read these rules in handbook which is the part of Monopoly game. However only few people play this game according to the original rules [3]. Is it not weird? Why is it like that? My work was going also through such questions.

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Communication in exhibition spaces

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I see this project as an optimistic attempt to bring, in Frankfurt school theorist's eyes, from culture industry polluted public over to the less standardized, manipulative and more schizophrenic works of society. The main questions of this project were: 1. What is the attitude of involved parties (curators, artists and visitors) towards making exhibitions available and 2. What would encourage communication and interpretation in the exhibition, making it more comfortable for visitors. The project is in its basic question interdisciplinary as it tries to merge knowledge from different areas to better understand the social issue. The theoretical part consisted of studying theories from various disciplines (sociology, philosophy, psychology, literature, culturology, anthropology, neurology and museology), and even though it started with revision of aesthetic theories, they did not turn out to be very useful for practical solutions I was trying to find. That is why I later overlooked the aesthetic part of the experience and focused on the social part - studying exhibition space, visitors' motivation, needs and goals, theories about interpretation of artwork and the impact of knowledge on it, diving into sociological theories about cultural capital and social class etc. The empirical part consisted out of interviews with people, who play main roles in this field - researchers of exhibiting spaces, curators and employees in cultural institutions, artists, graphic designers, architect and visitors. I made opened interviews about the mentioned problematical situation and received very different answers, which pointed to additional problem of communication and cooperation among them. The conclusion of the project is not as explicit as I expected it to be, since I wanted to find specific solution. But to summarize, the results of the project show that issues in this field lie in slow modernization of exhibition spaces (especially public representation of it), attitude of public, based on stereotypes from the beginning of previous century, lack of fresh approaches towards exhibiting high culture and especially ego war between artists, curator and public, where curator and artist emphasize the role of copyright in such a way, that it becomes uncomfortable for the visitor, which consequently does not feel invited to subjective interpretation and adopts disinterested attitude. I also realized that Slovenian institutions and public both have specific characteristics, both in need for specific solutions. I see the possible resolution in recognizing the importance of subjective interpretation, visitors' active participation and satisfying other motives than mere adoration of exhibited pieces as the only reason to come to the exhibition, thus loosening the barriers between institution and public and also making the whole experience more comfortable.

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Communication platform for agents in heterogeneous environment

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Small and smart devices are becoming part of man's everyday life. It is not that long time ago when people did't know what Internet is. Nowadays, most of them can not imagine their lives without it. They are creating and adapting different devices so they can keep them close and online. These devices help them to solve everyday tasks, or just keep them entertained during their spare time. These devices possess invaluable information about their owners, they know their habits, what kind of music they like, their favorite places to go, who are they friends with and what they have in common, and many others. Possessing such information about somebody gives the opportunity to deduce his personally, what his mood is or even predict his future actions.

Big Internet companies such as Google, recognized this trend at the very beginning and started to use these information in their own advantage. On the other hand, it looks like the cognitive science audience fail to catch this early train. In 2012 G. Miller in his article [1] summarizes the use of smart phones in different surveys and predicts the future development of these surveys. Although first surveys using smart devices dates back to year 2001, they are just becoming more widespread in yer 2010. Until this day, the scientific community did not offer any solution to connect these devices, nor grant them the ability to make agreements. We think, that the age of modern smart devices will develop into the age ambient intelligence, where devices work in concert to support people in carrying out their everyday life activities, tasks and rituals in easy, natural way using information and intelligence that is hidden in the network connecting these devices. Because of this, a multi-agent middleware that is able to run on such devices is needed. Multi-agent system is a system composed of multiple interacting intelligent agents and their environment. They can be used to solve problems that are difficult or impossible for an individual agent.

The coordination between the agents depends on a sophisticated system of inter-agent communication. The language used by agents for this inter-agent communication is the Agent Communication Language (ACL). The main purpose of this language is to model a suitable framework that allows heterogeneous agents to interact and to communicate with meaningful statements that convey information about their environment or knowledge. Different Agent Communication Languages evolve around the key concept of communicative act from Speech Act Theory proposed by John R. Searle[2]. Speech Act Theory claims, that a communicative act is a special type of action, in this particular case realized by sending a message. FIPA[3] was established in 1996 as an international non-profit association of companies that agreed to share efforts to produce standard specifications of generic agent technologies. Since then FIPA, has generated a set of specifications that went through three cycles of review: FIPA97, FIPA98 and FIPA2000. The last standardized review is called FIPA2002. The aim of these specifications is to make agent technologies usable across a large number of applications so that a high level of interoperability across applications is achieved. These specifications are focusing more on explicitly specifying how agents communicate and connect and less on specifying components such as agents, humans, data and services that transform, generate, process and store messages that are communicated.

There are several well known FIPA compliant multi-agent middlewares including JADE or SPADE. However, these middlewares have several important deficiency. Among others, they are not suitable for running on small devices and are not multi-platform. Therefore, we propose new multi-agent middleware that is able to run on embedded devices, computers, Macs, iPhones, etc. We implemented it in three very popular languages, Python, Java and C++ to ensure agents are able to work in heterogeneous environments. Agents are using FIPA-ACL language. Our multi-agent middleware is partially FIPA compliant to ensure agents are able to interact with agents from different

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Vibrotactile Feedback Application to Increase Control in Virtual Reality Hand Prostheses

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Introduction

Few to no current commercially available prostheses provide intended sensory feedback, constraining the users to solely rely on visual feedback when controlling grasp force. However this is not the only hardship prostheses' wielders may face. Due to the lack of sensation the missing limb might not be felt as part of one's own body and is henceforth disintegrated from bodily awareness. The prosthetic device might even be doomed to negligence due to missing efficacy, intuitiveness or comfort [1]. The properties of the human haptic system provides a bidirectional communication between humans and interactive systems. "Haptic interaction offers an independent sensory channel that the brain can process to further enhance a user's experience in a multimodal environment" [2]. Vibration is a common modality to induce haptic feedback, being adaptable in size, using relatively little power and easy to implement using mobile phone motors or piezoelectric actuators. Providing vibrotactile feedback might speed up reaction time and reduce hand-eye coordination or grasp force errors. To evaluate a set of factors specified below, test persons will be invited to participate in virtual reality experiments featuring visual and vibrotactile feedback application.

Goals

Virtual reality set ups conventionally use only a visual display in order for the user to interact. Even though temporal resolution in the human eye has a successiveness threshold of 25 msec, which is five times the value of skin mechanoreceptors (5 msec) [3]. Regarding those physiological features, control and performance within a virtual reality can be improved through the application of haptic feedback. Especially in spatial awareness and object interaction, combining vision and haptics, seems to be advantageous and enhances the feeling of interacting within a real world, where there is a multitude of sensory feedback combinations [2]. Correspondingly increasing actual immersion of the user into the virtual environment. Which in return allows acting and reacting in a natural way in addition to reducing the cognitive work load while performing. Without the latter, the user might not feel sufficiently immersed in the virtual reality to behave intuitively. The overall goal is the amelioration of prosthetic control for determining grasp force when visual feedback alone is insufficient.

Methods

In order to use the capabilities of vibrotactile stimulation efficiently, there is a set of preliminaries which need to be explored within the psychological, physiological and technical cluster. To develop a haptic feedback system it is necessary to register the sensory attributes of the human body. In detail, this means to identify the correlation between subjective experience of the user and quantitative measurable stimuli (psychophysics) under the premise of given physiological characteristics. For instance there are several mechanoreceptors in the skin which respond to different types of tactile feedback, for vibration this receptor is called Pacini corpuscle. As for the feedback application method of using vibration stimuli, the primitives to be identified are amplitude and frequency in order to derive their optimal feedback combination and gain an intermodally comparable transfer function. Moreover, the tested range of stimulus application needs to feel comfortable for the user in such a way that in the end the sensory feedback is fully intuitive and accepted. For this, also location, material and size of the feedback system needs to be considered. After the required characteristics of vibrotactile stimulation as well as psychophysical limitations have been identified and combined into a unique method of feedback application, the experimental phase to test its efficiency, accuracy, intuitiveness and comfort within a bidirectional human-computer interface within a virtual environment will commence. The experimental set up consists of a virtual reality lab in which participant's movements will be tracked via infrared cameras and reflecting markers on the person's body. Together with EMG signals which are derived from muscle contractions registered by surface

electrodes placed on the person's arm, this information builds the basis for the movements of respective virtual elements (arm and hand) through which the user will be able to interact with other virtual objects. This manipulation will be perceived visually trough video goggles as well as haptically through a vibrating motor attached to the test person's arm. The actual test phase will be a sort of game, where the participant is asked to grab a virtual ball using the virtual hand and put it on a given place within the virtual environment. During this sequence, the person will receive haptic feedback on grasp force of the virtual ball. The performance in these tasks will be evaluated according to speed, accuracy, comfort, intuitiveness and efficiency. After the virtual test phase is finished, the participant will be given a short questionnaire to assess his/her personal opinion about the performance, which is important for the evaluating the non-measurable factors.

Results

Since the experiments have to this day not started yet, the results can only be assumed. The hypothesis is the increasing interaction efficiency and accuracy, as well as raising levels in comfort and intuitiveness through the usage of haptic feedback. As an overall final result, vibrotactile feedback can improve general prosthesis' handling and user performance through intuitive learning curves and adaptable handling. These concerns support the approaching advanced prostheses which efficiently and sensitively model the functionality of a human hand.

Discussion

There are quite a few open grounds for discussions. One of them being the human factor. Not regarding personal preferences and obvious physiological limitations, which should still accomplish quite a representative population mean, there might be distinct disparities considering if the subject is top-down or bottom-up. Depending on the test person's attention, given when there is a task to focus on, the sensitivity to discriminate stimuli would be increased and sensory impressions would be more distinct and recognized faster. This would be different in a bottom-up style, where the test subject would only be presented with the vibration stimulus without a task to influence cognition. In this way the sensory threshold would differ

according to the setting. Another topic would be about physiological effects. For reaching and grasping not only tactile mechanoreceptors are activated but also proprioceptive ones. The kinesthetic sensory system provides information about a limb's or joint's location and movement, and if the nature of this movement is self-generated or passively inflicted. Awareness of body movements and location might be difficult to achieve using a tactile feedback mechanism.

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The importance of spatial conceptualization for cognitive load minimalization in graphical user interface

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In the last decades, rapid development of information and computation technology moved the human-computer interaction (HCI) from its peripheral position of a narrowly specialized working tool to the front position of our day-to-day life. Information technology became an intensively used means for obtaining information, for communication with distant world and ever more important in virtual-social interaction with the nearest environment. HCI has gone through a big evolution: from mainframe computers and punched cards, through text-based user interface and command line to the modern graphical user interface (GUI) of the personal computers available to laymen. Responsible for this development, apart from the technological progress are usability studies, whose main tasks are iterative evaluation and solving of users' interaction problems. The major focus of usability studies are unnatural or conflicting elements of user interfaces, which can be sources of unwanted cognitive load and induce interaction difficulties of perceptive, conceptual and motor character. Thus increased cognitive load, from the point of view of attention distribution, is demonstrated mainly in the transformation of limited cognitive resources, from the bottom-up perception to the top-down perception mechanisms. This unwanted concentration of user's attention, focused only to the problematic element of an interface, lowers user's chances of aiming at his targets and also his ability to perceive potential solutions offered by the interface at that moment. According to Baddeley's model of working memory the phenomenon can be interpreted as the overloading of the central executive part of the working memory which is responsible for the distribution of focused attention. The overload of the central executive part can be caused by supersaturation of one or several of its hierarchically subordinate memory elements, like the phonological loop, the visuospatial sketchpad and the episodic buffer. The likelihood of such an overload in the GUI environment is relatively high in comparison to the real world environment. This is so because in a GUI the user receives a substantial part of the information almost exclusively via the visual perceptory channel, thus increasing risks of overload of the central executive part through the supersaturation of the visuospatial sketchpad. This hypothesis is also supported by the multi-modal theories [1], which refer to a more effective memory coding through more modalities (more engrams). On the other hand, Baddeley's visuospatial sketchpad is responsible for a simultaneous coding of two different, provably independent modalities. The neural independence and the independent parallel coding per se are described in the two-streams (where and what) hypothesis [2]. This hypothesis assign the ventral path to processes responsible for object recognition, processes connected to categorization and processing of spatial visual information to the dorsal path. Dorsal path is responsible for the spatial sensorimotor coordination. From neuro-psychological point of view, the dorsal path represents an independent neural area ergonomically assignable to a visuo-motor type of dynamic interaction. According to Englekamp's enhanced model of working memory [3], the ventral path should also enable effective verbal interaction between pieces of symbolic information - applicable in multimodal interfaces (MUI).

A perspective solution for the purposes of GUI seems to be the reinforcement of the implicit spatial conceptualization (interaction in its respective perceptive and motor parts). Depending on the context, their metaphorical interconnections should also be reinforced. As far as the perceptual side of memory is concerned, spatial conceptualization in GUI makes sense in the long-term interaction. It is more specifically so in the acceleration of information search or the filtering of temporary irrelevant information (e.g via metaphors and traditional conventions). As far as the reactive level (short-term, immediate) is concerned, spatial conceptualization is important for a wider and more effective stream of consumption of new information (its transparent arrangement or enrichment by the

implicit context of the spatial relations.) A lot of cognitive mechanisms are rooted in the principles described by the embodied cognition theory. Spatial conceptualization of the HCI's motor skills side is important in mapping and adjusting the interaction inputs of natural human habits – his reactive movements (image schemas, gestures). In the ideal case, a user-friendly GUI environment offers only affordances implicated from the visual stimulus (for which a natural motor reaction exists), so that the user intuitively, dynamically and in real-time perceives the environment's reaction to his respective inputs without his prior experience.

