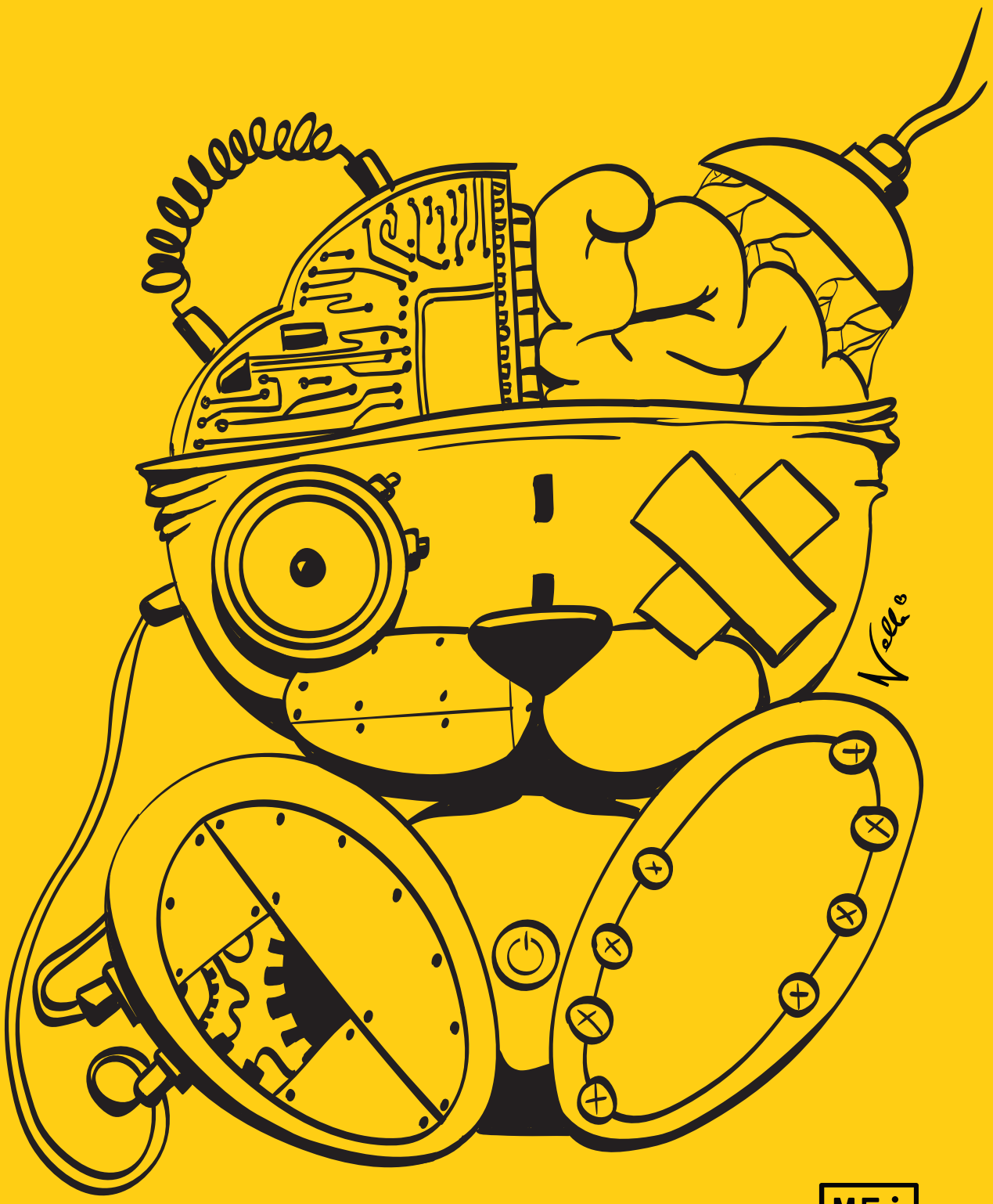
MEi:CogSci Conference 2018

Bratislava, Slovakia



MEi: CogSci

Middle European interdisciplinary master's programme in Cognitive Science

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Proceedings of the

MEi:CogSci Conference 2018

Bratislava, Slovakia

Editors:

Peter Hochenauer, Brigitte Römmer-Nossek, Katharina Roetzer, Alexander Steiner

University of Vienna, Austria

Igor Farkaš

Comenius University in Bratislava, Slovakia

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Proceedings of the MEi:CogSci Conference 2018

The conference took place at the Faculty of Mathematics, Physics and Informatics, Comenius University in Bratislava, Slovakia, on 14-16 June, 2018

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Nicole Vella

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Welcome!

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

Welcome to our 12th MEi:CogSci Conference; this year hosted by our partner at the Comenius University in Bratislava.

Due to the rise of cognitive technologies in our everyday lives, cognitive science has received increased attention in the public over the last year(s). We are proud that we can be part of this development by offering a high-quality interdisciplinary master's programme in this field. We mean to teach cognitive science and its applications in a wide variety of domains. Furthermore, it is our goal to educate not only experts in cognitive science, but also humans acting in an ethically and socially responsible manner in this highly relevant and impactful field.

We want to express our gratitude to Igor Farkaš and his team. We want to thank the Faculty of Mathematics, Physics and Informatics of the Comenius University in Bratislava for hosting our conference this year. We further thank Nicole Vella for creating the cover art for the conference proceedings and all other MEi:CogSci students of the Comenius University in Bratislava who helped organising the event locally.

We want to welcome our invited speakers Richard P. Cooper (Birkbeck, University of London), Olga Markic (University of Ljubljana), and Igor Riečanský (University of Vienna & Slovak Academy of Sciences). Thank you for joining us this year and for sharing your expertise and knowledge with us.

We also welcome our graduates, who join this event and provide insights into possible careers after MEi:CogSci. Thank you for supporting MEi:CogSci even after graduation!

The organising team of Comenius University in Bratislava and the printing of the proceedings was supported by the project "GOING GLOBAL" (No. 002UK-2/2016), and in part by the KEGA project (no. 017UK-4/2016), both from the Ministry of Education, Science, Research and Sport of the Slovak Republic. Thank you, Igor Farkaš, for organising this, as well as the publication of these proceedings under an ISBN number.

We also want to thank all reviewers and supervisors, who provide the foundations for this event.

And last but not least, it is you, Coxies, who make this conference happen. Your posters, talks, and initiatives will make the MEi:CogSci Conference 2018 an exciting and joyful event!

Thank you all for coming! Enjoy the 12th MEi:CogSci Conference!

Peter Hochenauer
Brigitte Römmer-Nossek
Katharina Roetzer
Alexander Steiner

Editor's Note

We, the editors, thank all MEi:CogSci students/authors for submitting their work to the MEi:CogSci Conference 2018. We are happy to present your work in the conference proceedings and to contribute to the field of cognitive science by covering such a variety of interesting topics.

The MEi:CogSci conference and its proceedings are a joint effort. The editors ensure that the work submitted to the conference is in accordance with the conference guidelines for authors. Thus, the editors revise the submissions in respect to formal criteria and formatting issues. Participating students/ authors are expected to adhere to good scientific practice and to honour the regulations relating to good academic conduct. The students'/authors' responsibilities include the usage of references and citations in a transparent, precise, and correct manner, as well as issues regarding style, spelling, and grammar of their abstracts. Despite our best efforts to meet our responsibilities as editors, the MEi:CogSci Conference 2018 proceedings may contain errors and we apologise for any inconveniences.

Thank you all for allowing us to represent MEi:CogSci and our programme's understanding of cognitive science through your submissions of original work.

Twelfth Middle European Interdisciplinary Conference in Cognitive Science (MEi:CogSci Conference 2018)
Faculty of Mathematics, Physics and Informatics, Comenius University in Bratislava
14-16 June, 2018

MEi: CogSci
Middle European interdisciplinary master's programme in Cognitive Science

MEi:CogSci Conference 2018

Thursday, June 14, 2018

13:30 – 15:30	**Registration**
15:30 – 16:00	**Welcome & Conference Opening** [Lecture Room A]
16:00 – 16:15	**Web of Needs Experiment – Introduction** *Soheil Human* [Lecture Room A]
16:15 – 17:15	**Plenary Talk: Sensorimotor Processes in Empathy** *Igor Riečanský* [Lecture Room A]
17:15 – 17:30	SHORT BREAK
17:30 – 19:00	**Poster Session 1**

Friday, June 15, 2018

10:00 – 11:30	**Track A:** Decision Making	**Track B:** Motor Cognition	**Track C:** Ageing & Dementia
	[Lecture Room A]	[Lecture Room C]	[Lecture Room I-9]
	The Rationality of the Crowd: Impact of Herding Behaviour on Financial Decision-Making *Gregory Bartel*	Action Observation and Motor Imagery Effects on Motor Learning *Jan Zibelnik*	Influence of Age Differences on Media Multitasking *Nives Đorđević*
	The Gamification of a Tax Experiment *Nicolas Valerian Pils*	Ask the Body: Utilizing Movement to Investigate the Communication of Emotion Experience *Imani Rameses*	Development of a Cognitive Training Application for the Older Adults: A User-Centered Design Approach *Zala Likar*
	Organizational Failure and Decision Making *Nejra Rizvanovic*	An Electroencephalography Study on Neural Correlates in Restorative Yoga and Mindfulness Meditation *Anja Krvina*	Lexical Processing of Complex Pseudo-Words in Patients with Alzheimer's Disease *Blaž Hren*
	Cognitive Biases in Performance Assessment Processes *Caroline Hannickel*	Vicarious Sensorimotor Activation and Dispositional Empathy *Xenia Daniela Poslon*	Resting-State Brain Connectivity and Social Understanding in Aging *Kevin Klarić*
11:30 – 11:50	COFFEE BREAK		
11:50 – 13:00	**Track A:** Phenomenology & Enactivism	**Track B:** Cognitive Psychology & Experience	**Track C:** Neuroscience
	[Lecture Room A]	[Lecture Room C]	[Lecture Room I-9]
	Ethics in Contemporary Mindfulness: Exploring the Transformative Power of Implicit Ethical Teachings *Judith Belkot*	Emergence of Visual Consciousness in ADHD Children *Katja Zupanič*	The Relationship Between Amphetamine-Induced Dopamine Release and Susceptibility to Induced Auditory Hallucinations *Irena Dajic*