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Invariant object recognition using perceptron with convolution

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Often there is need for dividing objects to categories according to their statistical properties. For this reason, technologies for this were developed that allow automatization of this process by machine learning and pattern recognition. One of these are neural network, inspired by principle of functioning of neural system of the humans. They are mainly statistical tool, although used also for other matters. Most universal of them are networks called multilayer perceptrons, that can be used for virtually whichever task that are neural networks suitable in general, because of their ability of learn almost anything, although with the disadvantage of slow learning. Convolutional neural networks are extented architecture for classical multilayer perceptrons (MLP), with addition of convolution technique that is very common in area of image processing or more generally, in any signal processing. Their architecture is inspired by structure of path which processes information in brain of cat which utilizes recognition of features that are contained in perceived image. They use following procedures: Receptive fields, that means area of surrounding neurons for one neuron, that influences potential of this single neuron. They can be specialized, for example on orientation or location of patterns in perceived image and have been identified for neurons of the auditory system, the somatosensory system, and the visual system.

Convolution. This is operation that iterates through image pixels and uses so-called kernel, that is actually square matrix of values, on every of them. As a result, depending on kernel values or size, the image gets an "effect". An example of these effects in practice are sharpening or blur that we can common see in any image processing application. In these networks, random kernels are utilized what usually runs into sort of edge detections. This is important to enable detection of features of input image as it can be used as

some "guideline" for what it contains. Sharing of weights. Some neurons between layers of network share their weights that means they have the same weight. This is very useful because it works as feature detector through whole input image. Additionaly, the feature can be rotated and even a bit distorted (noise etc.) and the layer is still capable of its recognition. Also this helps to decrease a number of parameters that have to be trained compared for example to multilayer perceptrons. This can result to smaller computational demands as well.

Subsampling. As the image proceeds through the network, its dimension is being decreased. This is done by pooling techniques, that means by some rule are squares of pixels converted to just one point. In this work, maximum rule is used. The goal of practical part was to test this kind of network on dataset of leaves from eleven kinds of trees. Five variations of this dataset were used - varying by training samples count and level of distortion for leaves images, in this case the percentage of noise artificially added to images. I wanted to verify whether network is able to cope with these problems in dataset and compare the dataset to other, somehow standardized one to make a notion about its difficulty. The network used consisted of two convolutional layer and one output MLP layer, with convolutional planes number and output layer neurons number varying to find an effect of these on network performance.

As a result, I found the following: I compared the dataset to MNIST dataset of handwritten digits. The leaves dataset seems to be harder overall to recognize, as the testing error for MNIST was under 1%; error for leaves vary from 1% to 8%. This is of course caused by distortions in leaves, although pure leaves with no distortions are harded to recognize as well, as they seem to be more complex. Another thing is that, in general, for big and complex datasets, more convolutional layers and more neurons in output layer helps. The last one is comparation to Deep Belief Network, when convolutional networks seem to be significantly better for these kinds of task, with difference roughly from 5% to 15%.

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Eyetracking on paintings

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Theoretical concepts

Eye tracker is a device for measuring positions and movement of the eye. It is widely used in research of the visual system, which includes visual perception (3). Differences in human gaze behaviour can be studied by analyzing fixations and saccades. Fixations are the periods when the eyes are relatively stable and visual information is gathered, while saccades are fast eye-movements which bring the fovea from one fixation point to another (1). With eyetracker we can see what people are looking simply by measuring gaze behaviour. In paintings, the viewer's eye is easily caught by figures presented in a picture. Although gaze behaviour during picture viewing is affected by visual features, cognitive factors are also important, for example person's knowledge about the picture (2). Eyetracking could be used when we would like to observe gaze patterns of two types of art - abstract and representational. Representational art consists of pictures that depict some recognizable thing or scene. It includes portraits, still-lifes, and landscapes. Precisely, it includes realist art, which attempts to reproduce the actual appearance of the things depicted. Representational art contrasts with abstract art. Abstract art uses a visual language of form, colour and line to create a composition which may exist with a degree of independence from visual references in the world.

Aim of the study

The aim of the study is to test hypothesis that there are differences in perception of abstract versus representational, more realistic paintings. Hence, I want to compare whether people look diversely at different styles of art pictures, that is why I choose abstract cubist paintings (for example Picasso) and older more realistic paintings (for example Velazquez). In addition I tried to collect pairs of pictures with the same theme, so that I could compare common eye-gaze points/patterns and number of fixations in each picture.

Methods

Gaze patterns were measured on iView eyetracking device where pictures were presented on a 19-inch computer screen. 9 point calibration was performed before experiment. 16 volunteers participated in a task, which was 4 minutes long. In that time, 27 pictures were presented, of which there was 8 pairs of pictures with the same theme painted in different style and 11 distractor pictures. Each picture was presented for 10 seconds and there was a fixation cross between each. Participants had the task to look at the pictures freely.

Expected results

I expect to find differences in eye gaze patterns regarding different styles of picture. In abstract-style paintings I expect more fixations with shorter duration, while in representational-style paintings less fixations with longer duration are going to be observed. I will analyse the data of which picture style, number of fixations, duration of fixations and position of fixations are crucial for analysis. A two sample t-test is going to be performed to test whether there are differences in perception of abstract versus representational, more realistic pictures.

Interdisciplinarity

The study focuses on human perception which is important topic in cognitive psychology. Not much has been done on the topic of perception of art pictures, although nowadays there is increasing interest in that field which is important for cognitive science and the broader horizons of it. Especially, it is interesting for understanding of art perception. Also we could see how different information as for example some abstract shape is perceived and analyzed to from a thing or a human. I believe this research is also important for the field of art history and for a number of artists who are interested in perception of art or "how we see" pictures.

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Estimating negative transfer of learning: adapting a competitive exclusion model for experimental testing

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Introduction

Learning denotes a change in problem solving efficiency with aid of prior experience. In most everyday instances, practicing a certain task for a longer period of time alone will improve performance. However, sometimes a novel task can be learned better when knowledge from a different domain is transferred to the new domain. This so-called transfer of learning is a well-known phenomenon in psychology and, in recent years, has attracted AI research as well. [1][2]

Such a transfer of extracted knowledge does not always prove successful, though: in a negative learning transfer, the knowledge of one type of domain may hinder or prevent the learning success of a new domain. In the classic AB-AC list paradigm, for example, learning a set B together with set A may decrease the learning outcome when the target set C occurs with A as well – a major problem in language learning.

While positive domain and feature transfer enjoys increasing popularity in computer science, few (if any) research focuses on negative aspects that certain knowledge domains might have on target domains. [1] Negative transfer usually is dismissed as undesirable (since it means worse than normal performance), summarizing it as false similarity of either features or tasks. [2] A formal description of negative aspects of learning nonetheless might prove a fruitful inquiry, since it seems to be a common and repeatedly occurring cognitive process.

Niche competition

This paper aims to present a first account of the functional properties behind a negative transfer by modeling the conflicting domains as competing niches, weakening each other by using the same shared features for the predictions. We adapt the competitive exclusion principle from the field of biological ecology, [3] saying that if two species consume the same resources in the same ecological niche, (at least) one will have a worse effect than in a non-competitive environment; if one species is taken out of the system, single-species equilibrium is reestablished.

Computational Modeling

We model the two task domains as competing niches, the overlap of which constitutes a space where learning is impaired. A competing niche algorithm is applied to learn our source dataset, then showing a worse than normal performance when applied to our target dataset*. Once the program becomes aware of its malperformance, the learned features of the source dataset are erased with a power function, simulating the forgetting rate of previously acquired knowledge. As a result, the target domain will be learned at a faster rate, even though source and target share a substantial amount of features (usually considered to aid learning).

*datasets to be determined yet.

As for the computational section of our research, we aim to account for the key factors involved in negative transfers: similarity of extracted features, domain size, and further. This would allow predictions for behavioral experiments when to expect a negative learning transfer. We predict that, comparable to resource competition in nature, an unsuccessful domain transfer in cognitive tasks can be modeled as a competitive environment.

Behavioral Experiments

In order to validate our assumptions concerning the source domain size, perceived similarity of tasks and such, two behavioral experiments will be conducted, where knowledge (source) and prospected learning outcome (target) are calibrated in a relation similar to the data sets used. The distribution of negative results is based on similar knowledge compared to the desired outcome of the task, rather than the nature of source and target.

Methods

in the sensorimotor experiment, subjects perform small, easy-to-learn tasks with a joystick in a virtual environment on a screen.

(for example, learning an accuracy-demanding task which, after a high success rate is reached, then has to be performed inversely). Data will be recorded with a trigger that allows the participant to perform the tasks on a screen. If the niche competition approach remains a valid assumption, similar distributions of negative-then-positive learning curves can be predicted. After a predefined number of trials for one task, the aim of the task will be changed to a seemingly similar task, where structural knowledge of the previous task will not aid but in fact hinder performance as compared to being naïve to the novel task.

In the second experiment, participants are asked to learn a list of Spanish and Portuguese words. Afterwards, they are asked to answer questions about the word morphology of the list of the language they learned later. Participants do not speak nor understand either of the two languages and ideally do not have extensive knowledge about roman languages in general. Expected results will provide evidence to the plausibility of modeling a negative learning transfer as competition between two domains, depending on size and similarity.

Conclusion
This would contribute strong evidence for a probabilistic approach to cognition, rather than being deterministic, since learning success would not be stored as single elements that will be recalled by a certain set of functions when needed. Rather, the mind applies previously learned theories of the world that are controlled for outcome while being executed. Negative transfer hence ought to be described as confusion of relation between structural properties of two domains.

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Posters

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Breathing through pursed lips aids in reducing stress anxiety

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Introduction
Breathing is a physiological function that can be either voluntary or involuntary. A wide known fact supported by various research shows that breathing is affected by our mental, cognitive, and emotional states and that breathing dysregulation plays an important role in anxiety disorders (Wilhelm, Gevirtz, & Roth, 2001). There are many empirical studies covering the application of breathing retraining on anxiety and beyond anxiety management, i.e. hypertension, chronic obstructive pulmonary disease, cardiac rehabilitation (Gilbert, 2003). In this abstract we present the effect of breathing retraining based on breathing through pursed lips on subjects with anxiety disorders.

Methods
45 subjects with anxiety disorder were asked to participate in a 10-minute task in which a computer program would randomly select one graphic image from a wide variety of images representing accidents, phobias, tragedies and stressful situations. The subjects were asked to observe the image on the computer screen and exhale through pursed lips as they would see the image fade away in accordance to their blowing. During inhalation the image was replaced by another one. The subject was instructed to play this game using the computer program for 10 minutes each day for 30 days. The subjects anxiety was assessed used the Hamilton anxiety scale three times during the experiment (Hamilton 1959); before the first breathing session, after 14 days and after 30 days.

Expected results
We predict a reconditioning of the stress response to an exhaling breathing pattern which increases parasympathetic activity and decreases heart rate. Thus we expect a progressive decrease on the Hamilton anxiety scale as well as a change in breathing patterns in stress inducing situations. We might have some difficulty determining the level of anxiety induced by the images. The set up, being simple as it is, could be a valuable self help tool in breathing regulation for patients with anxiety disorders.

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Optimizing Preprocessing Pipeline for MR Images

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Introduction

After images are processed in a magnetic resonance scanner, further treatment will have to take place, before the actual analysis can occur. For this purpose the preprocessing pipeline converts the data format from the proprietary scanner, which is DICOM (Digital Imaging and Communications in Medicine), to the so called NIfTI format (Neuroimaging Informatics Technology Initiative). DICOM is a standard for medical imaging which contains patients' data, such as patients ID, name, date of imaging, disorders or experimental issues. DICOMS also include a communication protocol, to support communication between different systems, due to the standardizes format.

The NIfTI format was specially designed for the scientific analysis of brain images. It is simple, compact, but still versatile. The most important feature of storing spatial orientation data within the file is a necessary component for analysis in brain research. Without a proper orientation, brain activity cannot be evaluated. The resulting NIfTI images enclose essential spatial information in order to reduce the chance of errors, which would lead to wrong interpretations.

Properties and goals of this project are to implement a data processing script in Matlab®, which arranges a sorting data structure for the different image formats. Since this procedure involves a lot of steps and errors can appear at any given state, it is also needful to report any failure that may occur while processing and especially the particular source of it. The script suppose to enable a fail-safe handling and design a user-optimized program for every researcher who may deal with it, without implying any further programming skills.

In order to provide for conversion from DICOM to NIfTI, images are preprocessed in a pipeline, which was programmed for this purpose to attach the necessary data for spatial orientation. The images must first be functional and anatomical preprocessed, realigned, which means that slight and unavoidable patient movements during the brain scan will be corrected, so anatomical and functional data merge again. The next procedure is a slice time correction. Images are taken in slices and cannot be processed all at the same time. But since e.g. stimuli occur at a certain time, it is necessary to adjust brain function and time afterwards. To allow comparison over studies, it is required to normalize the brain images to a standard brain. Since every brain morphology is individual, the images will be squeezed and stretched until they cover a standard anatomical brain image. In the end regular image processing take place, such as noise filtering and smoothing.

For converting the data, the medical MR center worked so far with a data structure, which was mainly implemented in Matlab®, but partly also in Python. The preprocessing pipeline itself runs in SPM8, a script implemented in Matlab®. Data arrangement and storage though was realized in Python. Since the programming language Matlab® became an important scientifically established and popular computing tool, also for the use of image processing, it is nearby to concentrate the internal data handling of the MR center on this approach and allow an easy, as well as transparent handling for every common user.

Methods & Results

In case of any form of interruption during the conversion process of DICOM to NIfTI, the script checks if all DICOMs are converted and applies the processing features according to whatever paradigm the researcher designed for the study, since every preprocessing has to be customized to the respective conditions of the specific study.

Mostly several measurements for each patient occur in a study. The script also allows applying different paradigms for each measurement, if this is desirable. In the end a report text file informs about all steps that have been taken place and issues that appeared during the preprocessing. Due to these features, the implementation allows a user-friendly and pragmatic handling.

Playing and Learning

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Introduction
The targeted elementary and middle school player of the logic puzzle game with 2D physics needs to take advantage of the physics rules such as gravity, power, speed, acceleration, centre and balance. The player also improves his aiming and accuracy.
In this project we are going to use online flash Fireman Tricks game created by Logamic. The goal is to get water to the fire and extinguish it. The fire is hidden bellow physic obstacles which need to be moved. The hints for the player will be revealed one after another in case the player would be unsuccessful more than five times in the same level and teach the player the rules of physics.

Research analysis
The game implements Mochi Media API to analyze the user events such as clicks, trials, length of session... The game was so far played by 50 000 unique users all over the world. From the data we can see how many times the player tried certain level, if he understand the physics behind it which he needed to take advantage of and how hard the puzzle was. According the results the players had the biggest difficulties to grab the following physic issues which we solved via the following hints.

Error Correction
The player can learn from his previous mistakes and enhance his aiming and accuracy. It means that from the last location of the bird on the screen where the last throw of the water drop from the bucket occurred, stays a stamp of the bird. From the bucket stamp goes trace of the drop fall. The player can position himself better for next throw and can learn whether he needs to adjust the height, speed or better angle and accuracy of aiming.

Hint of higher speed
The speed priming animation before the level, where the bird will be in the position like he is flying fast. There will be drawn wind behind him with distance it needed for gaining the speed.

Hint of higher height
People know that if they let fall an object from higher height it's going to have stronger power because of the gravity. Before the level we use priming animation where firstly a stone would fall from 1 meter height on the wooden bars and nothing much happens. Secondly we let the stone fall from 10 meters height on top of the same wooden bars and the bars just get smashed. From that the player should understand he needs to take advantage of big height and the gravity.

Hint about centre and balance
People subconsciously understand what centre and balance is. In case we detect in the game that the player lets the drops fall on top of the stable parts of the objects near the centre which results in failure of throwing away the obstacle then before the level an animation will be shown where will be two wooden bars in shape of letter T. Hammer will be hitting the top close to centre and the wood doesn't fall it would hardly move. But if the hammer hits further from the centre by the edge the top piece falls of.

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Embodied communication: Gesture synchronization in video chat experiment

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During communication process, gestures are frequently used to facilitate the expression of a message that a communicator is trying to send. According to the Information Packaging Hypothesis, gestures, together with language, help in the conceptualization of thoughts. Gesturing facilitates the communicator to express one's thoughts and they are more frequently used when the conceptualization of the content is more difficult (Hostetter & Alibali, 2004). However, not only the communicator has benefits from gesturing. Gestures also help the recipient to understand better. It is discussed that the neurological background for this lays in a neurological system called mirror neuron system. Iacoboni and Mazziotta (2007) state that two areas in human brain (posterior inferior cortex and rostral inferior parietal brain areas) become active just while observing movements of other people. These areas are in fact mirroring other peoples' action, activating the same internal motor representation of the action, as if we ourselves were performing it. It is a simple neural mechanism for understanding actions that other people do. This synchronization with the behavior can be a basis for the understanding of other peoples' messages. As suggested by Gallese, Eagle and Migone (2007), this mechanism of 'shared activation' is a mechanism of embodied simulation which enables the receiver to understand actions or emotions that the communicator is experiencing. This system is also held responsible for unconscious synchronization with other people in body postures or gestures. Regarding the previous statement, a hypothesis for this research has been made. It is assumed that recipients will synchronize with the communicator by imitating corresponding gestures in order to achieve better understanding of the message the other is trying to communicate. The goal of this experiment is to test if participants synchronize in gesturing.

To test this hypothesis, a procedure which uses video chat has been chosen. Video chat has methodological advantages that enable recording the participants without them being aware of it. The participants were able to see the entire body postures of their partner. 99 pairs were tested during a video chat conversation divided into three categories. The categories were 33 male-male dyads, 33 female-female dyads and 33 male-female dyads. Half of the participants were given a task to describe a picture of a house and the other half had to describe a short cartoon. The picture and the cartoon are appropriate material to use in the experiment as their content is difficult to conceptualize and according to the Information Package Hypothesis, an increased amount of gesturing would be required during the description process. Differences between men's and women's gesturing will also be analyzed. Theparticipants' interaction was recorded and subsequently will be analyzed using computer vision methods (motion energy and optical flow). Motion synchronization in gestures will be analyzed in vertical and horizontal motion in cross-correlation matrices. Because the communication isn't only a verbal process, yet it involves our entire bodies, it is important to assess how this process operates and to put an emphasis on important question whether understanding is also part of embodied process in communication.

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Variation in Mind Wandering during class

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Introduction
Mind wandering is not uniquely define yet, mostly is considered to be experience of thoughts which are environment or tasks unrelated. It does not remain trapped for a long time in a particular topic, especially when people are not engaged in a task that requires their attention (Schoolar, 2011). Inspired by Killingsworth and Gilbert's (2010) research we devised a similar research question, aiming to population of students of University of Ljubljana. In the research we are presenting here, the main research question was how much students are present during different lectures and what is their mood during them.

Methods
Because there is no clear example in the present science literature, we decided to form our own research method. Our pilot research was performed in a form of modified experience sampling method. During the different lectures a random moments were selected where students were asked to described their current experience. For this reason a random sound generator was programed. We tried to quantify experiential reports by asking participants to place their experiential state into two dimensional plane: one axis presenting their thoughts and the other axis presenting their attention. Participants were also asked to evaluate what kind of mood were they in at the time just before the signal emitted by sound generator. At the end of the questionnaire the participants were asked to write down some basic demographic data. There were six random signals performed during two different lectures. 28 test subject participated in the research.

Result
We were able to analyse the data along different pairs of variables according to type of study program (Cognitive Science and Philosophy): position of attention in relation to gender, position of thoughts in relation to gender and mood in relation to gender. Our expectation that there will be the difference between attention of philosophy and cognitive science students was not confirmed. Due to different conditions (different lectures) in which the research was preformed and due to the minimum differences in data, we concluded that there is no significant difference between both groups of students. But still we managed to get some interesting comparisons. Perhaps the most interesting is the difference between signals which showed that general attention was much more focused during some periods and less during others. This last result let us to idea that similar method could be successfully used as a way to evaluate lecturers ability to draw attention of the students.

Conclusion
In this line we would believe that further studies could yield interesting results, one of them being improving quality assessment methods of a higher education lectures.

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3D triangulation as a method for evatluation of dystonia in patients with torticollis

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Dystonia is a neurological movement disorder which causes involuntary sustained muscle contractions. It may affect the whole (generalized dystonia) or parts of the body (focal dystonia). In our project we had to deal with a special case of dystonia named Spastic torticollis. Torticollis is a focal dystonia of the neck muscles resulting in abnormal postures of the neck, head and shoulders. Dystonia can be primary (unknown cause, often genetic) or secondary (symptomatic, due to other diseases, e.g. cerebral palsy). Pathophysiological mechanisms involve imbalance of neurotransmitters in the basal ganglia.

The established first line treatment of focal dystonia is the infiltration of affected muscles with botulinum neurotoxin which is the most potent natural toxin that inhibits neurotransmission at the neuromuscular junction through blocking acetylcholine release, resulting in a state of chemical denervation and rendering the muscle unable or less able to contract. These effects last between 2-6 months and then resolve.

The main goal of this project is to develop an instrumental method which will objectively evaluate the degree of dystonia and the effect of botulinum toxin treatment in patients with torticollis by using a 3D surface measuring method.

This student project is carried out in the interdisciplinary context of neuroscience (Department of Neurology, University Medical Center Ljubljana) and mechanical engineering (Chair of opt dynamics and laser applications, Faculty of Mechanical engineering, University of Ljubljana) as the part of the LASTRIM (Laser triangulation in medicine) project. The technical part (3D surfaces measurement method) is done by the mechanical engineering faculty researchers.

We are comparing three methods for the evaluation of torticollis and the effects of torticollis treatment: (1) the Tsui rating scale (a subjective rating scale for evaluating the degree of spastic torticollis); (2) the global scale of improvement; both of them semiquantitative, largely subjective and clinically based; (3) 3D surfaces measurement of the human body as a new method for completely objective evaluation. This method, used in dystonia for the first time in the present study, is gathering a measure for the angle deviation of a patient's neck position, providing a more objective assessment of dystonia as well as more accurate evaluation of botulinum toxin effects.

With the development and clinical introduction of the 3D measurement method, we expect to improve medical evaluation of torticollis, enhance the selection of neck muscles that need to be treated with botulinum toxin and provide a more objective study method of the therapeutic and/or adverse effects of botulinum toxin. The main idea is to gather data faster and in a more meaningful way, which will improve the decision making process done by the medical staff.

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Intelligent Tutoring System for Salsa Dance

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Introduction

The long-term goal of the project is to build a dance tutor that could function as a part of a system in educational and other pedagogical disciplines. This involves learning to recognize basic salsa dance elements, specifically various dance steps from the motion data, recorded using Animazoo motion capture equipment and software.

Methods

An upgrade of existing tutors functionality was essential by improving the recognition of dance steps in real time. The recording of multiple dance subjects was necessary to improve the learning capabilities of the system. The gyroscopes were used as a part of a tutoring system that records the rotations of the major joints of the human body. The recorded data was preprocessed into human understandable form and classified for effective recognition of dance steps.

Results

By using several recorded dance samples from an expert (and amateour) we made the system tutor more tolerant to faults. Furthermore, a greater accuracy was achieved in step recognition. The data were preprocessed into machine and human understandable form to be able to find differences as well as similarities in the movement data. By using K-Nearest Neighbor algorithm and Markov Chain we managed to improve the classification accuracy in steps recognition process and to reduce the number of Animazoo gyroscopes from 19 to four.

Conclusion

This project is trying to present a specific classification of human dance steps that are presented in a form of time series. One of the goals of our work is to build an unexpensive Intelligent Tutoring System (ITS). Therefore the software based on 19 gyroscopes is not an option. The fully fuctional ITS can be easily extended for use in health care as a part of rehabilitation process after injuries or similar.

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Scanning the World: Eye Gaze as a Measure of Social Attention

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Social attention in real world settings is triggered by several behaviors that are linked to socially relevant information. Social attention is defined as the processes by which observers select and encode aspects of other people (Frank, Vul, & Saxe, 2011). Cues that our brains use to interpret an actual social event are found on basic levels, such as gender, speed, and body motion of the people present in the scene (Shiffrar, 2008). It is imperative to study this phenomenon in real world settings, because previous work on social attention was limited to laboratory studies. This study combines behavioral observation with visual attention in a natural environment. The aim was to find out which factors elicit social attention on a subliminal level. It was conducted with the use of electric occulo-graph (EOG) and surveillance videos that can hold social events in a natural environment. Tested were 100 randomly selected people (50 male and 50 female). We projected videos from surveillance cameras of an underground station on four screens simultaneously. The participants' task was to monitor the screens and to look at the things that triggered their attention. The experiment consisted of four trials, each consisting of two-minute video parts. Participant's gaze direction was measured with an EOG. We used a four channel configuration, which simultaneously records vertical and horizontal eye movements using LabChart software. We annotated behaviors occurring in the videos with a catalogue consisting of 8 items. Results of our study showed that a certain part of visual attention is reserved for random scanning of the movies, but the attention is not randomly distributed. People pay greater attention to evolutionary relevant cues, such as intentions of others (potential threat) and unexpected events (Birmingham & Kingstone, 2009). We also found sex differences. The behavior coded as "forbidden object" caught the most attention to male participants. That means that attention of males was mostly triggered by the objects that are prohibited on the train station. With our study, we could show that visual attention can be used as a measure for relevance of a given scene. This research is part of the European VANAHEIM* project.

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hiffrar, M. (2008). The Visual Perception of Dynamic Body Language in Embodiment of Communication in Humans and Machines, ed. Ipke Wachsmuth, Lenzen M., Gunther K., 95–109. New York: Oxford University Press. *VANAHEIM: European FP7 project (Video/Audio Networked surveillance system enhAncement through Human-cEntered adaptIve Monitoring).

The cognitive bases for social attention in real life situations

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Human sensory systems are confronted with large amounts of information. Processing every detail about the environment would overload our cognitive system. That is why humans have evolved sensory biases towards evolutionary relevant stimuli over irrelevant stimuli (Birmingham et al., 2008). We hypothesized that there are social cues that attract relevant numbers of individuals, thus attention should not be randomly distributed; behaviours are biologically determined and therefore vary among sex. The experiment took place at Vienna University.