	The Role of Vitality Affects in Human Experience and Its Relation to the Ontogenesis of the Body-Mind Split *Balint Ory*	"To Pluck from Rooted Memory" Task Performance Strategies for Memorizing Position and Orientation in Change Detection Task *Aleš Oblak*	Influence of Amphetamine Sensitisation on the Prediction Error Signal *Iga Willmann*
	Phenomenology of Blind People *Izabela But*	The Meaning of Dying *Felipe Gonzalez Tubio Machado*	Preservation of Moral Knowledge in Patients with Frontotemporal Dementia and Their Legal Responsibility *Sara Brus*
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15:00 – 16:10	**Track A:** Phenomenology & Enactivism	**Track B:** Neuroscience Methods & ADHD	**Track C:** **Master's Thesis Defence 13:00-16:00 (!)**
	[Lecture Room A]	[Lecture Room C]	[Lecture Room I-9]
	Enactivism and Language: A Conceptual Analysis *Tomaž Babić*	Frequency-Dependant Local and Remote Immediate Effects by Concurrent TMS-fMRI Setup *Matic Princic*	13:00-14:00 *Ioana-Cristina Siserman-Gray* 14:00-15:00 *Eugen-Calin Secara* 15:00-16:00 *Indre Pileckyte*
	Cognitive Processes in Creative Aha-Experiences *Anna Berger*	How Dependent Are fMRI Results on Specific Analysis Tools: A Comparison of Results Analyzed with AFNI, FSL and SPM *Nina Demšar*	
	Experience of Sexual Fantasy *Katja Škafar*	Decision-Making Performance, Satisfaction and Stability in the Context of Adult ADHD *Lulu Považan*	
16:10 – 16:30	**COFFEE BREAK**		

16:30 – 17:30	**Plenary Talk: Set-Shifting and Place-Keeping as Separable Control Processes** *Richard P. Cooper* [Lecture Room A]
17:30 – 19:00	**Poster Session 2**

Saturday, June 16, 2018

10:00 – 11:00	**Plenary Talk: Expert Performance: Merely Automatic Skills?** *Olga Markič* [Lecture Room A]		
11:00 – 12:10	**Track A:** Science, Technology and Society	**Track B:** Language & Meaning – Development & Pathology	**Track C:** Applied Technologies
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	Beyond Constructivism: Exploring Novel Learning Paradigms and Their Implications for Educational Robotics *Anna Dobrosovestnova*	Recurrent Neural Network Model of Phonological Development Using Distributed Representations *Endre Hamerlik*	Blockchain-Based IoT Data Storage *Franz Georg Papst*
	At the Intersection of Neurotechnology and Economics: Social Impact and Ethical Questions *Marjana Subotic*	Enaction of Meaning in an Intersubjective Context – from Cognitive Science to Psychotherapy *Polona Rudolf*	Face Recognition and Classification of Mood *Igor Slovak*
	Labour, Its Coercion, and How Cognitive Science Has Engaged with Them *Tim Reinboth*	The Phenomenology and Linguistics of Schizophrenia: A Battle of Selves *Julie Tangeten*	Genetic Predisposition for Neurological Disorders in Populations – An Evolutionary Perspective *Ana Jeličić*
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14:00 – 15:30	**Track A:** Language & Meaning – Uncertain Communication	**Track B:** Modelling	**Track C:** Human-Computer Interaction & User Experience
	[Lecture Room A]	[Lecture Room C]	[Lecture Room I-9]
	On the Impact of Cognitive Science Terminology on Interdisciplinary Knowledge Creation Processes as Analyzed with the Example of Reinforcement Learning *Sebastian Jakob Götzendorfer*	Extended Agent Based Simulation of Cipolla's Model of Stupidity *Blaž Potokar*	Application of Physiological Measures for Evaluation of User Experience: A Skin Conductance Experimental Study *Andrej Brinkač*
	The Role of Linguistic Markers, Expertise and Domain Specificity in Uncertainty Communication *Martina Simanová*	Ethnographic Knowledge Elicitation: A Modelling Perspective on Decision Making in a Neuroscience Laboratory *Stefan Sametinger*	Enhancing User Experience Testing Using Electroencephalography *Márius Rak*
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16:00 – 17:10	**Student Initiative: Simulies: Graded Lies and Dynamic Trust. A Simulation Study** *Anna Dobrosovestnova, & Sebastian Jakob Götzendorfer* **Alumni Talk: Do You Speak Interdisciplinary?** *Nikola Ondríková (MEi:CogSci Year 2017)* **Alumni Talk: Few-Shot Learning in Artificial Neural Networks** *Matúš Tuna (MEi:CogSci Year 2016)* **Alumni Talk: There and Back Again: A Tale of Disciplines** *Matúš Konečný (MEi:CogSci Year 2014)* [Lecture Room A]
17:10 – 17:30	**Web of Needs Experiment – Conclusion** **Best Poster & Best Talk Award** **Conference Closing** [Lecture Room A]

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Invited Talks

Set-Shifting and Place-Keeping as Separable Control Processes

Richard P. Cooper

Centre for Cognition, Computation and Modelling and
Department of Psychological Sciences,
Birkbeck, University of London
London, United Kindom

A great deal of research has explored the mechanisms underlying the control of cognitive processes in complex tasks. Typically, that research has focused on the operation of individual hypothesised control functions such set-shifting or response inhibition, but in complex tasks it is likely that behaviour will depend on the coordinated action of multiple control functions. I will present three experiments and a model that explore the relationship between two proposed cognitive control functions: set-shifting and place-keeping (i.e., keeping track of one's place within a sequential task). The experimental task involves switching from one stimulus-response mapping to another across a series of trials, according to a predefined sequence and in the face of occasional brief interruptions. Response-stimulus interval, interruption length and interrupting task were varied. In all experiments, varying response-stimulus interval led to standard effects attributable to set-shifting, while varying interruption length led to standard effects attributable to place-keeping, but in no cases did the factors interact. The results support the view that set-shifting and place-keeping are achieved by separable control processes. This view is illustrated with a computational model of performance on the task that extends an existing model of set-shifting through the addition of a separate place-keeping mechanism.

Expert Performance: Merely Automatic Skills?

Olga Markič

Department of Philosophy,
Faculty of Arts
University of Ljubljana
Ljubljana, Slovenia

A growing number of studies is dealing with the topics that are at the intersection between philosophy of sport, philosophy of mind and cognitive science. According to classical cognitive science approach athletes are processors of information and intentional movements are set up in advance by a rule or command structure ("motor program"). The embodied cognition approach puts much greater emphasis on the role of the body, is bottom-up and takes the primacy of perceptual and motor processing. It provides a framework to investigate the kinetic-tactile processes that were previously pretty neglected area of research. According to the embodied approaches knowledge emerges through the agent's bodily engagement with the environment. Some researchers (e.g. Dreyfus) think that for experts who have gone true a long training regime, skillful behavior and knowledge-how do not need additional conscious awareness. In the talk I will focus on the role of movement and action in sport, point to the interdependency between theoretical and practical knowledge and suggest that there is still a role for consciousness in expert performance.

Sensorimotor Processes in Empathy

Igor Riečanský

Department of Basic Psychological Research and Research Methods,
Faculty of Psychology
University of Vienna
Vienna, Austria
&
Department of Behavioral Neuroscience,
Institute of Normal and Pathological Physiology,
Centre of Experimental Medicine,
Slovak Academy of Sciences
Bratislava, Slovakia

Empathy is an important social cognitive skill that enables us to share and understand the feelings of other people. In recent years, social neuroscience research has made considerable progress in identifying the neural mechanisms of empathy. Earlier accounts of neural underpinnings of empathy mainly stressed the role of shared affective representations between self and others. My talk will address the increasing body of evidence suggesting that empathy is also supported by sensorimotor processes.

Student Initiative

Simulies: Graded Lies and Dynamic Trust. A Simulation Study

Borut Trpin[1], **Anna Dobrosovestnova**[2], **Sebastian Jakob Götzendorfer**[2]

[1]University of Ljubljana

[2]University of Vienna

Despite the common definition of a lie being the liar believing some proposition A but asserting that A is not the case, in reality few lies are so clear-cut [1]. Particularly, we are interested in partial lies (when a liar is confident but not certain that A and asserts "(probably) not-A") and start our investigation at the outset of a recent debate regarding the blameworthiness of partial liars (see [1];[2]). We argue that partial lies are more damaging since they are harder to detect.

To test our claim, we developed a coin-toss-based computer simulation based on an artificial agent (the dupe) who updates her beliefs based on partial lies and her dynamic degree of trust in the source, while following the principles of Bayesian epistemology for partial beliefs. Particularly, the dupe iteratively updates her belief based on the following parameters: the outcomes of the previous coin tosses, prior assertions made by the liar and the current degree of trust

Lying – if to be successful – is only possible when the recipient of a lie extends at least some degree of trust into the message and the liar as the source of the message. Thus, following Wang and Vassileva [3] we incorporated trust dynamics in the simulation by inferring that the dupe will update her trust in the liar by "keeping a tab" of how many times the liar made either a correct or a false assertion. Furthermore, we used Brier Scores to assess the *epistemic damage* caused by relying on the liar's assertions whereas a form of cash betting was incorporated to formalize *practical damage* (see [1]).

Preliminary insights showed, that in instances of both short-term and long-term simulations partial lies lead to more epistemic damage than outright-lies – however, with differences as to how the "severity" of the lie affects the trust dynamics.

We acknowledge that simulation studies of (embedded) social phenomena such as lying and trust streamline the complexity associated with real-world-interactions. However, formalization processes and computer simulations afford philosophy with a distinct advantage (e.g. systematical exploration of temporal dynamics) over traditional ways of research, which otherwise suffers from small sample sizes or could hardly be extensively investigated [4].

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[1] S. F. Krauss, "Lying, risk and accuracy," *Analysis*, vol. 77, no. 4, pp. 726–734, 2017.

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Talks

Enactivism and Language: A Conceptual Analysis

Tomaž Babić

University of Ljubljana

Enactivist conceptualization of language stems from biological and epistemological assumptions posited by Humberto Maturana. Based on his observations, there has been an increase in understanding language as a biocultural phenomenon. Maturana does not see language as an abstract system of symbols with which we manipulate according to syntactic rules, but rather a lived "entity", which constantly enacts itself based on the interactions between the organism and its environment on the one hand, and between the organism and another organism on the other [1]. Language serves to coordinate behavior between organisms and it is in a state a state of flux based on the interaction. Language is thus an ongoing process, which exists only as "languaging" not as isolated "items of behaviour" (as per Maturana and Varela) [2].

Philosophy of life, which accompanies every enactivist interpretation of cognitive processes and cognition in general, does not find its way into the mainstream conceptualizations of language. Therefore, it is not unusual that the concepts used by traditional cognitive linguistics to explain and understand language, do not resemble a living thing at all, but quite the opposite. Traditional cognitive linguistics treat the mind akin to a von Neumann computer and view language as a symbolic system for translating thought. Thinking is therefore computation. Symbolic manipulation is governed by a set of rules that predict what possible "legal sentences" can be generated in a given language [3]. Such highly abstract conceptualization of language and thought has little to do with a living language.

My goal is to conceptually analyze epistemological assumptions of traditional cognitive linguistics and see how they fit into enactivist conception of language. I will attempt to adjust those assumptions in order to provide a concept of language that more aptly resembles a living "entity". Evidence acquired by traditional cognitive linguistics thus far will not be discarded, but rather interpreted in a new way to fit the embodied paradigm. I will also attempt to provide a methodological approach to studying language that will encompass various aspects of human behaviour and cognition. These include phenomenological, behavioral and cognitive processes.

References

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[2] H. R., Maturana, "Biology of language: The epistemology of reality," *Psychology and Biology of Language and Thought*, pp. 27–63, 1978.

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The Rationality of the Crowd: Impact of Herding Behaviour on Financial Decision-Making

Gregory Bartel

University of Vienna

Context

Extreme financial market fluctuations, such as stock market bubbles and crashes, are mainly seen as the result of inadequate use of reason and herding behavior[1]. Herding is defined as a decision-making process during which individuals follow others and imitate group behaviors, rather than to decide independently based on personal perceptions.

Purpose

This article proposes an innovative approach to herding behavior in financial decision-making. The hypothesis is that herding reflects a specific pattern of interactions between different cognitive and emotional decision-making systems. By integrating the observed behavior of the other market participants in the calculation of the value of decision options, the individual efficiently adapts to conditions of high risk and uncertainty. This extended form of social learning is rational at its core as it aims at improving decision-making. The goal is to describe the behavioral and neural mechanisms by which herding influence affects value computation and probability-weighting functions, using the framework of Prospect Theory [2], and measure the context-dependency of its magnitude and duration.

Method

In a series of behavioral experiments, changes in probability-weighting functions in simple financial decision tasks will be analysed to see how choices are affected by the presence of herding influence. Supplementing behavioral measurements with neuroscientific methods, its neural signature will be explored in the brain's emotional and cognitive decision-making systems in the ACC and vPFC.

Results

The results should reveal that the probability-weighting functions change in the direction of the aggregated decisions and are modulated by the relative size or direction of the crowd. Context-dependency of this effect in terms of amount of risk and uncertainty, framing, emotional valence and arousal further affect individual valuation mechanisms.

Implications

The results of our experiments will reveal which factors precipitate herding behavior in financial market situations and how value calculations of alternative behavioral options are shifted to the crowd. The model will hopefully be able to predict magnitude and duration of herding influence on financial decision-making, based on levels of endogenous fluctuations and other context-dependent variables. This is a first step towards a more comprehensive model of crowd rationality.

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Ethics in Contemporary Mindfulness: Exploring the Transformative Power of Implicit Ethical Teachings

Judith Belkot

University of Vienna

Through the introduction of mindfulness into the West, the practice has been radically recontextualized and thereby, so the criticism, deprived of its potential to transform practitioners on an existential level. Extracted from the Buddhist framework to be utilized in secular clinical and therapeutic settings, mindfulness has been integrated into a substantially distinct system of beliefs and values, which is arguably not fit to provide it with the same kind of guidance and purpose – e.g., [1]. Critics are especially concerned about the omission of explicit ethics teachings in modern mindfulness programs – e.g., [2]. Yet, while arguments for augmenting mindfulness with an ethical dimension are cogent – especially in consideration of some specific applications as in military training or corporate settings –, the claim for the teachings to be explicit remains debatable. Indeed, this postulation rests on a typical Western conception of ethics, which is one of abstraction and formalization. There are, however, alternative, more practical approaches to ethics that conceive of it as a method of training rather than an intellectual study. These notably include Varela [3] and his notion of 'ethical know-how'. Drawing upon recent insights from cognitive science, he suggests that ethical understanding and behavior are rather embodied and enacted. Such understanding of ethics supports the idea that ethical development is not dependent on explicit teachings but may well be elicited through implicit teaching elements.

There is little research yet on the actuality and potential of implicit ethics teachings in the context of contemporary mindfulness. With my thesis, I seek to take a step towards filling this research gap. Specifically, my goal is to identify implicit (and explicit) teaching elements in modern mindfulness programs and assess their effectiveness in eliciting ethical development in practitioners. The concepts of ethics and ethical development, as employed here, denote virtues as manifest in one's character and conduct and the cultivation thereof. Since the project is still in the planning phase, the exact methodology is yet to be determined. To allow for an in-depth exploration of the topic, a mixed methods approach, such as a combination of qualitative and quantitative measures and ethnographic observation, may be worthwhile. Insights into the effectiveness of implicit forms of teaching are not only valuable in the context of contemporary mindfulness but can also be useful in many other areas.

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[1] S. Vörös, "Sitting with the demons – mindfulness, suffering, and existential transformation," *Asian Studies*, vol. 4, no. 2, pp. 59-83, 2016.

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Cognitive Processes in Creative Aha-Experiences

Anna Berger

University of Vienna

Within the interdisciplinary field of creative cognition, researchers are trying to identify cognitive processes and structures that constitute creative acts [1]. A further goal is to identify which cognitive processes are underling creative acts, using different methods from the interdisciplinary field of Cognitive Science. In that sense, the creative cognition approach aspires to create a better understanding of creativity as well as new methods that enable and facilitate creative acts [2]. Inspired by the interdisciplinary research of the creative cognition approach, this master thesis addresses the question of how creative Aha-Experiences are emerging and what different phases they consist of. An Aha-Experiences can be described as "A sudden comprehension that solves a problem, reinterprets a situation, explains a joke, or resolves an ambiguous percept…" [3]. In this regard I argue that successful creative processes, which are resulting in new ideas and products, follow procedures which necessarily include creative Aha-Experiences.

Besides a general review of the current stance of cognitive theories about creativity with a specific focus on the creative cognition approach, my thesis is mainly based on the data that is collected from interviews with 25 people that are pursuing a creative profession. Therefore I will interview designers, artists, musicians, photographers and architects. The creative professionals are interviewed about personal, creative Aha-Moments that they experienced during creative work. Although creative Aha-Experiences are also experienced by other professional groups, the research is restricted to creative professions because professional creatives face the constant need to create new work and therefore seek for Aha-Experiences and new ideas frequently. Therefore they are highly experienced in having creative Aha-Moments, which makes them eminently suitable for my investigations. The used method for the interviews is called "Elicitation Interview technique" [4] and originates from the field of empirical phenomenology. This technique is designed to enable the interviewer to get access to conscious and pre-conscious cognitive processes of the interviewee. In that sense the goal of the interviews is to find out how creative insight processes are experienced and which circumstances enable or facilitate them. The scope of the master's thesis is to develop a phase model of creative Aha-Experiences that comprises the findings from the empirical, phenomenological research and incorporates possible similarities with interdisciplinary research from the field of creative cognition. The phase model should ideally work as a generalized overview of Aha-Experiences. Additionally, I am trying to find out which circumstances are generally beneficial for creative ideas, adding a rather practical perspective to my thesis.