A total of 100 randomly selected participants (50 women and 50 men) took part and were naïve to the purpose of the experiment. Demographic data was collected. The experiment lasted for 16 minutes (8 two-minute movie-clips). There were 150 movies in total, collected from Torino automatic underground station surveillance cameras. Movie clip scenes were compatible in terms of basic layout- they were randomly selected (RS) without replacement. The average age of participants was 25 years old. The task involved subjects watching four movies at once for 2 minutes. Every 2 minutes a new set of four random movies appeared on the screens, repeatedly for 8 times. When an event or behaviour triggered their attention, participants had to decide and press a corresponding key to the respective movie. The behaviours in the movie clips were annotated with a behaviour catalogue consisting of 10 behaviours . We analysed the data with SPSS in order to search for statistical differences. The distribution was skewed to the right therefore we used the non-parametric tests. We used the Kruskal-Wallis test to obtain differences with the highest attention scores in coded behaviours. The Mann-Whitney test was used to test sex differences. Our results confirmed our hypothesis, that the attention is not randomly distributed over the movies; there are sex differences in attention scores. Kruskal-Wallis non parametric test showed that key pressing coded behaviours differ among them significantly.

The coded behaviours we observed were: 1. Disabled people/children alone (CD); 2. Change in a group size (CS); 3. Forbidden object (FO); 4. Group (GP); 5. Left luggage (LL); 6. Standing around/loitering (LS); 7. People running (PR); 8. Turnstile problems (TS) and NO- no action/code. "Groups" and "change in group size" attracted significantly more attention than others ($\chi2 = 257.267$; p = .000); these are the behaviours that attracted the majority. The most coded behaviour in the movies was "groups", coded was "left luggage "(LL). The study of social attention is important to enable us to understand how our cognitive attention system selects and prioritizes relevant events in our surroundings. The presented study provides one of the first attempts to explain social attention in the complex social word. References

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Prosody of Motherese

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In everyday life, it is not difficult to notice that parents and caretakers alter their speech when talking to toddlers and infants. This type of speech is called Motherese or better yet infant-directed speech, because it can be observed in more situations than only in mother-infant speech. Motherese was first described and named in 1964 by Ferguson, but only spectrographic analysis allowed studying prosodic features of Infant-Directed Speech (IDS) in more detail. These studies captured certain linguistic and prosodic features that were different from adult directed speech and characteristic for IDS (Remick, 1976; Garnica, 1977).

Studies describing Motherese were conducted in many languages and after a few cross-linguistic studies a hypothesis arose that there may exist a Universal Motherese – a set of features that are similar in infant-directed speech in multiple cultures. Similar features of infant-directed speech were identified in many non-tonal and even tonal languages (Grieser, Kuhl, 1988). However, this hypothesis has also been disputed mainly in some cultures where the infant-directed is scarce, but the existence of so called non-Motherese societies was based only on one single informant research by Heath in 1983 and it was suggested that this may be a misleading approach (Haggan, 2002).

The goal of this work is to propose the experiment that would go forward with the support of the theory of Universal Motherese by studying infant-directed speech in Slovak language, identifying the features different from adult-directed speech and to compare it with other studies in this area to perhaps confirm the similarity and universality with other collected infant-directed speech data. The proposed experiment will involve 8-10 children to ten months of age and their mothers in home setting. 10 to 15 minutes of recordings of infant-directed speech as well as adult-directed speech of mothers with other adult person to compare is deemed to be sufficient to extract all the features necessary in follow up computer analysis.

The results will be compared with other studies which talk primarily about several prosodic features that can be measured by sound and computer analysis. The fundamental frequency or pitch, frequency range per sample and phrase, duration of pause and phrase, number of syllables and phrases per sample and various others. In according with the theory of universal motherese the fundamental frequency should be significantly higher, pauses longer and utterances shorter with fewer phrases and syllables as opposed to adult-directed speech. This experiment will be realized as a diploma thesis of the author in the following year.

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Henry Rider Haggard's "She" and Cognitive Dissonance

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Background

Human beings are constantly trying to align their self-concepts with their beliefs. As a result, most people tend to conceive of themselves as "moral" people. If they do not manage to be sure of their morality while believing that it is important to be moral, they are likely to face cognitive dissonance (psychological conflict resulting from incongruous beliefs and attitudes held simultaneously). The worldview of late 19th century colonial Britain contained many morally questionable attitudes (mainly racism and misogyny), which were generally accepted and perpetuated. Focus For this project, I have chosen a par excellence case of cognitive dissonance – Henry Rider Haggard (1856-1925) was a man who spent seven of his formative years in Africa as an assistant of colonial officials. At the same time, he was a writer and a scholar whose writing reflected existentialist thought and utmost intellectual sincerity. His novel She [1] is commonly referred to as an adventure novel suffering from both genre limitations and discrimination. However, there is a high proportion of philosophising. The character of She has a complex, distinct worldview which would not seem to have any purpose if She was to be discarded as easy reading. I propose that She can be interpreted as a result of Haggard's internal struggle between the worldview of colonial Britain imposed on him (represented by the narrator) and his intuition (represented by She).

Method

The central paradigm of this project is cognitive philology, the study of textual material as the product of human cognitive processes. My research consists in analyzing the text through the optics of two theories: schema theory which holds that all knowledge is organized into units; and text world theory which claims that human beings understand discourse by constructing complete and coherent mental representations (text worlds). These are applied to the text in order to identify the manifestations of author's cognitive dissonance.

Results

The main results of this project can be summarized as follows: Haggard's intuitions, as reflected in the character of Ayesha, contained many attitudes which anticipated the socio-cultural changes of the 20th century, for example the emancipation of women, vegetarianism, secularity, moral relativism and economic thinking. Despite the fact that all this is set within a popular and Victorian-friendly plot, where these visionary attitudes not always consistently mix with typical genre-defining features (eternal love, cruelty, happy ending), the representatives of colonial Britain are unexpectedly vague in defending their worldview. All this is making up for an interesting mosaic, which can be looked upon as a "map" of Haggard's cognitive dissonance.

Conclusion

It is necessary to stress that despite being likeably wrapped as an adventure novel, She is a highly psycho-socio-culturally significant book which enables us to illustrate the impact of writing and reading literature on individual and group cognition. This project indicates that human striving for consistency is invariable throughout history, but at the same time the moral consensus is highly context-dependent, which could contribute to the discussion about the nature of morality and to a better understanding of historical processes through cognition.

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Touchscreen to Reality: Can kea mountain parrots transfer behavior from a computer to real-life situations?

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This project tested the question:
Can kea mountain parrots (nestor notabilis) learn a behavioural pattern on a touchscreen, and then transfer this behaviour to a real world situation when confronted with similar stimuli in the form of a three-dimensional box?

Pilot Study:
As it had not yet been tested whether kea could transfer knowledge gained on a touchscreen to a real-world situation, there was first a small pilot study on picture/object recognition. Kea were presented with a simple image discrimination task on the touchscreen. Once they performed reliably on this task, they were presented in reality with the same objects encountered on the screen. If they showed the same response in the real world situation as on the touchscreen, or if they matched more to this response than naïve subjects, this was a good indicator that they could make the transfer.

Main Study
The kea were alternately confronted with two distinctive images on the touchscreen. The visual stimuli were presented in the form of a single flower design image, but divided into 9 panels. Each of the two images required a different type of action for reward. Image A required that the kea peck the screen in a dispersed way. Image B required a persistent type of behaviour, where it was necessary that the kea repeatedly peck the centre panel. Once the kea could reliably perform the two behaviours on the touchscreen, they were presented with a three-dimensional box. On top was the same image they had encountered during the touchscreen training, this time displayed on wooden tiles. The task here was that they had to remove the tiles from the frame for reward, and they had to show the same type of behaviour as on the touchscreen; namely, when presented with image A, they must remove the tiles in a random, dispersive way. When presented with image B, they must persistently remove only the centre tile.

Discussion
These experiments tested several different cognitive aspects in the kea. First, transferring knowledge from a two dimensional touchscreen to a three dimensional object shows flexibility in learned behaviour. It also highlights abstraction away from context, in the sense that they perceived an image as not only being the same, but as signalling the same type of behaviour in two quite different situations. This abstraction was impressive, as the image on a touchscreen consisted of pixels, and the image on the box was made of paint. Object affordances were also highlighted in this study, as the touchscreen affords a pecking action whereas the tiles in the box afford a gripping and removing action. Because of the different affordances of the two modalities, simple associative learning can be partially ruled out, as more complex mechanism must also be at work. If the kea comprehends that the same behaviour type is required despite the different specific actions, this shows that it has learned a behavioural rule which goes beyond the actions themselves.

ERP Measure of Automatic Number Processing

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Number cognition is a topic of growing interest in the field of cognitive science. Recent investigations have shown that humans, both pre-linguistic children and adults, as well as animals, possess a special intuition of numerals called number sense [1]. Generally, two systems of number representation have been identified in the literature: the former dealing with approximate representations and the latter - with precise representations of numerical magnitude [2]. Different mathematical operations are associated with different number systems: subtraction employs the approximate representation of numerical magnitude and relies on online strategies, while multiplication uses the precise representation of numbers and is believed to retrieve the information replying on multiplication tables stored in long-term memory. However, the case of addition is slightly more complicated because it can rely on both core systems. It is suggested that single-digit additions are retrieved from the memory, while more complex operations with multi-digit Arabic numbers rely on the approximate number system [3]. Our project aims at exploring the automaticity of number processing in humans by analysing behavioural data and comparing event-related brain potentials (ERPs) during comparison and addition tasks of one-digit Arabic numerals. Our hypothesis suggests that adults automatically process one-digit numbers by adding them. This has been tested in two separate EEG experiments. 20 female right-handed students, aged between 21 and 27 years old, were recruited for the study and took part in both experiments on two separate days. All participants had no history of neurological or psychiatric disorders and they were asked to give informed written consent. In both experiments, two numbers A and B were shown consecutively, followed by a third target number. The same stimuli were used for the two experiments, only the task was different. In the comparison task, participants had to decide if the third number was either A or B, while in the addition task, whether the target number was the sum of A and B. Experimental conditions varied the target numbers; they were the following: A's or B's (comparison condition), their sum (addition condition), sum+-1 (approximate addition condition), or unrelated prime numbers (unrelated condition). A total of randomly selected 144 trials were shown in every experiment and each experiment lasted for about 30 minutes, with 2 pauses in between. The stimuli were presented using E-Prime (2009 Psychology Software Tools, Inc.) and behavioural data have been collected and analysed using SPSS. ERPs were derived from the EEG recordings using a cap with 32 electrodes (actiCAP 32 channels). The ERPs from the two experiments were compared in order to define an electrophysiological trace of automaticity of addition. Reaction time and accuracy of responses were analysed. The participants had accuracy ranging between 93 % and 100 %. They were divided into two groups, depending on whether they have started with the first or second experiment. The behavioural analysis showed no significant effect on group and task alone, but a significant interaction between group and task, which suggests that the RT of the second group during the comparison task was influenced by the addition task executed beforehand. The EEG data was pre-processed using ocular corrections, filters (low pass 30 Hz, high pass 0.1 Hz), editing of channels (excluding ocular electrodes detecting for blinks), raw data inspection (excluding corrupted data), and segmentation of the four stimuli. ERP grand averages from experiment 1 and experiment 2 for both groups were compared separately. The following factors have been selected: lobe (frontal, central, parietal), hemisphere (left, central, right), task (experiment 1, experiment 2), and conditions (the four conditions mentioned above). The preliminary results suggest a significant difference between frontal, central and parietal activation. There was a positive effect observed for addition at 200 ms, as well as late parietal positivity. All in all, the current results confirm an activation specific for the addition condition which is different from all other conditions.

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Effect of the sensorimotor contingency of visual stimuli on animals

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In 2011, there were some series of efforts made in the Saimiri monkey(Saimiri sciureus) lab of the University of Vienna to train them to work with the touch-screen. The goal was that a monkey touches certain image out of given multiple images on the screen, then the monkey receives the reward if the touched image was correct in terms of a simple grammar such as one used in the work of Tecumseh and Hauser (2004). To achieve this goal, a monkey must learn that 1) if one touches an image on the screen, one can receive a reward, and 2) when there are multiple images on the screen, they pertain different meanings, therefore, it could bring different results, so to speak, reward or no reward. Two main problems emerged which can happen on works with any animal species. 1) Monkeys were afraid of the new object itself, the touch-screen. 2) Monkeys perceived the touch-screen as a whole object no matter what images were shown on it. To help them to perceive an image as an independent object from the screen, we made the image on the screen to move around randomly which helped them to some degree. They eventually understood the concept, but it took quite long time. This study focuses on facilitating this learning process.

To help animals to perceive an image on the screen as an object, the visual sensorimotor contingency was considered in this study. The definition of 'sensorimotor contingency' in this study is simple which is that an animal acts in certain way then the animal's environment including any object in it presents itself in the corresponding way to the animal's action. For instance, if one goes around a piano toward the left, one will see the left side of the piano. All the animals including human learn about any novel object in this way, by acting on it. Held and Hein (1963), O'Regan and Noë (2001). In this study, one device, which can provide the sensorimotor contingent image to the viewer in a close distance, was developed. This device consists of the camera and a computer. The camera captures the posture of the monkey and the monitor shows the corresponding side of an object according to the animal's posture. There was severe time limit on the period I could test on Saimiri monkeys, hence this work did not provide any specific task or rewarding system, but only the device itself and the recording of their reactions.

Due to lack of rewarding, the monkeys lost their interests on the device very quickly, therefore, the result data was not meaningful. Their reactions were active and positive on the visual stimuli on the screen. ('Active and positive' means that they were not afraid of the monitor nor image and they actively tried to examine the object on the screen. This is not a conclusion, but only a mere preliminary observation. There is no prominent conclusion so far-JUN.2012) This could be due to the sensorimotor contingency it showed, but also there are a number of other possible reasons for their behaviors such as that some of them already actively worked on another touch-screen task for a while, simply they were in the group situation so that they could be bolder, and so on. To clarify the effect of the sensorimotor contingency of the computer image on animals, more specific tasks have to be given to animals to rule out other possibilities.

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Spatial normalization at 3T and 7T and the importance of EPI distortion correction for fMRI group analysis

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When studying neural activations that are elicited by the employed fMRI paradigm, it is in most cases necessary to compare the results between multiple subjects in a so called group analysis, in order to make sure that ones finding is not a single-subject phenomenon. Variations in the size and form of the human brain across patients require it, that the brain scans are normalized—that is shifted, rotated, sheared and zoomed—to fit a reference brain template[1]. It is only after this normalization that neural activations in brain scans from different subjects can be compared, as their coordinates now correspond to the same region in the reference brain. Ever since the creation of these reference templates for MR imaging at 1.5 Tesla scanners, there has been a trend to strive for higher field strengths—such as 3T and 7T—to increase the resolution and signal-to-noise ratio of brain scans amongst other benefits. In this project, it will be investigated whether these templates are still appropriate for the resolutions and contrasts that can be found in high-field MRI. To examine this, 26 resting-state scans will be normalized. First with the original template and in a separate run with a template that has been created using a 3T MR scanner. Finally, the differences between the two runs will be discussed. In the second part of the project, the main limitation of the commonly-used Echo-planar imaging(EPI) method will be analyzed. This method is an optimization in the way the image is acquired by the MR scanner and allows for much faster acquisition times. Unfortunately though, it is much more sensitive to inhomogeneities of the magnetic field[3] due to different magnetic susceptibilities throughout the brain, but particularly in the temporal lobes and the basal ganglia. These field inhomogeneities can cause voxels—which is the name of smallest measurable volumetric unit—to be shifted from their actual position, blur out or cause the signal measured for this voxel to differ in strength[2]. Therefore, distortion correction methods should be used to control for this variability. While this effect can be easily seen in single-subject scans, it is not clear whether group comparison studies are also affected by it in a significant way and therefore require a correction for distortion as well. To further investigate the importance of this correction method, the results of a group-analysis with and without distortion correction will be compared and their differences reported.

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The significant correlation between potencies of tryptamines to block the NMDA channel and their potencies to block the ifenprodil site

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To decipher medical functions of drugs and their effects on treating certain neurodegenerative disease in pharmacotherapeutics, Structure Activity Relationship (SAR) study investigates the interaction of the mechanisms of drugs tryptamines (Ts) with the N-methyl-D-aspartate(NMDA) receptors. Melatonin, Serotonin, LSD and DMT as well as many other members of the tryptamine family, derived from an amino acid called tryptophan very known as tryptamines, play critical role in different clinical treatments. SAR study is characterized, in this lab, by its concerns in the correlation between the effect of drugs on human and its molecular structure. This correlation is assessed based on series of molecules; each has its own structure characteristics which describe its biological activity. As a type of ionotropic glutamate receptor, NMDA receptors play significant roles in excitatory neurotransmission and synaptic plasticity and considered to be targets of therapeutic interest, including neuroprotective drugs. Building on a long experience with compounds acting as inhibitors at NMDA receptors, our lab became interested in [3H]ifenprodil binding. Ifenprodil specifically is being under investigation due to its effect on inhibiting glutamate (GluN1) and GluN2B NMDA receptor subunits, and to its potential use in the treatment of various neurological disorders such as Parkinson's, and Alzheimer's disease. However, ifenprodil as NMDA receptor antagonist, which easily crosses the blood-brain barrier, may cause behavioral as well as physiological effects. Perceptual alterations, hypotension, dysphoria are manifested as a result of low doses of such drug, whereas higher doses cause other behavioral manifestations such as hallucinations, confusion, agitation, paranoia, and excitement. Such severe side-effects which often lead to memory impairment and disturbance of logical thinking have up to now limited the use of NMDA receptor antagonists as therapeutics. Selective inhibitors of NMDA receptors with the NR2B subunit seem to have a more favorable therapeutic index. Therefore, SAR studies at this site may result in pharmaceutical leads to the treatment of highly relevant brain diseases without producing intolerable side effects. In the project of our lab, we try to test up about 64 different tryptamines as inhibitors to find out how they interact with [3H] Ifenprodil binding to rat brain membranes. Since tryptamines have been shown to block the NMDA receptor (Berger 2000 Neurosci Lett 296:29; Berger et al 2012, Current Medicinal Chemistry, in press), the next step now is to find out by which site(among the 4 NMDA subunits). Tryptamines might easily block this ligand-coupled ion channel by going directly into the channel, but they might also block by interacting with the "Ifenprodil-site". Detailed structure/activity relationship (SAR) studies have been already performed at the channel binding site; now, some more studies at the ifenprodil site are following by screening different tryptamines at NMDA, 5-HT 1A and 5-HT 2A receptor; as a comparative binding and modeling study. Preliminary results point to a significant correlation between potencies of tryptamines to block the NMDA channel and their potencies to block the ifenprodil site. To name but few, 5-Carboxamidotryptamine (5-CT) and serotonin at 5-HT 1A receptors, and 2-Me-4,7-Cl2-T (1.2 µM) and 2,7-Me2-4-Cl-T (2.0 µM) are tryptamines screened to have strong potencies on these receptors. Carrying out this study, the computing tools MOE 2009.10 and the statistical software SYSTAT (Version10.2) have been used. The data of this research were transformed into negative decadic logarithm and subjected to Quantitative Structure-Active Relationship (QSAR) modeling.

The influence of verbal and visual processing resources in the generation and application of recursive representations

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Recursion is a term used to describe the process of embedding a constituent inside another constituent of the same kind, establishing a dependency between two constituents of the same category. The development of the human ability to represent recursion has been described as an important step in the evolution of language [1]. In order to investigate whether recursion may be used independently of language, we developed a method to assess recursion in the visual domain [2]. Since the available literature suggests that visual and verbal working memory are processed independently [3], our results in previous research with this method propose that verbal resources may be more strongly activated in recursion than in simple hierarchical embedding. The first goal of this study is to identify whether the ability to process verbal and spatial information (i.e. working memory) correlates with the ability to perform adequately in a visuo-spatial recursion task (VRT) and in a non-recursive embedded iteration task (EIT). The second goal is to assess if the generation and the application of recursive representations dissociate cognitively. The hypotheses are that: i) The ability to perform adequately in a visual recursion task will improve after explicit instructions; ii) the generation of abstract recursive representations (and not its simple application) will be more correlated with verbal working memory than in EIT. To address these questions we analysed performance in the above behavioural computerized tasks (VRT and EIT) in two distinct conditions: rule generating (RG) and rule application (RA), where subjects have to choose the correct image following a rule-based (recursive or iterative) sequence of visual stimuli. For the RG condition, subjects perform the 2 tasks without receiving explicit information about the two rules, but only auditory feedback for their choices. Then, for the RA condition, subjects were explicitly informed about the rules and perform both tasks without feedback. Between both conditions they also perform a battery of standardized cognitive tasks which assess different cognitive abilities: Tower of Hanoi (ToH), Corsi Blocks (Corsi), Digit Span (DS) and Wisconsin Card Sorting Task (WSCT). Preliminary results with 17 participants seem to suggest that RG and RA conditions dissociate cognitively, both for VRT and EIT. While the RG in VRT is more associated with prospective planning and sequential problem solving (ToH), RA in VRT was more associated with verbal working memory (DS). Furthermore, while RG in EIT was more associated with spatial working memory (Corsi) and with modulation of impulsive responding (perseverative errors in WCST), RA in EIT was more strongly correlated with verbal working memory -although less than in VRT. Interestingly, despite equal performance between RG and RA in VRT (93% vs. 93%), the cognitive abilities that predict it in both conditions are different. This seems to suggest that although the usage of explicit rules (more associated with verbal resources) may be used in VRT, it is not a necessary condition for good performance. References

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The effects of different kinds of imagined movements on the accuracy of a BCI system

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The subject that will be briefly discussed in this paper are the brain-computer interfaces (BCI) and the aspects of a research related to this topic. BCIs can be seen as an artificially established way of interaction with the environment using our brain, mediated by a machine. By a machine, we mean virtually anything ranging from now widespread mobile "smart" phones, to personal computers, electric wheelchairs or even cars. Such technology, when perfected, would be beneficial in assisting or treating people with impaired cognitive or motor functions, but also in various everyday situations. As such, BCIs are now a widely spread and challenging research area for many scientific institutes and universities worldwide.

For the Department of Applied Informatics at the Faculty of Mathematics, Physics and Informatics at the Comenius University in Bratislava, BCIs are a rather new research effort which is yet to be fully explored. Present research is oriented primarily on BCI operated by human sensorimotor rhythm (SMR), also called the mu rhythm [1], which is a brain wave that desynchronizes during both actual and imagined motor actions. The brain readings are taken using an electroencephalograph (EEG), which is easily one of the most used and studied devices in BCI research due to its non-invasiveness (meaning the readings are taken only from the scalp with no surgical procedure needed) and ease of use. The goal is creating a reliable interface capable of two-dimensional control of cursor in a personal computer using BCI2000 [2] software, while gathering valuable information and preparing the ground for future projects dedicated to more complex and robust systems.

In mu rhythm experiments, subjects are asked to react to a presented stimulus or to control a cursor by imagining a movement of one or both their hands or feet. The movement is usually desired to be a kind of a grasping movement, e.g. squeezing a small ball in the respective hand. What is not clear is whether the character of the imagined movement in fact affects the ability of the BCI system to correctly recognise the imagined movement and carry out appropriate action. This paper tries to shed more light into this question. In a series of stimulus presentation mu rhythm experiments, we asked our subjects to imagine different kinds of movements for each set of trials. There were three kinds of movements used in our experiments: the aforementioned ball grasping, simple waving and punching (or kicking if leg movements were desired). Each session started with a set of practice trials to familiarize subjects with the experiment. After testing all three kinds of movements, subjects were also asked to devise their own imagined movement and test it on an additional set of trials. This was a voluntary task which purpose was to potentially find a new effective movement. The experimental data was then statistically evaluated and the results processed into graphs showing the effectivity for each imagined movement.

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Tracking Eyes Tracking Photographs Tracking Brains? Investigating Photographic Composition Using a Low-Budget Eye Tracking System and Interviews

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Introduction

Based on their observations, artists like Paul Klee or Wassily Kandinsky analyzed and proposed means of composition. Authors, such as Harald Mante, a professional photographer and art scholar, adopted those ideas and defined composition principles which became famous and ubiquitous in photographic theory. Basically, these principles are in line with the traditional work of Gestalt psychology and are still object of investigation in newer fields of psychology (e.g. aesthetics). According to the Gestalt approach, we have a natural disposition to perceive patterns in stimuli based on norms which are claimed to be general and universal. Furthermore, biologists claim that humans have an innate sense of composition based on our ability to recognize organic forms which is crucial in the course of evolution. [1] However, research in the field of art theory has shown that such photographic principles are hardly based on experimental data. Thus, this project focuses on the empirical validation of such composition principles by testing the theory of Harald Mante using a low-budget eye tracking system which provides data on how we perceive pictures composed in a specific predefined way. In addition, participants are asked to describe their personal experience during the trial in order to derive knowledge going beyond the observation of their gaze movements.

Research Question and Focus

Harald Mante is an important contributor to photographic theory. By adopting ideas of the Bauhaus tradition to photographic composition, he proposed a theory on how we perceive specifically composed photographs. In his textbook "Bildaufbau – Gestaltung in der Fotografie", he explains how we are supposed to perceive example pictures presented, thus, how our eyes move. In addition, he illustrated those explanations by sketching edges on his photos marking eye movements and significant components. To put it simple, I am going to compare those sketches (hypothesis) with the eye tracking results and enrich the variety of data by interviewing participants additionally. The three research questions are: * Can we find evidence for Harald Mante's photographic composition theory by experimental eye tracking testing? * Is the subjective perception (data acquired through interviews) consistent with the eye tracking data? * Can we derive additional knowledge about subjective perception from the interviews?

Methods

A promising experimental method to examine perceptual processes in humans is eye tracking. As I have no access to professional equipment, a large part of this project is to search for alternatives and, finally, to design, construct and set up an eye tracking equipment consisting of low-budget hardware (ordinary IR webcam on a head-mounted device) and freely available open source software [2, 3]. Such a system enables me to compare eye movements (fixations and saccades) to how people are supposed to look at photographs in theory. However, acquiring data only from this observing position does not embrace the whole process of visual perception including the content memorized and diverse experiences gained. Therefore, I investigate the subjective experience of the participants by conducting qualitative interviews. Thereby, I acquire two sets of data of different qualities which I merge and analyze for consistences and contradictions. Furthermore, I evaluate the interviews for factors influencing the perception going beyond the theory tested.