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Application of Physiological Measures for Evaluation of User Experience: A Skin Conductance Experimental Study

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Measuring data on the user experience (UX) is important in many ways— for example, web developers, interaction designers and UX researchers may find such data useful in enhancing the information architecture or navigational features of web pages and mobile applications. The need to measure this data as accurately as possible arises, in order to help in the process of creation of more user-friendly web and mobile applications with better findability, accessibility, and easier learnability, from which the most benefit goes to the user, i.e. all of us [1]. It is most common for usability studies to evaluate usability via measures such as completion time, success rate, questionnaires [2]. While most studies resort to these 'typical' methods of evaluating an interface's usability, the subjective nature of the methods generates concerns as to the reliability of the data. On the other hand both, task-performance and subjective measures do not reflect directly the users' cognitive loads and psychological involvements, and they are not able to explain the related emotional arousal [3]. Consequently, a more objective and efficient methods are needed. In this thesis, we therefore decided to combine typical task-objective measures (completion rate, time needed for finishing tasks) and subjective participant evaluation (task difficulty, intuitiveness of application, etc.) with a physiological approach, particularly measuring the skin conductivity response (SCR). Our main objective within this study is hence to analyze the relationship between physiological measures and traditional usability measures. In order to evaluate the relationships between these measures, we design an experiment with a subsequent correlation analysis. We investigate whether skin conductance response is effective in identifying specific emotions in users' interactions with a web application, and examine if skin conductivity measures can enrich or support traditional usability metrics. Our hypothesis is that we will find correlations in a manner that reflects that with worse task-related results (longer time needed for completing tasks, number of clicks) and more negative self-evaluation data (difficult task, unusable interface, etc.), higher levels of skin conductance levels will be observed.

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Preservation of Moral Knowledge in Patients with Frontotemporal Dementia and Their Legal Responsibility

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Morality is defined as a code of values and customs that lead social behaviour in all rational human beings. Neural underpinnings in the brain consist of several different regions; the main one is ventromedial prefrontal cortex (VMPFC) which applies moral and emotional values to social events and cooperates in the processes of the theory of mind and empathy. Important regions in the morality network are also orbitofrontal cortex and ventrolateral cortex, amygdalae, anterior insula and dorsolateral prefrontal cortex (DLPFC) [1]. Studies with healthy subjects and patients with frontotemporal dementia (FTD) revealed notable distinctions in moral knowledge between groups. One of the earliest sign of FTD is drastically changed personality and loss of moral compass. Patients can become aggressive, insulting and often involved in traffic accidents. In some cases, they start to steal or even develop pedophilic tendencies. Studies have shown that patients with FTD exhibit lack of emotional moral knowledge but keep moral sense for rational dilemmas where utilitarian solutions are required [2]. VMPFC as the first damaged region in morality network causes lack of moral knowledge, especially in emotionally determined situations when a person can direct harm to another (human)being. One example is an emotional dilemma in which you are standing next to a stranger on the bridge when you see the train driving toward the group of people; if you push the stranger from the bridge the group of people will survive, inversely they will die. Since healthy individuals would normally hesitate to push the man from the bridge, patients with FTD would do so without guilty conscience [3]. To find out how patients with FTD interact in social circumstances they will be presented with several moral dilemmas divided into emotional and rational ones. Dilemmas will be introduced by written scenarios, pictures and through talk. We will measure responses, reaction times and overall behaviour, and compare their results with the control group of healthy participants. We hypothesise that patients with FTD will exhibit different moral knowledge compared to healthy subjects, especially in personal or emotional moral dilemmas. Our expectations can contribute to better understanding of changes in behaviour and moral knowledge in patients with FTD. Furthermore, we can shed a light on how to proceed with these patients in trials after they committed a criminal act.

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Phenomenology of Blind People

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Context

Sight is our very important sense. Healthy adults rely on it maybe even more than we realize. The experience of seeing something is something so intimate and so tightly incorporated in our everyday experience, that we can hardly imagine life without it. Even harder, how blind people experience the world; from reading to communicating verbaly. In my project I would like to investigate more on phenomenology of blind people and how does their phenomenology differs from healthy adults. For example: how did (verbal) communication change? Are blind people better in recognizing the colour of our voice because they lack the visual information?

Purpose

Because it is hard for me to imagine how blind people comprehend the world and themsleves, I would like to learn more about it through my research. I think it is important to investigate this area, because there is not much information available and still needs a lot of research.

Method

Before I would start my project I will analyse some of the existing literature and researchs on the topic. After that I will choose five subjects for the project and then proceed with the interviews. I will then analyse and interpret the anwsers.

Results

Because I haven't started my research yet, I don't have any results to show. Yet, I can say I am expecting there are going to be some differences between healthy and blind individuals. It will be difficult, though, to isolate and compare some aspects of experiences due to differences in pre available information between the two groups.

Implications

I think there could be more researchs on this topic. I will try to point out some aspects that I haven't found in other researchs and complement the existing knowledge.

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The Relationship Between Amphetamine-Induced Dopamine Release and Susceptibility to Induced Auditory Hallucinations

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Auditory hallucinations are a major psychotic symptom. They are most commonly associated with schizophrenia, but infrequently occur in other conditions, as well as in a population of people who do not meet diagnostic criteria for any psychiatric disorder. According to the predictive processing view, perception is an inferential mechanism, whereby incoming sensory signals are combined with top-down predictions about their causes to yield actual percepts. Within this framework, aberrant perceptual experiences are seen as resulting from deficits in assigning proper weight to either of the two elements. In case of hallucinations, it is thought that overweighed top-down predictions can lead to percepts even in absence of external stimuli [1]. This model is supported by evidence that auditory hallucinations can be induced by means of strengthening perceptual expectations in a conditioning task [2]. Furthermore, the frequency of induced hallucinations differentiates between hallucinators and non-hallucinators, suggesting a connection between susceptibility to conditioned hallucinations and the propensity to experience them outside of the lab. In line with consistent findings that psychosis is characterized by increased dopamine neurotransmission in the striatum, a recent study [3] has linked perceptual biases resulting from overestimated priors to both hallucinatory experiences and dopamine release. This points to a possible dopaminergic basis of the predictive processing deficits thought to underlie auditory hallucinations. The thesis will try to establish whether higher susceptibility to induced auditory hallucinations can be associated with an increased responsiveness of the dopamine system to small doses of intravenously administered amphetamine in healthy subjects. Sixteen volunteers will undergo a d-amphetamine [11C]-(+)-PHNO positron emission tomography scan, allowing for measurements of dopamine levels before and after amphetamine administration in a single scanning procedure. Same subjects will complete the conditioning task [2] at a different time and the estimated propensity to experience induced hallucinations will be compared to dopamine release at baseline and post-amphetamine.

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How Dependent Are fMRI Results on Specific Analysis Tools: A Comparison of Results Analyzed with AFNI, FSL and SPM

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Introduction

Functional magnetic resonance imaging (fMRI) is a neuroimaging method based on the blood flow in the brain, which indirectly indicates neural activity. The data is analyzed in multiple steps; this can be done in one or more of the available software packages, the most common being the open-source packages AFNI (Analysis of Functional NeuroImages), FSL (FMRIB Software Library) and SPM (Statistical Parametric Mapping) [1]. It is possible, however, that these software packages could give different results. A few studies have shown that there is a methodological plurality, that can result in a different general pattern of identified brain activation [2]. If that is the case, it would put into question the validity of applying this type of neuroimaging. The aim of our study is first to compare the results of obtained using AFNI, FSL and SPM tools, and second, to compare the results of a block design to an event-related design.

Methods

We will be using data from a study on obesity, where 16 subjects performed an attentional capture task using salient stimuli. This included a block design run and an event-related design run. The data will be analyzed separately with AFNI, FSL and SPM and the results will then be compared quantitatively and qualitatively.

Results

We expect the results from the different software packages to not differ significantly. Whereas some studies have shown that they do differ [2], our expectations are in line with the assumptions in today's neuroscience. The results from the block design are expected to be more robust than the ones from the event-related design, as the models indicate.

Discussion

With our research, we wish to improve the validity of neuroscientific studies that use fMRI as their method. While there have been many comparisons of fMRI software packages, very few directly compare the results obtained on the same dataset, so this will be valuable information. Showing that results do not differ when using different software packages will support the presumption that neuroimaging gives us a reflection of reality and not just methodological bias. It is not possible to make this conclusion at this point, as there is still the question of other theoretical assumptions, interpretation of results etc., but it is a step further into reflecting on the methods used in cognitive science.

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Beyond Constructivism: Exploring Novel Learning Paradigms and Their Implications for Educational Robotics

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Developments in the fields of AI and robotics have led to an increasing interest towards using humanoid robots in education. But what does it mean for a robot to assume a role of an educator amid increasing (technological and societal) complexity? What kind of goals, behavioral protocols and normative frameworks should a robotic educator incorporate? How should we approach conceptualization and design of the structure of a relationship between a robotic educator and a human leaner? To answer these questions, we ought first to define what is understood by knowledge, learning and, more broadly, education and the role we wish to ascribe to it. Dominant approaches to education, also in the field of educational robotics, have been largely shaped by constructivism and, more recently, constructionism [1]. Unlike traditional positivist approach, where knowledge is conceived as some sort of representation of "external truth", constructivist paradigm construes knowledge as shaped by subjective experience of the learner. Despite its predominance and, no doubt, practical usefulness due to its orientation toward active, problem-solving and embodied learning, I believe that both subject-centered constructivism and social constructionism are epistemically insufficient if one chooses to conceptualize knowledge neither as an independent entity "out there", nor as an individual-based subjective construct, but as a complex, non-lineal space of emergence.