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Mental Imagery Testing Suite

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The relation between mental imagery and memory has been explored rather well during the past decades, focusing both on how we recall images from memory or how mental practice influences what we remember (Kosslyn & Moulton, 2009). But there is still room for further study. While the first experiments in the area relied mostly on "pen and paper" techniques, the fast advance in computational technology allowed it to make its way into the field of experimentation. It is common nowadays to utilize personal computers to some extent during experiments. With a strong focus on the visual, and reaction times being used as the primary form of measure in many experiments centred on mental imagery, using computers seems like a step in the right direction. The goal of this project is to develop a set of specialized software tools focused on carrying out and evaluating experiments in the area of mental imagery. The overall idea is to have a easily modifiable tool that can be quickly configured to accommodate for changes in the testing protocol and/or parameters, and even be used for different experiments altogether (within the paradigm of mental imagery). The main benefit is a decrease in busywork with aids like paper templates or transfer sheets (that are commonly employed in a "pen and paper" approach), every time a change is introduced to the experiment, thus allowing for a more rapid evolution of the testing parameters. Since it is commonly required from test participants to interact with the testing application for an extended period of time during and/or before the test (such as memorizing a given image followed by inquiries about the nature of the image), a great deal of effort is put into creating a pleasant and easy to use user interface in order to minimize any negative effects of disdain or boredom in the test participants could have on their performance in the experiment. A sample experiment is carried out with help of the tool. A well documented type of experiment is chosen in order to provide a basis to which the gathered data can be compared to. The experiment is based on the scanning paradigm in spatial mental imagery as presented in (Borst & Kosslyn, 2010). In this paradigm, the participants are tasked to memorize an array of dots, and later required to visualize them and decide whether an arrow on the screen points to a location previously occupied by on of the dots. The longer the distance that needs to be scanned, the longer the reaction time. The experiment is carried out only with the help of a personal computer and no additional physical aids. The gathered data is then compared to data from a traditional "pen and paper" approach (Borst & Kosslyn, 2010). As long term goals, the project will focus on various methods that can be used to enhance mental imagery (Tartaglia et al., 2009), allowing participants to create more precise and vivid mental images, aiming to increase the the benefits gained from mental rehearsal, as shown in (Kosslyn & Moulton, 2009).

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Collaborative Design Processes out of an Enabling Spaces Perspective

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In various parts of everyday life, creative problem solving and innovation, in terms of (co-)creating new knowledge [1], get more and more attention. Collaborative design processes, as being processes consisting of (expert) actions happening in parallel, accompanied by joint negotiation and evaluation [2], are a setting in which this plays an important role. As investigating such processes can lead to a deeper understanding of their unfolding, involved structures and ways to support them, they build a fascinating area of research. A theoretical framework is given by the concept of Enabling Spaces [1], which takes into account multiple dimensions (such as physical, organisational, social, communicational, emotional or cognitive dimensions) in an interdisciplinary and integrative manner for creating a 'space' enabling innovation in terms of knowledge (co-)creation [1].

The research here is done in an educational setting and focusses mainly on the physical and social dimensions, with the aim to understand the implications for this setting, especially given by the tools. Thereby the term 'tools' denotes all kind of artefacts which constitute the physical framework for/of the process and/or are manipulated during the process. The leading research question is: What patterns of interaction, latent needs, structures and affordances in respect to the process environment can be extracted from students interaction with tools in a collaborative design process? The concrete research context is given by a high school multimedia design class in Vienna with students working collaboratively on a small design project of film animation in groups of three people. The research was done as qualitative field research, the main methods including observation and qualitative interviews with students and teachers. The field research was thereby divided into basic and deepened phases accompanied by literature research and expert interviews arranged in a cyclic and iterative research process [3].

As a first step, tools (such as tables, paper, sketches, laptops or graphic tablets) and their position and role linked to the place and context were identified and the interaction of the students with these tools during the design process was observed. The following preliminary analysis revealed that students (actively) build and constitute (personal or group) areas for working, communicating or making a break by manipulating and (re-)arranging tools in their environment and design process. The omnipresent tools seem to have different roles as constituting a social space or being a device to communicate, explain, visualise or convert ideas. Furthermore different patterns of interaction were shown with the same single tool depending on the phase of the design process.

The further, still ongoing, analysis and interpretation will be concerned with extracting patterns of interaction, latent needs, structures and affordances in respect to the process environment, identifying the background and causation and synthesising that in form of qualities which can form a general and flexible basis for the integration of this aspects along several dimensions in the sense of an Enabling Space, or lead to the development of design patterns for the concrete case of the multimedia design class.

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Event network advancement. Graphical note taking as cognitive tool

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The importance of information visualization is indisputable for everyday life as well as in the scientific context. Prepared visual concepts, presentation sheets and flyers which are provided at and prepared long before a targeted event (mostly from professionals) are up to standard. But an interesting, upcoming dimension lies in the current trend of spontaneous visualizations, graphical notes, any kind of visual documentation and their integration into knowledge processes, for reasons such as reducing cognitive load [1]. As a sub-topic embedded into the project Event Network Advancement (ENA) this Into Research II project focuses on the potential of graphical note-taking in bridging the critical intersections within the usually rather segregated event phases and objectives according to ENA, as well as accounting for motivational aspects and enhancing cognitive capabilities during and after knowledge intense events.

ENA has the two main objectives to support the interaction of event participants with a combination of concepts to a whole new multimodal visualization tool, as well as the optimal adaption of architectural, technical and social aspects in sense of the Enabling Spaces concept [2]. It is realized from a consortium including the Danube University Krems, the University of Vienna, as well as the two business partners Innovation Service Network and Skill3D. The three project main structures consist of the »Pre-event-phase«, »Event-phase« and »Post-event-phase« that will be fused into an overall conceptualization during the three-year project, with the objective to optimize knowledge intense experiences and event spaces that usually lack cognitive and social quality due to their characteristic of permitting only limited short-term-networks.

Proposed findings are centered on the cutting area of individual & public communication as well as the documentation as parts of both the »Event-Phase« and »Post-Event-Phase«, where people organize newly collected data and knowledge from the event and may document it as graphical notes and visualizations. This can happen for purposes of taking notes for private use, a later public access and viewing or even for a further collaborative respect (where people can develop and adjust the content of notes taken). The aspect of »sustainability« is to be strongly questioned, as of its characteristic of having a more short-term impact established during events and conferences, where visualizations may help to provide a captured frame (indeed from a certain, subjective angle) that allows revisions of ideas, point in the plane aspect of aesthetics or even serve as a trigger on accessing own memories and experiences via a subtle approach of visual impressions.

Through an extensive literature research, state of the art analysis through qualitative interviews and ethnography's of national conferences, as well as evaluations of currently provided mobile applications, this project aims on a concrete conceptualization for a mobile visualization tool or module optimized for embedment in the ENA Virtual Event Explorer. There is a need to find an appropriate approach in engaging people to see graphical note taking as the enriching cognitive tool that it is.

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Neural Correlates of Unconscious Visual Attention – Testing the Role of the Superior Colliculi by Subliminal Color-Cueing

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Research question

One of the most intriguing questions in the study of the mind certainly is how conscious experience relates to neuronal brain-events. Many studies in the fields of cognitive psychology and neuroscience try to tackle the issue by exploring the limits of unconscious cognition. The brain mechanisms underlying unconscious (subliminal) visual attention are currently subject of debate. Although many researchers assume that they are to large extent of cortical origin, others have argued for an alternative [1]. According to the "bottom-up theory of attention", subliminal attention is dependent on areas in the midbrain, namely the Superior Colliculi (SC). One line of evidence comes from results of cueing-experiments: Subjects search for targets, and target positions are either cued or not with subliminal abrupt onsets. If these cues capture attention, responding to targets at cued locations is facilitated and vice versa (cueing-effect). Given that neuronal processing in the SC was reported to be largely color-insensitive, the SC-hypothesis is supported by recent findings showing the absence of cueing effects in the search for color-defined targets and a strong dependence of the cueing-effect on the cue´s luminance-contrast [2]. However, the same study reported an almost equally strong cueing-effect by black contrast-cues and color-cues [2]. This result is puzzling because the luminance of color-cues was objectively equated to the background. Possibly, individual differences in luminance-perception account for this observation as objectively luminance-equated color-cues are perceived brighter or darker than the background. The present study tests this hypothesis.

Methods

The luminance of red, green and blue cues is subjectively matched to the gray background by Heterochromatic Flicker Photometry [3]. In comparison, the luminance of red, green and blue cues is objectively matched to the gray background by direct colorimetric measurement. In a subliminal cueing-paradigm similar to experiment 1 in [2], the cueing by subjectively luminance-equated cues is compared to that of objectively luminance-equated cues.

Results

Results for four subjects indicate just small differences for subjective vs. objective luminance-matching. Accordingly, significant differences in the actual cueing-experiments cannot be shown. Yet, the study is still in progress and it is too early for a final statement.

Conclusions

The preliminary results don´t account for the previously observed subliminal cueing-effect by color-cues [2] in terms of individual variations in color-luminance-perception. Further experiments with a higher number of participants are planned because the present data don´t allow a final conclusion.

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Effects of cognitive and motor tasks on gait parameters and stride variability during treadmill walking

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Introduction

Human walking was considered to be automatic behaviour controlled by subcortical structures of brain, especially basal ganglia. Since then, scientists discovered that gait is a complex task which places demands on sensory and cognitive systems. Results from our study on healthy participants will provide some clues on how does cognitive system interfere with control of walking. We will measure what influence does cognitive and motor interference have on human walking and (give us an opportunity to) later compare results with measures from patients suffering from neurological disorders (Al-Yahyaa E. et al., 2011).

Methods

For research on the effects of cognitive and motor interferences on gait parameters and stride variability we will follow the dual task paradigm. This is a procedure that requires an individual to perform two tasks simultaneously. We will compare the results in dual-task conditions with results in single-task conditions. For our project we will test 20 healthy subjects. The gait parameters and stride variability will be measured while walking on treadmill. The participants will have to solve tests for measuring cognitive and motor abilities while walking on treadmill. In control settings, participants will have to solve all of those tasks while sitting. Besides the second control will be just walking on treadmill without any distraction. The final analysis will be comparison of measured parameters of gait and stride variability while walking with those in control settings and also comparison of results from cognitive and motor tasks. Measured parameters will be step and stride length, step and stride time, time of contact with treadmill and cadence.

Expected results

We are expecting differences in stride variability and step length during walking on treadmill and executing second task. This leads to different cadence and also change in time of contact with treadmill. We are not expecting any impact on measured parameters regarding the type of the second task, whether cognitive or motor task (O'Shea S. et al., 2002). Furthermore, we are expecting lower scores on cognitive and motor tasks during dual task conditions (Al-Yahyaa E. et al., 2011).

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Stratego

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Artificial intelligence (AI) players dominate most of the games. World best players of games like chess or Jeopardy has been defeated by computers, despite of these games seems to be unmanageable for computers, until IBM build Deep Blue or Watson. Of course computer will eventually beat humans in every game, but for now, there are still games in which dominates human players. One of them is Stratego.

Stratego has been evolved from traditional Chinese game Jungle or Game of the Fighting Animals. Game came to Europe during WWI, and it has been called L'attaque. Modern version of the game and also the name Stratego is known since 1960s. Stratego is board game for two players on a 10x10 square board. Each player controls 40 pieces with different ranks. Goal of the game is to capture opponent's flag. Position of flag is unknown, because player set up pieces at its discretion at the beginning of the game. Game can look similar to chess, but major different (for AI) is, that player can't see rank of opponents pieces until they face in combat. This make game unpredictably, so we can't use traditional approaches like MiniMax algorithm. Firstly the branching factor would be multiple times larger as it is in chess. Secondly, we would have to count with every possible distribution of ranks, and this restriction made us choose actions that are preferably for us based on the ideal (possible) distribution of pieces, not the actual one.

In this project we focus on one specific problem: How to guess where is opponent's flag in ending states of game. By ending state of game we mean state of game, when players have ten or less pieces, that doesn't move yet. It's easy task for skilled human player, just by quick look at the board, but it is almost impossible to define formal rules, which would specify the position of the flag. Therefore we use neural network that is trained in numbers of ending game states. Game states are represented as binary vectors. One represents piece on the square, zero represents empty square. Size of vector is 40 because flag can be only in first forty squares. If pieces move during game, it is represented as zero for the neural network, as flag is unmovable piece. Network has multi-layer binary perceptron architecture. Training and testing data are real-game records with known position of flag. This clearly means that neural network is able to guess position of flag, only if it's predictable and don't guess right when position of flag is random or absolutely illogical (bluffing), but the same applies for human players.

Neural network is "guessing" position of the flag more accurate, than any other formal algorithm ever should. As far as I know, best Stratego-playing AI are guessing position of flag only if they play with particular player before, not trying to generalize the problem. This NN will be part of complex Stratego-playing AI that will be implementing in the following year as my diploma thesis.

Investigation of perceptual learning in contour integration with eye-tracking methodology

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Background.
Despite that both perceptual learning and contour integration are individually intensively researched areas of science the effect of perceptual learning on contour integration has not yet been investigated with eye tracking methodology. In the primary visual cortex, cells code information from a certain area of the visual scene in a certain dimension. Orientation specific neurons code the orientation information of the visual percept. Local orientation information is integrated through the horizontal connections of orientation specific cells in order to enable us to see the outlines and edges of the visual scene. Visual perceptual learning can be defined as a mechanism in which we learn (through experience) to see parts of our environment that we formerly were unable to perceive [1]. According to current studies, visual perceptual learning can be located (among other areas) in the primary visual cortex. Investigation of perceptual learning is favorable as neural substrates of perceptual learning are well defined, and the effect of perceptual learning is independent of gender, culture, IQ and education. Behavioral correlates of perceptual learning potentially bear information on the topic of the extent to which learning influences adaptive behavior of the organism.

Aim and Hypothesis.
In the present study we addressed a question that has not yet been studied: the effect of perceptual learning on visual scanning patterns in a contour integration paradigm. We assumed to find quantitative and qualitative changes in visual scanning patterns as a result of learning. Method and

Design.
Stimuli in the contour integration test comprised of closed contours of Gabor patches against noisy background also comprised of Gabor patches [2]. The test was introduced in five training sessions on five consecutive days. Eye tracking data were recorded on the first and last day of training. 18 subjects participated in our study. Contour integration performance threshold was calculated for every session.

Results.
Enhancement of contour integration threshold through the training sessions indicates perceptual learning. Number of fixations decrease from Day1 to Day5 under the perceptual threshold of the group, and the amount of fixations increase from Day1 to Day5 above the perceptual threshold of the group.

Discussion.
Results indicate an alteration in visual scanning patterns due to perceptual learning. The decrease in the number of fixations from Day1 to Day5 on the difficulty levels below threshold shows the growing presence of the pop-out effect, i.e. the target pops out more likely from the noise as a result of learning. These results suggest a shift from 'effortful' to automatic searching mechanisms. We assume that the increment in the number of fixations above the perceptual threshold from Day1 to Day5 indicate that subjects were able to see more than noise on these above threshold levels by the fifth day, and they tried to enhance their performance by scanning the pictures more extensively.

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Robotic Superior Temporal Sulcus

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The topic of Superior temporal sulcus (STS) in mirror neuron system and motoric resonance is still discussed. STS is located in temporal lobe and encodes biological movements, but it responds only to visual stimuli incoming from lower levels of visual cortex. Based on empirical evidence, it is known, it plays crucial role in mirror neuron circuit and action recognition. According to research of D. I. Perrett, et al. [2] it was shown that it doesn't respond to objects or actions independently of viewpoint. In the experiment monkeys saw a face at four viewpoints. Activations of STS contains populations of neurons which were active for face seen from different viewpoints. They discovered existence of four main populations specialized on four cardinal directions (0, 90, 180, 270 deg.). For any viewpoint was dominantly active population for which was the viewpoint the most similar (eg. when monkey saw a face from 80° viewpoint, the 90° population was activated the most). Similar property was later measured by V. Caggiano, et al. [3], but they were measuring activations of macaque mirror neurons in F5 area. Their monkeys were observing and performing grasping and reaching a food. Caggianos tema discovered similar organization of mirror neurons activations as was in the STS. There were also four main populations for cardinal directions and a small fraction of STS neurons was view-indipendent, they were active for all viewpoints. We have implemented simple model of STS with mentioned property of activation at different viewpoints. The key element of our model is recurrent self-oragnizing map. This neural network is based on Kohonens model extended with internal memory. Basically can be described as matrix of artificial neurons which is using hebbian (unsupervised) learning. We focused on two newer models: Merge SOM and Merge neural gas (MNG) proposed by M. Strickert and B. Hammer [1]. These two models are computational efficient and less memory consuming than older RecSOM or SOM-SD. MSOM doesn't copy whole hidden layer to context but uses context descriptor which is linear combination of current input and past contexts. MNG behaves in similar way but has no topology so neurons are acting as gas molecules. We have chosen a few measures to compare their capabilities (quantization error, information entropy). Our main goal was to simulate a behavior of STS when there is presented action seen from more viewpoints. The network obtained on the input preprocessed data containing sequences of three types of motion. These were grasps generated by ICub robot simulator. In the first step, data were preprocessed: rotated and projected (exactly as it is done on eye retina) from 3D to 2D. So we have gained training set of three actions seen at four different viewpoints. In the next step the network was trained on this set and organized itself to cover all inputs. We are expecting creation of neuron clusters responding to each grasp seen at one of the four viewpoints. In future we are planning to extend this model and connect it to grater architecture. It should be the input module for computational model of simple mirror neuron system. It will be used in ICub robots (in simulator) and we believe the model could perform their action recognition and action mapping from our robotic STS to robotic F5.

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Meditation and P3 event-related brain potential

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Meditation practice has been a matter of study for many years. There has been promises from various meditation traditions about positive effects that meditation practice has on one psychical and physical body (Davidson & Lutz, 2008). »Meditation can be conceptualized as a family of complex emotional and attentional regulatory training regimes developed for various ends, including the cultivation of well-being and emotional balance« (Lutz et al., 2008, p. 163). In scientific research there are numerous problems regarding meditation research that involve both theoretical and empirical obstacles. On the other hand there has been some interesting results in research focused on studying effects of meditation on attention regulation.

On the representational poster there will be presented various aspects of meditation and scientific research. From heterogeneity of styles to theoretical obstacles regarding unclear definitions. There will be presented two different styles of meditation that are commonly used in experimental research. Those two types are: Focused attention (FA) and Open monitoring (OM) meditation. The first type of meditation refers to focusing on some kind of object (either abstract or real). Whereas, the second type goes beyond focusing on an object, the aim is monitoring ones mind. In the empirical part there will be focus on attention regulation and meditation showing results of the latest neuropsychological research. There will be presented the experimental setting involving electroencephalography, oddball paradigm and P3 component. It is known that this component represents event related potential (ERP) with some unsuspected stimuli. The oddball paradigm is usually reffered to as a two-stimulus task, with a standard stimulus (appearing about 80% of time), and a target stimulus (appearing about 20% of time). Beside this traditional version, there is also a three-stimulus oddball task, where in addition to these two stimuli, there is also a distractor. Our focus will acctually be on the subcomponent of P3 – the P3a component. Subcomponents P3a and P3b appear in a three-stimulus oddball task (standard tone, target tone and distractor), where P3a denotes frontal neural activity related to distractor, whereas P3b denotes central-parietal activity related to target stimulus (Polich, 2007). For us, P3a is important beacuse it is related to attention regulation.

In the end there will be presented the results which show that long term meditation practices has effect on attention regulation. The aim of the poster is to present the interesting field of meditation so that an observer can understand the framework and current problems of meditation research. With presentation of the specific research observer will be able to understand the setting behind the meditation and attention regulation experiment.

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Comprehension of indirect replies

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Abstract for: Comprehension of indirect replies My semestral project is from the area of psycholinguistics/pragmatics and deals with indirect speech act comprehension. To use language is not only to express propositional content, but also to perform action. We can promise, bet, threaten, just by using the right words in the right circumstances. Speech acts become indirect when a speaker communicates to the hearer more than he says by relying on their mutually shared knowledge, general powers of rationality and inference on the part of the hearer (Searle, 1969). When people engage in dialog, their common goal (according to P.Grice) is to cooperate to exchange information/ convey meaning. This is done by respecting Grice's maxims – a set of rules, that interlocutors should follow. There are 4 maxims; maxim of quality, maxim of quantity, maxim of relation(relevance maxim) and maxim of manner. Basically they say, that your reply should be clear, relevant, of appropriate length and you should believe, that what you are saying is true. When people talk they often violate these rules and express their intended meaning indirectly. Indirect speech is often used in order to ensure plausible deniability, negotiate relationships or save speakers face. Plausible deniability means that proposition we make can be understood, but when listener does not want to cooperate, we can possibly deny we made one. Negotiating relationship occurs when we meet someone and we do not have established relationship. We try to communicate in a way that is not disrespectful and somehow suggesting we are in some way superior. Saving face means not to lose reputation or respect of other people. Holtgraves(1999) studied comprehension of indirect replies that violated Grice's relevance maxim. We used first experiment from his paper to inspire our research. His hypothesis was that comprehension of an indirect reply will facilitate sentence verification. Sentence verification happens when the sentence is presented and we have to judge if it is valid grammatical sentence or not. Verification should be facilitated when target sentence is direct interpretation of meaning indirect reply conveyed. The experimental stimuli consisted of short dialogs. In the first few sentences author described relationship between conversational partners and the situation in which dialog occured. Each description was followed by a question and an answer. When the answer was indirect and the target sentence was its direct interpretation, the time the decision took was measured and compared to time when maxim was not violated or target sentence was neutral. Our adaptation of the experiment will have altered method and stimuli, it will be done using Slovak language. Final product of my semestral project will be an experiment(Java application), which will be used for our future research.

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Toward a Simulation Theory Inspired Computational Model of Theory of Mind in Storytelling and Story Generation Systems

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The Austrian Research Institute for Artificial Intelligence, Vienna, Austria University of Vienna, Vienna, Austria During the last years, there has been an increasing interest in research on storytelling and story generation systems that can be used in entertainment and learning environments and allow users to participate in a dynamical story as a character or as a director. While storytelling systems try to maintain a consistent story-line, story generation systems do not assume a backbone story[1]. Since stories in almost all cases are the retelling of events in social groups, implementation of the cognitive ability to describe others in terms of their beliefs, desires, emotions, intentions, goals and personalities and explain their behaviors in terms of these and other similar states, which is called "Theory of Mind (ToM)", plays a key role in storytelling and story generation systems. In this project after an investigation of philosophical backgrounds of the ToM, including theory theory, modularity theory, rationality theory, and simulation theory, we researched in the current literature on computational models of ToM in storytelling and story generation systems and made an online annotated bibliography of the field. Afterwards, we chose the following three models for a detailed investigation: * Improv[2], in which the properties of all characters are written on a public shared "blackboard" and any of the characters can access and modify the data on the blackboard to coordinate the others' behaviors and simulate the ToM. * PsychSim[3], in which each of the characters has its own decision-theoretic model of its beliefs about the environment and recursive models of other characters. * Chang & Soo's Model[1], which proposes a planning technique called "social planning" to implement ToM in characters. Based on what we learned from the investigation of the above-mentioned philosophical theories and computational models, we tried to determine the general requirements, specifications and evaluation metrics of a computational model of ToM in storytelling and story generation systems. The proposed model is based on simulation theory because of a large number of empirical findings that support this theory. As a future work, we will design, implement and evaluate a software based on the proposed specifications.

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Personality Traits in Common Marmosets (Callithrix jacchus) - Influence of Social Environment on Individual Behaviour

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Animals exhibit consistent behaviour through time and across different contexts (e.g., aggressive behaviour in mating and feeding context). Such behavioural consistencies, which have been labelled with the term "personality", have been well documented throughout the animal kingdom [1]. In contrast to classical behavioural ecology, which considers behaviour as being potentially infinitely plastic, the notion of personality implies limited plasticity. Consequently, personalities can, via life-history trade-offs, account for non-optimal behaviour. Furthermore, the notion of consistency suggests that behaviour should not be investigated in isolated contexts. Instead, it should be pursued in an integrated fashion [2]. Research has shown that social environment is an important factor in personality research. It has been observed that sex, age and dominance status of conspecifics can have a significant influence on the behaviour of the individual [3]. Moreover, the social environment might be a necessary condition for the expression of a broader range of behaviours. Findings suggest that it can facilitate learning and exploration. Additionally, it seems to have a fear-reducing function. Here, we investigate the influence of social environment on personality traits, more specifically boldness, in common marmosets (Callithrix jacchus). We use twenty-one common marmosets from three different family groups. All individuals are tested in novel object and startle response tasks under two different conditions, namely individual and social. In the social condition each family group is divided into two experimental subgroups such that each subgroup contains one dominant individual and one individual of each following generation. The novel object task is an addition to an experiment that was previously carried out at the Department of Cognitive Biology, University of Vienna (Šlipogor et al., in prep.). In this task, which lasts five minutes, the animals are confronted with a novel object, whereas in the control test, they are confronted with a familiar object. In the startle response task, a bowl with mealworms, a high value food source, is offered to the animals. Next to the bowl there is a remotely controlled startle object which we trigger when the animals approach the bowl within one body length. After the startle we record the behaviour for two minutes. In the control test the animals are presented with a bowl of mealworms, but no startle object. For the purpose of the analysis we record the time durations spent on object manipulation, different vocalizations and foraging (only in startle response task). Additionally, we measure latencies (the time between the start of the experiment and the moment when the animal comes within one body lengh of the novel object/bowl or touches it), the time spent in different experimental compartments, which represent different levels of danger, and the returning time (the time between the startle and return of the animal within one body length of the bowl). We hypothesize that individuals will exhibit bolder behaviour in social environment, when compared to individual trials. Futhermore, we investigate whether the social experience can produce any lasting effects on subsequent behaviour in individual trials. Finally, we expect to find consistency in inter-individual differences in behaviour across both tasks and conditions.