My research is an attempt to move beyond constructivism and to hypothesize what would such a conceptual and epistemic shift mean for the future of educational robotics. With this aim in mind, I will first explore recent works at the intersection of complex system theory and philosophy of education [2] and examine their possible points of intersection with the dynamic enactivism paradigm as formulated by Varela and Maturana [3]. Using the insights gained, I will proceed to formulate an education and learning framework that will ground my further investigation into the field of educational robotics. Seeing that this is an exploratory project, my end goal is not to propose a concrete architecture and its underlying algorithmic structure of an educational robot. Rather, I aim to suggest possible answers to the questions raised in the beginning of this abstract, with a broader intent to conjecture what the future of educational robotics could look like in line with the proposed education framework.

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Influence of Age Differences on Media Multitasking

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Multitasking is defined as performing two or more tasks simultaneously. The prevailing concept of multitasking as a process derives from cognitive theory. Currently the most holistic explanation of the continuum of multitasking (from concurrent to sequential performing of activities) is threaded cognition [1]. It is based on three pre-existing theories: ACT-R cognitive architecture, which explains processing of information; the threaded cognition theory of concurrent multitasking that explains the simultaneous execution of two or more tasks; and the "memory-for-goals" theory, which explains the interruption and continuation of activities based on memory consolidation that enables tracing of goals [1].

With the development of new types of digital media and online services for interpersonal and mass communication, new types of multitasking have appeared, such as media multitasking (MM). Prevalent phenomenon of MM refers to "a person's consumption of more than one item or stream of content at the same time« [2]. Because most of the studies of MM are based on student population samples, there is a lack of insight into the possible differences in the form and occurrences of MM with respect to the age of those individuals. Therefore, the purpose of the study is to determine whether there is a correlation between age and the expression of MM; more precisely, how is the scope of MM changing with age (rising or decreasing by age groups), and are there differences in the specific forms (combinations of each concurrent activities) of MM related to age.

Research is based on the online questionnaire of a representative sample of the Slovenian population aged between 16 and 55 years. The questionnaire contains one of the most used measuring instruments of MM – Media Multitasking Index, which measures the proportion of time a person uses more than one medium [2]. It also consists of a series of questions that examine the possession of various multimedia devices and a set of questions that relate to the sociodemographic characteristics of the respondents.

According to previous research it is expected that, at first, the extent of MM will increase by age groups and then decrease due to the cognitive decline and generation differences that are related to the use of technology. Different combinations of concurrent activities are expected to be observed by age groups (e.g. for the oldest age group fewer combinations of concurrent activities are expected compared to younger age groups).

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On the Impact of Cognitive Science Terminology on Interdisciplinary Knowledge Creation Processes as Analyzed with the Example of Reinforcement Learning

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The (interdisciplinary) cognitive science community is flooded with loaded terms, such as "behavior", "reward", "input" or "output". What scientists *want* to communicate when using such terms, and what they *do* communicate to peers of neighboring disciplines with overlapping terminology diverges [1]. Such phenomena are analyzed by means of philosophical frameworks such as constructivist theories of language and thought. One prominent manifestation of this phenomenon at the intersection of psychology (PSY) and artificial intelligence (AI) will be investigated: "Reinforcement Learning" (RL) and what RL respectively is understood to be. The objective is to investigate language-related and theoretical components in the knowledge creation processes both within AI and PSY, and then in interdisciplinary collaborations on RL. Borrowing terminology of speech act theory [2], research involving RL can be characterized by locutionarily identical but illocutionarily and perlocutionarily diverging scientific nomenclature and such mismatches can be expected to affect the scientific results.

Reaching authoritative conclusions about a phenomenon as intangible as the difference in meaning created by a divergence between the *literal* use of a scientific term and the *implicit* theoretical connotations conveyed constitutes an effort facing serious challenges. However, the use of multiple scientific methods aims at approaching conclusive statements.

This multi-method investigation comprises of two steps, first, a theoretical and qualitative approach to explicate a theoretical grounding, followed by empirical experimentation with a computational model consistent with said grounding: - descriptive literature research (analyzing key journals and glossaries in PSY & AI) and meta-literature comparisons (using e.g. ProQuest or Scopus) - computer simulations (using one tractable RL model to assess the influence of rather PSY- or AI-inspired conceptualizations – of e.g. "behavior" or "reward" – as carried out by different structural representations and formalization of parameters).

Indeed, the very instance of a psychologist as myself, who is studying cognitive science and experiments with AI-inspired computer simulations, might be viewed as a variation of the research topic. This combination – as a further assessment of the phenomenon itself – might also produce interesting insights regarding the field of interest.

Acknowledgement

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Recurrent Neural Network Model of Phonological Development Using Distributed Representations

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Context

The goal of present thesis is to build a psycholinguistically plausible computational model of phonological development, inspired by the existing models by Takac et al.[1] and Dell et al. [2]. Takac's [1] current model of phonological development is considering localistic representations of phonemes and word-meanings (one-hot vectors, more technically). Moreover, according to their study, even the localistic neural activations provide an explanation for several patterns shown by infants during phonological development. Merely all the neurobiological or even neuro-imaging studies claim, that neural activations are distributed within the brain; Moreover, when such an area, where an activation pattern is exceeding during a given treatment, cannot be considered as the brain area responsible for that phenomenon. Suggesting, that every brain area respond to different treatments to different extent. Our thesis aims to reproduce this phenomenon within the hidden layer of our network.

Method

Thus, in the experimental part of our work, we developed a Simple Recurrent Neural Network (SRN) model, trained under circumstances of the source study [1]. However, in our study, phoneme and even the meaning representations are modified in a neurobiologically more plausible way. The model is tested for performance during the training, analogically to children learning their first 300 words, approximately in their first two years. Nevertheless, even the methodology of analyzing infant's data will be maintained, accounting for phonological Neighborhood density and related phenomena.

Results

Our results suggest, that the phonological Neighborhood Density effect is not necessarily related to localness of representations. In line with our novel findings, we provide an alternative explanation of the present phenomenon. Furthermore, speech error analysis is presented, in order to better understand and to support our hypotheses based on the Parallel Distributed Processing Paradigm [2]

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Cognitive Biases in Performance Assessment Processes

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The dual theories of cognitive processing [1] suggest that we are not always in full possession of our rationality [2] when it comes to making decisions. Furthermore, recent discoveries in behavioral economics [3],[4], demonstrate that we are constantly subject to several types of biases at any given moment. This research wants to bring the ideas developed in those fields into the realm of management strategies, most precisely the practices and processes of performance management [5]. It aims to explore the kinds of cognitive biases that we are mostly subject to during assessment processes, and what it represents in terms of impact to the people and business involved.

This research sits in the merge of social and cognitive sciences. It's relevance lies in the fact that most companies in the world use and subject its employees to a similar model of performance management that presupposes a rational agent [6].

The entire field of behavioral economics itself emerged after the questioning of the presuppositions of the field of economics, in which the humans were viewed as rational, purposeful, capable of statistical inferences, fully aware of their movements and decisions. Now we know it is not quite so [7]. We are mostly responding to our immediate environment, we are prone to influences beyond our capacity of recognitions, and we are not always operating with an engaged consciousness.

This research will bring this way of looking into the human agent into the realm of performance management and performance assessment. My hope is to be able to shed some light into the foundations in which those practices are grounded and then, by questioning those assumptions, suggest new possibilities of action.

I will explore the topic by conducting exploratory interviews with leaders in human resources management, which will give me a panoramic view on the assumptions operating in the systems of performance management. Then, I will conduct a qualitative questionnaire-based investigation with employees and leaders in several companies on the possible biases that operating in those PM processes. The research will be conducted in Brazil, where the author comes from.

The hypothesis is that we may find misalignment between the assumptions that guide PMPs and the current understanding of human rationality, and also the presence of biases in PM assessments. Hence, the consequent failure of PMPs to deliver what they promise, that is, higher motivation and performances, both for individuals and organizations.

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Lexical Processing of Complex Pseudo-Words in Patients with Alzheimer's Disease

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Context

Alzheimer's disease (AD) is the most common etiology for dementia . It affects cognitive performance of elderly adults. Previous research reports subtle language impairments in individuals specifically in domains related to lexical meaning. It has also shown that progressive decline in language can be investigated by looking for subtle anomalies in EEG activity.

Purpose

Given that language performances in individuals with cognitive impairment are often subtle and unclear some researchers have claimed that their performance depends not so much on their language knowledge but rather on the task [1]. Patient performance deteriorates with increased task complexity, an indication that other-than-language cognitive systems, such as executive functions, might be interfering in language processing. The purpose of this research is to investigate the role of executive functions in lexical processing of pseudo-words that violate various principles of word formation in Slovene. The task represents complex situation in which individuals will be presented with lexical decisions that demand conflict resolution.

Method

The role of executive functions will be investigated by looking for subtle anomalies in EEG activity. The focus will be on induced power changes in oscillatory activity, generated by the onset of target pseudo-word. I'll be examining oscillatory activity in theta (3-5 Hz), alpha (8-12 Hz) and beta (15 – 20 Hz) frequency ranges given that prior studies have implicated these bands in various aspects of language processing [2]. Electrodes of interest will be determined by Hagoort's neurobiological model of language. The model is extending beyond the classical core language regions and gives great importance to brain connectivity. According to Hagoort, modalities such as executive functions are part of language comprehension [3].

Results

Given the examined literature I expect the oscillatory activity in patients with AD to be attenuated which would indicate that lexical processing is slower. The comparison between pseudo-words and words within AD group could imply on interference of executive functions when complex lexical decision is made. If I can show specific electrophysiological correlates in AD patients with psycholinguistic approach it could represent another potential method for determining biomarkers for early detection of AD.

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Genetic Predisposition for Neurological Disorders in Populations – An Evolutionary Perspective

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Introduction

Novel research in genetics and genomics has shown that the development and function of the brain are controlled by the genetic blueprint, and it reflects changes that have happened over the history of evolution [1]. The phenotypic evolution in populations is the result of different evolutionary forces acting on heritable variation such as mutation, genetic drift, gene flow and natural selection. Disease risk alleles of neurological disorders should be under strong negative selection because of its negative fitness effects. However, it appears that at least some neurological disorders are highly polygenic, suggesting that their genetic predisposition should be due to the additive result of a hundred to thousand genetic variants with small effect size [2]. Moreover, these risk variants may differ among the human populations. The strength of natural selection may be dependent on various environmental factors driving the population-specific frequency of selected alleles. For instance, results of a recent study suggest that certain autism spectrum disorder (ASD) risk alleles are under positive selection during human evolution due to their involvement in neurogenesis and cognitive ability [3].

Method

In this study, we will use different population genetic models of natural selection and genome-wide tests of positive selection to examine the hypothesis that polygenic selection drives population-specific risk alleles for neurological disorders in human populations. We will combine bioinformatics analyses of the genomic data, human population genetics analysis, and machine learning methods in order to identify the important variables, gene networks, and molecular pathways.

Results

The integration of genomic data, population genetic data, and functional genetic data will help us to identify the causal genetic variants and to determine the evolutionary networks underlying neurological disorders susceptibility. Finally, we will try to answer to what extent is human behavior a product of genes and to what extent of the environment.

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Resting-State Brain Connectivity and Social Understanding in Aging

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Theory of Mind, Empathy, and Intrinsic Social Brain Networks

Understanding others is necessary for successful social interaction. Studies on both affective (studied under the term "empathy") and cognitive (studied under the term "Theory of Mind" (ToM)) routes to understanding others have typically been conducted using participants performing either specific ToM tasks, empathy tasks or both in conjunction [1]. Importantly, there has been a lack of studies reporting possible intrinsic interactions of these empathy and ToM related brain regions, especially when it comes to age-related changes in intrinsic connectivity. Such research endeavours would be intriguing since the distinct neural networks for both ToM and empathy strongly overlap with the intrinsic (resting-state) Default-Mode Network (DMN) of the human brain [2]. For example, age-related studies suggest that the DMN goes through structural and functional changes throughout the lifespan, with functional connectivity of the DMN at rest significantly reduced in older compared with younger adults [3].

Method and Expected Results

Participants will be separated into groups of adolescents (14-17), young adults (20-30) and older adults (60+). Each participant will undergo a behavioral session measuring Empathy (Using the Emotional Contagion Scales (EC), the German version of the Interpersonal Reactivity Index (IRI) and the Bermont and Vorst Alexithymia Questionnaire), ToM (Using a modified version of the classical Frith-Happé animation task) and a separate rs-fMRI scan. Both of the behavioral measures and the fMRI scans will be acquired for each participant individually. Rs-fMRI scans will enable us to assess intrinsic brain connectivity which is later to be compared with the task behavioral results. We expect there to be differences in intrinsic connectivity both between and within the main resting-state networks of interest that are not only correlated with the behavioral results but also with the age of the participants.

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Natural Human Reasoning Abilities and Visual Matrix Puzzle Solving

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Context

Raven's Progressive Matrices and similar matrix problems have been used in research and intelligence testing for decades. The matrix puzzles are nonverbal and are thought to measure analytical intelligence. They are based solely on visual representations and challenge one's ability to recognize patterns that consist mainly of visual similarity and analogy [1]. In our research we will address natural human reasoning abilities in the case of the Raven's progressive matrices-like puzzles of varying difficulty.

Goals

Our first goal is to analyze the underlying structures in Raven's original Standard Progressive Matrices to determine what types and combinations of relations were used. Within the matrix sets two basic types of problems have been identified: object transformation problems, and logic problems. The object transformation problems are primarily zero-, one-, or two-relation problems, and describe the number of pattern changes in the matrix problem. The logic problems consist of operations such as addition, conjunction, disjunction, or exclusive disjunction [2]. Our next goal is to generate a large set of matrix problems that have properties similar to those of Raven's original matrices. This way we will create a bigger and more diverse set of puzzles that will still correspond to the same underlying structure of Raven's original matrices. It will allow us to have control over the surface features and difficulty of the matrix problems, as well as expand the underlying rules of puzzles for the purpose of our research. Our final goal is to present a developed matrices test to participants in the form of a questionnaire and the results will enable us to determine natural properties of human reasoning abilities.

Results

We hypothesize that the difficulty of the matrices will increase in the following order: one-relation, two-relation, three-relation problems, and logic problems. The latter should be the most difficult to solve because it involves inference from the patterns of surface features to a specific underlying rule. The puzzles in each of these sets consist of different underlying structure, the complexity of which corresponds to increasing difficulty of the puzzles. The difficulty of the developed matrix problems will be determined on the basis of a criterion that is yet to be selected. Success rates of solved puzzles will enable us to determine the properties and the limits of natural human reasoning abilities.

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Are Truer Perceptions Really Better Perceptions? A Genetic Algorithm Study

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Cognitivism regards the cognitive system as an information-processing machine. Its purpose is to build an isomorphic representation of the outside world through the input and processed information from the environment, which is supposedly knowable to the cognitive system. Evolutionary scientists claim that, consequently, natural selection optimises perception in such a way that the internal representations mirror the outside world more and more accurately [1]. Enactivism, a contemporary non-cognitivist paradigm in cognitive science, rejects the notion that cognition's purpose is the mental reproduction of the outside world through perception. The objective reality is not knowable to the cognitive system according to the paradigm's constructivist presumption. Each organism co-creates its own world through its own perception or the process of knowing – as according to enactivism, perception is inextricable from knowing. This is the consequence of the organism's identity-production based on its own survival needs [2].

In my work, I will research whether veridical or non-veridical perception bears more survival value for an organism. I will do this by testing different agents with a genetic algorithm (GA). The GA will be grounded in philosophical analysis of how different presumptions of different cognitive science paradigms influence research on epistemic questions of the process of knowing the outside world. My overall aims are threefold: 1) to deepen the understanding of how cognition, computation and construction are connected, which will be necessary to build the model, 2) to reveal the influence of presumptions on such research, and 3) to make research on theories of non-veridical perception more credible. According to the previous research by Hoffman et al. [3], whose work was based in cognitivism, I expect for my own computer model, which will be based in enactivism, to show similar results – that certain kinds of non-veridical perception offers more survival value to the modelled organism. Hoffman et al.'s model is presented as evidence in support of authors' Interface Theory of Perception, which claims that perception is a user interface between an organism and the outside world, fitted to the organism's fitness and not the objective truth. Hoffman et al.'s model will be reproduced and its presumptions analysed. Then, Hoffman et al.'s cognitivist model's results will be compared with the results of my enactivist model.

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An Electroencephalography Study on Neural Correlates in Restorative Yoga and Mindfulness Meditation

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Restorative yoga is a very gentle type of yoga and an active relaxation. It makes use of props (blankets, bolsters, straps, blocks, weights, chairs, eye pillows etc.) to create positions of ease and comfort that facilitate relaxation and health. This type of yoga is highly suitable in psychosomatic, stress related issues and can offer a great balance against invasive procedures and discomfort that patients go during their treatments[1]. Mindfulness meditation practice is done eyes gently closed, sitting position, legs crossed with a straight spine while the attention is placed on breathing in and out. While meditating the individual is focused upon her or his breathing, and when thoughts emerge, the meditator returns focusing on the object of meditation, breathing. Research has found that mindfulness meditation can reduce depression, anxiety and perceived distress. John Kabat-Zinn in one of the main influencers for Mindfulness meditation in the West. In 1979 he developed a Mindfulness-Based Stress Reduction program (MBSR) at the University of Massachusetts Medical School. This type of a program has been used in many hospitals and health clinics in the past decades [2]. We will be comparing a restorative yoga group to mindfulness meditation group in beginners with 7 different questionnaires and the EEG (electroencephalography) method. Subjects will have no prior experience on restorative yoga or in mindfulness meditation or any other type of meditation. The study will focus on detecting the presence of theta rhythms in the brain while performing mindfulness meditation and restorative yoga. Specifically, we are curious to see whether there is a difference in attaining the theta state between restorative yoga group and mindfulness meditation group.

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Development of a Cognitive Training Application for the Older Adults: A User-Centered Design Approach

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Introduction

Due to demographic changes, the number of elderly people in Slovenia and in the world is increasing. The percent of the older adults (65+ years) in Slovenia is 19.1% and is expected to increase to 33.4% by 2060 [1]. Cognitive impairment is a major health problem in old age and the effective treatments for reducing cognitive decline are needed. One of the alternative non-pharmacological strategies for improving cognitive functions is cognitive training. Applications for cognitive training have shown benefits [2], however training programs, available to elderly Slovene population are either too expensive or not adapted to their needs and abilities.