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Impact of play and positive emotions on divergent thinking

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Play has been identified in literature as a potential indicator of the current welfare and therefore linked to the experience of positive emotions in animals and in humans. Panksepp [1] suggests that "the main adaptive function of play may be the generation of positive emotional states. In such states animals may be more willing and more likely to behave in flexible and creative ways". This presumption is in line with the broaden-and-build theory created by Barbara Fredrickson [2]. According to this theory, negative emotions function in a manner that they call to mind an urge to act in a particular way. On the other hand, positive emotions widen the array of the thoughts and actions that come to person's mind, or they "broaden peoples' momentary thought–action repertoires" [2]. Also, work of A. Isen and colleagues shows that positive affect leads to greater creativity, improved negotiation processes, more thorough, open-minded, flexible thinking and problem solving. Guilford (as cited in [3]) posited that the ability to envision multiple solutions to a problem, called divergent thinking, lay at the core of creativity. The opposite of it is convergent thinking, the tendency to narrow all options to a single solution. The aim of this research was to explore if play can generate positive emotions and by that induce divergent thinking. This research was conducted individually in a standardized testing condition on 33 five and six-year olds (20 boys and 13 girls). Subjects were randomly divided to experimental (N=18) or control (N=15) testing condition. In the experimental condition the experimenter played a short game with the subjects in which the experimenter would name different objects or animals and the child had to tell, as soon as possible, if the named object or animal can fly. After the game, children's emotions were measured with a short questionnaire made especially for this purpose. After reporting their emotional state, divergent thinking was measured with the test created for this research using Torrance's "Thinking Creatively in Action and Movement Test" as a template. The control condition was the same as experimental, except the experimenter did not play the game with the children. It was assumed that the children who played the game would exhibit more positive emotions and less negative one, and therefore more creative behaviour than the children in the control condition. This hypothesis was only partly confirmed. Because of a small sample size the variables were not distributed normally, so the differences between groups were tested using non-parametric Mann Whitney U test. Although the means of all variables showed differences between testing conditions in the expected directions, most of these differences were not significant. The only significant differences were in: sadness (p=0.001), one of the three possible tasks that measured imagination (p=0.011), one of the two tasks that measured originality of responses (p=0.04) and the negative emotions in general (p=0.004). This means that the experimental group, which played the game, showed less negative emotions, especially sadness, and more imagination and originality in their responses.

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Visual attention, decision making and scene description revealed by bee swarm analysis

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Attention stands as a fundamental capacity of our cognitive systems, for it enables us to effectively use its limited resources in a flexible and dynamical way [1]. Therefore, it is not surprising that a considerable amount of research has focused on that topic. However, most of this research has been mainly carried out on visual attention by using static stimuli in highly controlled experimental settings. Although this provided valuable insights concerning the basic mechanisms underlying visual attention, very little is known about visual attention in dynamic and social situations with less simplified stimuli [2]. Thus, conducting research using closer to real-life situations as stimuli, would significantly contribute to a more complete understanding of visual attention, while it would allow looking into social attention more reliably. This, in turn, could provide a better understanding of phenomena based on social attention such as, social cognition, social learning and the like. In the present study, we hypothesized that visual and social cues capture visual attention, and also lead to an increase in reported interest. The stimuli consist of a set of surveillance video recordings from a European metropolitan subway. 150 subjects (middle European university students) watched 4 screens, each displaying 1 video simultaneously, and indicated, using a joystick, when their interest was triggered. Additionally, we measured the resting potential of the retina using electro-oculography, a technique which allows us to record the eye movements of the subject to further determine eye-gaze direction. Bee swarm analysis allows localizing the visual attention locus on the selected frames, in order to identify both visual and social

attention triggers. Preliminary analysis suggest a number of visual cues, as potential triggers of social and visual attention, in dynamic and more close to real-life like stimuli. Therefore visual cues are categorized as visual (movement, colors, appearance and similar) or social (human interaction, manipulation of objects, interaction with pets and similar). Consistent with previous studies, attention is not-randomly distributed. Visual attention and cognitive attention are correlated. We could identify a number of visual and social triggers of attention, and thus extend our knowledge about the mechanisms of attention in complex dynamic social situations. We could shed light on some cognitive phenomena, such as social cognition and social learning. Moreover, our results demonstrate the importance and benefits of studying social attention by using more complex dynamic and closer to real-life stimuli.

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Colors in language comprehension

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In my work I am dealing with language comprehension in its embodied character. Situational models are discussed since Dijk & Kintsch [1]. To understand situations depicted in text we need to create models of situations in our minds. Construction of such models involves some of the brain structures which are used for perception of such situations as well. My experiment is a modification of experiment described in Rakovsky [3]. In the experiment he uses habituation of neurons in the visual cortex by watching the screen presenting only one color for two minutes. This habituation then affects processing of sentences containing, either explicitly or implicitly, the same color. Rakovsky uses two opposite colors [2]- blue and yellow. There are four blue sentences, four yellow and eight nonsense sentences. All of them, especially the those ones which are meaningful, are approximately equally long. In the first phase participants have to watch one of the colors for two minutes. In the second phase participants are asked to accomplish a simple cognitive task – that is to recognize sensible and nonsense sentences. In order to recognize sentences which are describing possible situations, participants have to create a model of the situation. If the situation involves the color of previous habituation phase, reaction time increases. In my experiment I added one non-opposite color, green, to the sentences presented. I also have two groups of participants, one with yellow and one with blue habituation. There are three types of sentences: Green sentences, Yellow sentences and Nonsense sentences. The setting is same as of the original experiment; there are two phases, in the first one participant is asked to watch the screen for two minutes and in the second he is asked to judge sensibility of sixteen consecutively presented sentences. The theory of opponent color processes, as proposed in Hurvich & Jameson says that colors are processed in three channels: red versus green, blue versus yellow and black versus white (light and dark). In these channels, each of the colors is antagonistic to the other color. So it is possible, that habituation to one color, for example blue, enables easier and hence quicker processing of opposite, yellow sentences. The modification I provide in my version of the experiment is therefore needed to answer these questions: Does the habituation to certain color increase the reaction time for processing sentences containing that color, or does it speed up processing of sentences with opposite color mentioned? Or do both of these principles cause the difference in reaction times?

Terrasim C++ GUI Client

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In this paper I am describing my motivation to create client application with graphical user interface to simulated virtual environment TerraSim which was created by Mgr. Ladislav Benc as his diploma thesis in 2011. "Our goal was to design an environment the agent can explore, reason about, categorize various objects it encounters and observe results of its actions. The simulation itself is implemented as a module for TerraSim – our solution working as a network server, allowing remote control of agents. Single- as well as multi-agent scenarios are supported. The modular architecture of TerraSim enables us to easily define multiple different scenarios with new sets of sensors, actuators or even whole worlds, making its potential uses quite broad. We also provide usage examples, an application for controlling the agent in any kind of simulation and a visualization application."(Benc, 2011) As a programming language for building TerraSim was choosen C#. Benc also makes available graphical user interface client application written in C#. Choosen programing language is platform dependent. As I am using TerraSim in work on my thesis and I consider platform dependency as a significant restriction I have decided to overcome this problem by creating platform independent graphical user interface client application.For securing of platform independency I decided to write core of my application in C++ programming language and user interface using Qt framework. Product of this combination can be compiled on platform of one's choice and used to remotely control agents in virtual environment provided by instance of TerraSim installed on Windows OS platform. Client implements application user interface for easy integration of new types of agents(for example direct user controled agent, AI agents, ...). Furthermore client contains log viewer with adjustable filter and visualization of virtual environment in which agents reside. In my thesis I focus on modeling of behavior of cognitive agents. TerraSim is simulating "human like" perception(agent can visualy percept only space and objects in direction which it is facing, it doesn't have access to atributes of objects which it can not detect by its sensors, etc) My goal is to create population of agents, which will create representation of objects and actions they percieve in TerraSim, categorize them, reason about them, learn from their own actions as from action they percieved and hopefully they will develop language and signs of social interaction.

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How does the (dis-)belief in free will affect satisfaction in life and cooperative behaviour?

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Recent studies provide evidence that whether we believe in free will or not has great impact on how we behave and how we feel about ourselves. It could be showed recently that people tend to cheat more when believing that their own behaviour is determined [1], but are more willing to help if they believe in free will [2]. A probable explanation is that people tend to feel less responsible for their own behaviour if they believe to have no influence on it.

The aim of our study is concerned with two different correlations. The first research question is concerned with the correlation between the belief in free will and the overall satisfaction with life: How do our beliefs affect our emotional conditions? Our hypothesis was that people who believe in free will feel more as the agent of their decisions and behavior and are therefore more satisfied with life than those who don't. Of course other explanations and results are possible as well e.g. one possibility could be the other way around: people who don't feel responsible for their behaviour are more satisfied as they don't feel so responsible for their actions. To measure the satisfaction with life and the beliefs we handed out questionnaires to a heterogeneous group. The mood in the last twelve months was measured with the "Positive And Negative Affective Scale" (PANAS). To quantify the Satisfaction with Life we used the "Satisfaction with Life Scale" (SWLS) and for the belief in free will or determinism we used the "Free Will And Determinism Plus Scale" (FAD+), which consists of statements like e.g. "People's biological makeup determines their talents and personality" or "People can overcome any obstacles if they truly want to". For all the three Scales we calculated the Median to assign the subjects into groups. Against our prior expectations we could not find a correlation between the belief in free will/determinism and the overall affective state. A reason for that could be that the small amount of people we found so far tending to determinism (only 10 subjects), is not enough yet. Eighty persons have been tested and we plan on getting up to 200 participants. Data, however, still suggests that these few people who belief in determinism tend to have a rather negative overall affective state than those who believe in free will. Almost one third of all subjects (3 of 10) who belief in determinism have a negative affective state, which is a high amount compared to those who belief in free will (5 of 70).

The second research question measures the effect of the (dis-)belief in free will on cooperative behavior. For determining the influence of decreased belief on free will we are using a computer game called "bob68k". Karl Grammer from the department of Anthropology of the University of Vienna originally designed the game. In this game the willingness of people to cooperate can be measured, based on a simulation of "tragedy of the commons", a game-theoretical dilemma in which participants can choose between more cooperative or more defective strategies. Our hypothesis of our ongoing research is that people who were primed to a deterministic view are less cooperative than people who were not primed (and therefore mostly have a natural belief in their own free will and agency).

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Retrocausal Habituation: A Study on Time-Reversal Effects in the Human Information Processing

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In recent years, a number of reports have been published about unusual timing phenomena in human information processing. These effects have been termed time-reversed interferences (Klintman 1983; 1984), or, more generally, time-reversal effects (Savva, Child, Smith 2004). The basic finding of this research field is that under some circumstances, human subjects appear to display psychologically or physiologically meaningful reactions to future stimuli about whose occurrence they have no direct or indirect knowledge. Reports of such findings were scattered in the research literature and gained little general attention for a while; this, however, changed in 2011, when social psychologist Daryl Bem published a highly controversial paper, in which he summarizes research work of his retrocausality research lab at Cornell University and presents what appears to be replicable evidence suggestive of a relatively reliable retrocausal cognition effect. In sum, Bem reports nine retrocausal cognition effects; in each case, the protocol consists of reversing the sequence of a well-established psychological effect (such as affective habituation, mere exposure, evaluative priming, boredom and aversion induction, etc.) in order to look for predictable influences of future stimulus exposure on present likability ratings and/or choice behaviour. In this study, the so-called retrocausal habituation effect was chosen for replication, since this is the effect of this paradigm which has been replicated most often (about 9 published studies). Furthermore, it is intended that the results of this study will be sent to Wiseman and Watt's database at Edinburgh University for their planned meta-analysis. The retrocausal habituation effect refers to the well-known finding that repeated exposure to emotionally arousing stimuli leads to an increasing habituation. The conventional finding behind Bem's protocol, affective habituation theory, holds that repeated exposure to an affectively arousing stimulus produces a progressively smaller arousal response. For example, in a study by Dijksterhuis and Smith (2002) subjects who were subliminally exposed to emotionally arousing words (e.g., 'happiness', 'summer', 'free', 'hell', 'bomb', 'fear') subsequently perceived these stimuli to be significantly less arousing than novel emotional words. Bem's precognitive version of the affective habituation protocol consists of a forced choice affective habituation study, the only distinguishing feature being that the experiments are run backwards. Subjects are asked to first choose, according to their spontaneous preference ('gut feeling'), one of two pictures of equal emotional valence and arousal potential, one of which they will be subsequently repeatedly exposed to. In this replication study, these effects will be tested with 50 subjects. Furthermore, given that earlier studies report that individual differences which are known to moderate conventional (i.e. forward) habituation (such as emotional reactivity, boredom proneness, and sensation seeking, also moderate the backwards variant of the effect (Bem 2012), additional tests for the impact of these factors on the putative retrocausal stimulus exposure effect will be studied. Interestingly, preliminary results appear to suggest that the retrocausal habituation effect is indeed replicable with our sample.

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Cognitive aspects of Starcraft 2

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Author tried to determine how and which cognitive capacities are developed by playing strategy video game Starcraft 2. In this study author focused mainly on capacities leading to wining of the game.

Starcraft 2 is real-time strategy video game that is played at extraordinary speeds. Player choose one of three races and to win the game he must command his units, prepare defenses, build base expansions to gather more resources while build bigger armies to outmanoeuvre his opponent. Players have to act simultaneously and continuously to accomplish their goals. The GUI of the game contains angled top-down view over map terrain, where players have his vision limited to his own units and buildings. This creates a game of incomplete information where efficiently distributing one's attention is paramount. Top players issue hundreds of actions per minute navigating around the terrain at prodigious speeds and maintaining their forces. Optimized attention to the environment allows for proper navigation and the coordination of global and local information for real-time decision making.

Data for this study was obtained by analyzing the replay files, which enables users to rewatch games after they concluded. These replay files are records of the actions that players took and the time that each one occurred, so we can precisely see the every interaction of player with game environment. Main tool for relevant information extraction was program Sc2gears. Author also wrote Java analysis plugin for Sc2gears to enhance extraction of important game information.

The main collected variables were: *Actions per minute (APM), calculated as the total number of actions over game time in minutes *Spatial variance of action (SVA), the 2D spatial variance of all actions with location, such as placing a building or moving units. In results author assumes to obtain underlying evidence for explanation of basic skill set that good Starcraft 2 player has. This skill set should consists of well developed fine motor skills, the distribution of attention, precise planning, highly developed working memory, rapid problem solving, multi-tasking ability etc.

List of Participants