Purpose

The goal of our study is to develop a functional prototype of a cognitive training application for the older adults. The application will be designed for tablets as they are the best suited for the targeted population in terms of portability and users' visual abilities. The development will include the design of the cognitive training tasks which will be based on the theories of aging cognition and will target the following cognitive processes: memory, language, attention and visuospatial function. Furthermore, special attention will be dedicated to application's interface and interaction design to ensure that the application will be accessible, easy, engaging, user-friendly, satisfying, relatable to the user's everyday life and effective in terms of improving targeted cognitive processes.

Method

In user-centred design approach extensive attention is paid to the needs, requirements, and limitations of the users at each stage of the design process. The characteristics of the older adults will be analysed so the training tasks will be adapted to their perceptual, motor, cognitive and psycho-social capabilities. Iteratively, at least three successive versions of the user interfaces will be tested with five older adults per testing session in nursing homes and day-care centres. Sessions will be audio recorded and later analysed. These data will be then used to measure tasks and allow for a detailed analysis of participants' performance. Additionally, the participants will be also asked to complete the System Usability Scale (SUS) to access the usability of the application.

Expected Results

Task performance and user's satisfaction from the first to the last iteration is expected to be improved. The results and findings from the usability tests will be assembled into design recommendations for older adults that may be a useful contribution to the broader community when designing tablet interfaces for the older adults.

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The Meaning of Dying

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Terror Management Theory (TMT) can be introduced with two observations. First, humans, like other animals, are striving to survive. Second, the capacity for abstraction gives human beings the awareness of their own mortality. Limited existence combined with the will to survive creates a potential for anxiety. In order to deal with this terror of death, humans developed cultural worldviews that give life a sense of order and permanence [1].

Culture gives humans the possibility to cope with death by pursuing, for example, literal immortality - some religions, for instance, offer the belief that life is just a transition to eternity - and symbolic immortality, by which people want to be part of something bigger than themselves. In the latter case, the ideas of nation and ideology have a strong appeal in reducing death anxiety. This set of beliefs about reality is able to give the sense that humans are valuable individuals in a meaningful world. They can be understood as cultural worldviews that will be defended when threatened [2].

Existential terror, according to TMT, can be produced when people are reminded of their mortality. However, this approach is perhaps too reductionist and it seems to lack other existential aspects that might produce the same terror. The idea of a meaningless universe, for example, can be as terrifying (or even more) as the idea of a finite existence. Rather than just a tool to cope with death anxiety, meaning seems to have a value in itself, which perhaps even surpasses the promise of immortality in the endeavor of mitigating existential terror.

The methodologies developed in empirical studies with TMT are used then to access what is the role of a meaningful finite existence in the cultural worldview defense. In this study, after reading one of two different arguments: one endorsing the belief in mortality, but supporting the meaningfulness of human existence; the second affirming the belief in immortality but refuting the meaningfulness of life, the participants will be primed either with reminders of death-also referred to as mortality salience (MS) - or with a pain-related control condition. The hypothesis in this study is that the subjects who were primed with MS, after reading the essay supporting the belief in a meaningful mortality, will present a reduced defense mechanism in comparison with the participants who read the essay advocating a meaningless immortal existence.

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Joint (Group) Rushing in YouTube Videos

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Anecdotal evidence suggests that even well trained musicians tend to drift from the desired tempo when playing in a musical ensemble. Investigating under what circumstances this is true helps us update our understanding of how human groups coordinate their actions in time.

According to substantial evidence from the sensorimotor synchronization literature when participants are asked to maintain a certain tempo without any external queue they tend to drift. The amount of drifting in individuals is known to depend on initial tempo. [1] How drifting in different sized groups differs from that of individuals is relatively understudied. The limited amount of evidence we have indicates that while individuals are equally likely to speed or to slow down, pairs tend to rush. [2] Unpublished work found that this "joint rushing" increases with group size. [3]

With our YouTube mining study we intend to answer the following questions:

A. Does observational YouTube data on group/joint rushing confirm experimental findings?

B. What is the relation between amount of rushing and group size when group sizes are relatively large (4 people and above)?

To answer above questions we are collecting and analyzing videos of musical performances (e.g. body percussion, pen tapping, etc.) from YouTube. Public videos are collected through an automated process via the YouTube data API. We extract tempo and visual classification data from the videos.

In this observational study we mainly focus on tempo changes and group size but we also investigate how professional performers compare to amateurs. Our aim is to create a model describing the relation between the amount of tempo drift and group size using simple linear regression. Results will provide further insight into how well our current models of sensorimotor synchronization describe human synchronized rhythmic activities.

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"To Pluck from Rooted Memory" Task Performance Strategies for Memorizing Position and Orientation in Change Detection Task

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Introduction

In visual working memory research, individual variability in third-person data, such as accuracy and reaction time has traditionally been attributed to neuronal noise, contextual effects (i.e. participants' visual experience prior to the experiment), perceptual effects (i.e. the color of the background, the specific sequence of stimuli), and even technical difficulties associated with calibrating a homogenous screen across both trials and participants [1]. We propose the hypothesis that these third-person differences may stem from varying phenomenal states reached by the participants while solving visual working memory tasks. To test this possibility; however, we first have to establish the existence of varying phenomenal states during manipulation of objects in working memory, or what we call task performance strategies.

Method

We will make use of the experimental paradigm of change detection, whereby the participants are exposed to a memory stimulus, followed by a brief delay period, and a test stimulus. After the latter, they are prompted to answer whether it is identical to or different from the memory stimulus. Periodically, at random moments during the performance of this task (both during the maintenance period, as well as between trials) the participants are prompted to take note of their experience by an interviewer who further uses the technique of expositional interview to discern their so-called pristine inner experience [2]. These interviews are then transcribed and categorized according to the quantitative method of thematic analysis to yield task performance strategies, that is to say, the ways participants experience the act of memorizing. We report experiential strategies for two modalities of spatial stimuli, orientation and position.

Results

Both of these parameters yield varying strategies, including non-rational responses, such as responding randomly, or lack of memorization, due to phenomena such as test anxiety, of mind wandering. Further, the strategies themselves differ in modality (visual, symbolic, motor, spatial, affective, and complex integrations thereof), sense of agency, temporal structure, and the amount of conscious input. We suggest that the number of dimensions along which task performance strategies differ from each other may be the source of individual variability in third person data in visual working memory studies.

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The Role of Vitality Affects in Human Experience and Its Relation to the Ontogenesis of the Body-Mind Split

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Introduction

Cartesian views, which radically split body and mind, have penetrated our day-to-day lives. However, if we look at our everyday human experience with a phenomenological attitude, we find that the 'true subject' is not only the 'thinking Ego', but a body-subject [1].

Problem

The aim of this research is to understand how this body-subject develops in infants, to study the ontogenesis of a sense of self that encompasses an experience of the split between body and mind – primarily based on Daniel Stern's central concept of *vitality affects* [2]. How does the infant's experience, immersed in bodily affectivity, later evolve into a fully fledged, Cartesian understanding of the subject?

Gap in Literature

There are two ways in which vitality affects appear in the literature. On the one hand, there are studies that explicitly discuss the term 'vitality affects'. These works, however, most often either (i) lack a properly interdisciplinary approach, (ii) fail to account for the developmental aspects of the phenomena, (iii) or do not recognise the relational, intersubjective nature of vitality affects. On the other hand, there are texts, mostly from phenomenological literature, whose subject matters are centered around a similar aspect of experience to what Stern coined as vitality affects, yet the links between these texts and Stern's account have not been established.

Approach

Phenomenology considers affects a phenomenon that connects body, self, and the world. In this thesis, an account is developed that attempts to provide an all-encompassing treatment of the concept of vitality affects: a truly multidisciplinary, developmental approach that hopefully facilitates the discussion of the role of affectivity in subjectivity by exploring the journey infants go through. The conclusions drawn from the study of infant affectivity are applied to a philosophical analysis of movement and somatic therapies.

Method

An integration and conceptual clarification are carried out in the literature on vitality affects. It is followed by a critical comparison between Stern's phenomenologically influenced developmental psychological account [2] and views in enactivism [3], phenomenology [1], clinical psychology, and neuroscience.

Impact

Gaining a deeper phenomenological understanding of the nature and development of affectivity has huge implications in comprehending how movement therapies and somatic oriented psychotherapies work.

Acknowledgement

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Lucky: Stress Management Mobile App

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Introduction

Stress is lowering psychological well-being of individuals and is a risk factor for developing different diseases (for example, cardiovascular diseases [1]). Life-style in modern society puts high demands on individuals who often lack the knowledge and tools to manage stress effectively. Many scientifically effective methods, techniques and programmes exist which are not accessible to general population due to high time and financial costs, and stigma. On the other hand, modern technology is highly accessible. We will offer a stress management mobile app for individual use in everyday life.

Development of the App

In the first phase, the content of the app will be conceptualized based on thorough literature research and a prototype will be made. The mobile app will combine different scientifically effective [2] stress management techniques: - *breathing techniques*, - *body stretching* techniques in combination with breathing, - audio guided *mindfulness* relaxation, and - *cognitive-behavioural elements* that will consist of education about stress and how to prevent it, and recognition of stress-inducing thinking processes in stressful situations.

For the purpose of weekly evaluation, Cohen's psychological questionnaire Perceived Stress Scale (PSS) [3] will be translated into the Slovene language and validated on a Slovene sample. The time frame of the questionnaire will also be changed – we will be interested in the perceived stress in the last week (and not month, as it is stated in original version of the questionnaire).

The third phase will be programming of the app. The app will be written in Java.

Evaluation of the App and Expected Results

In the first step, user experience will be evaluated. Smaller sample of critical users will use the app for a week and afterwards semi-structured interviews will be conducted in order to get critical evaluation of different aspects of the user experience. If needed, the app will be changed considering the comments. In the next step, the effectiveness of the app will be evaluated during the six-week trial. At least 30 individuals will use the app as often as they want it. On a weekly basis, users will fill in the PSS questionnaire that will be sent to them via the app. The cumulative time of the app use will also be monitored. We hypothesize that, both, cumulative time of the use of the app to the point of PSS measurement and the number of weeks of the use will be negatively correlated with the PSS score which could indicate that the use of the app helped to lower perceived stress.

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Blockchain-Based IoT Data Storage

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The internet of things (IoT) enables devices to communicate with each other and to share data, e.g. sensor data. This enables a lot of new use cases in many domains, one particular interesting use case is in the production of goods. Highly automated production lines allow for a paradigm shift for industries from mass production to mass customisation, instead of producing one good in large quantities, many goods can now be produced in small quantities but with a higher variability in their respective shape or functionality, enabling even the production of unique goods to be profitable. IoT-backed production also helps to make manufacturing processes, post-production services, and supply chains transparent to both manufacturers and customers.

However, despite the rapid development of IoT applications, the current cloud-centric IoT architecture is not necessarily the most suitable solution for storing IoT data, since it neglects the locality of the data and imposes centralisations and dependency on third parties. Blockchain technology is a promising approach to tackle these issues. The idea of decentralised, immutable accounting of (financial) transactions was introduced and made popular by Bitcoin [1], since then this technology was adapted for a manifold of different use cases. Ethereum [2] allowed Blockchains to store and alter states of a program, resulting in a programmable blockchain with a turing-complete programming language on top of it, Which Allows to use the advantages of a blockchain in a much more flexible way.

For my thesis I would like to design a blockchain-based data storage for IoT data, implement it (on the Ethereum blockchain) and demonstrate its operation in the Smart Factory at TU Graz. In particular, I would like to use microtransactions to keep track of the amount of energy and material spent by manufacturing facilities to build a (batch-size-one) product. This allows tracking and storing the production history of a product, making this process transparent to the customer and helping the producer to keep track of the manufacturing costs of a product, which can be used as a reference for future products.

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The Gamification of a Tax Experiment

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Introduction

The use of laboratory experiments in tax compliance research is often being criticized for having high internal validity but low external validity [1]. My assumption is that using gamified questionnaires in laboratory experiments might be more immersive for users and thus have higher external validity than standard questionnaires. A first step to test this assumption is using gamification, which is using game elements and mechanics in non-game contexts with the goal of engaging users [2], on a tax compliance questionnaire. In this thesis such a questionnaire will be created and a gamified version of it will be compared to a non-gamified version of it. For the process of gamification at least one of Marczewski's element of gamification (e.g. customisation, competition, progression…) for each of the six gamer types (Player, Free Spirit, Achiever, Disruptor, Philanthropist and Socialiser) and four general elements (feedback, tutorials, loss aversion & investment) [3] will be used.

Method

The gamified questionnaire will be realised by putting the user in a manager's shoes (on a computer) who has to make decisions about purchasing items and declaring taxes. After every other task the user will answer questions about his/her emotions and will be told information to test whether manipulation of behaviour by information has a different effect in the two versions of the questionnaire. The non gamified version will have the same tasks and questions but no gamification elements. The manipulations are not only important for this thesis, but lay the groundwork for future research because testing external validity could work by comparing effects (and their sizes) that may occur in a gamified questionnaire as well as in real life (e.g. windfall gains, bomb crater effect…).

Future Research

Even though first steps towards testing external validity will be taken in this thesis, doing research on the external validity of the gamified version will be the next step, due to the fact that one should not create and use a questionnaire for research in one step. Additionally one has to know whether gamification has an impact when doing research on tax compliance first because nothing has been done on this topic so far.

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Vicarious Sensorimotor Activation and Dispositional Empathy

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Embodied approach to social cognition suggests that the central aspect to the understanding of others relies on the activation of neural structures involved in our own personally experienced actions, bodily states, and emotions. Vicarious sensorimotor resonance, i.e. brain activation resulting from observing other people's actions or sensations, is believed to contribute to the neural underpinnings of empathy [1]. To further explore the associations between the vicarious oscillatory activity and empathy as a personality trait, we used data from two electroencephalography (EEG) studies measuring resonant responses of sensorimotor cortex to the pain and touch of others. The aim was to assess the correlation of event-related desynchronization (ERD) and synchronization (ERS) of sensorimotor mu and beta rhythms with behavioral measure of dispositional empathy.

In study 1, participants (N = 37) observed videos showing hands being either penetrated with needle or touched with a cotton swab [2]. The stimuli were presented on a monitor placed in front of the participants. In study 2 (N = 29), identical stimuli were used, but were presented on a monitor placed over the participant's hand, to increase bodily self-attribution of the target hand. In both studies, participants filled out the Interpersonal Reactivity Index (IRI) questionnaire, measuring four dimensions of empathy: perspective taking, fantasy scale, empathic concern, and personal distress. Event-related spectral power modulation (event-related synchronization and desynchronization, ERSD) was assessed for each subject within the frequency bands of 7-12 Hz (mu) and 13-30 Hz (beta) over sensorimotor cortex (more negative ERSD values indicate stronger sensorimotor resonance). We used the difference in ERSD between 'pain' and 'touch' conditions to determine its correlation with the participants' scores in the four dimensions of IRI. There was no significant difference between the correlation coefficients in the two experiments, thus we ran the analysis with the data pooled from both studies. We found a significant relationship between beta ERSD and perspective taking scores ($r = -0.282$, $p = 0.011$). These preliminary findings suggest that emphatic sensorimotor responses might be positively associated with the participants' perspective taking skills, i.e. the ability to transpose into others' feelings and states.

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Extended Agent Based Simulation of Cipolla's Model of Stupidity

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In 1976 Carlo M. Cipolla, late Italian economic historian wrote an essay entitled The Basic Laws of Human Stupidity[1]. The essay is humorous and written in a playful style. Humor was and is often used as a socially acceptable way of communicating unpleasant truth. In the essay Cipolla formulated a model of stupidity in fundamental laws representing simple economic model of interactions. In Cipolla's theory we have four basic types of interactions[1]. Intelligent interaction (win-win) occurs when both agents in interaction have gain with interaction. Altruistic interaction (lose-win) occurs when the active agent in interaction has loss and the passive one has gain. Robbery (win-lose interaction) occurs when the active agent has gain and the passive agent has loss. Stupidity (lose-lose interaction) occurs when both agents have loss with interaction. All agents can be represented graphically on Cartesian plane[1,2]. A point on Cartesian plane is representing agent's average interaction[2].

In Agent Based Modeling (ABM) a system is modeled as a collection of autonomous entities, agents[3]. Each agent has his own set of rules for shaping its behavior and defining its decisions. ABM is used to study the dynamics of complex systems in social sciences and economics[3]. ABM is a simulation of autonomous interaction resources in evolving systems. Tettamanzi and da Costa Pereira[2] carried out an agent-based simulation to test compatibility of Cipolla's theory and Darwin's theory of evolution. Under some parameter setting they got emergent behaviors in line with Cipolla's theory. In our research we intent to reproduce this simulation experiment, extend their simulation model and explain some nonintuitive results, like prevail of the stupid altruists in one parameter setting[2]. In their evolutionary algorithm Tettamanzi and da Costa Pereira used mutation only. We are going to use mutation, recombination and agents with sex. They used three initial populations (all agents, deleterious and stupid), we are going to use more and different initial populations and test different populations against each other. Cipolla's theory assumes that agents are not capable of learning from previous interactions and have no memory of previous interactions. We are going to simulate learning and memory of previous interactions.

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Decision-Making Performance, Satisfaction and Stability in the Context of Adult ADHD

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Research shows that children with ADHD have various cognitive difficulties through their life, from the major symptoms of attention deficits, impulsivity and often hyperactivity, to comorbidity with learning disorders and mental disorders like anxiety or depression. These children once become adults and the struggles continue. This master thesis addresses decision-making of adults with ADHD, specifically their intuitive versus analytical solutions to decision-making problems, satisfaction with choice and choice stability. We revise the theoretical and diagnostic background of ADHD, neurological concepts of ADHD, and current research on decision making in ADHD adults [1][2][3]. In our research, the participants were asked to make three pairs of complex choices and to solve three cognitive biases-related decision-making problems (confirmation bias, attribution error and status quo bias). Afterwards, they rated their satisfaction, willingness to change their choice, and subjective decision-making style. We compared two samples of participants (N = 76) - general population and ADHD adults - balanced in gender, age, education level and study discipline. We hypothesized that there would be differences on the side of ADHD adults, in means of lower choice satisfaction and stability, and more prevalent intuitive decision-making, therefore greater susceptibility to cognitive biases.

The two samples did not differ in decision-making performance - thus, ADHD adults were not more prone to the three cognitive biases. Yet, they were constantly less satisfied with their choices and more willing to change them. However, these results were significant only in two out of six cases. This indicates that the differences between general population and people with ADHD in choice satisfaction and stability may depend on the context - for instance, what are people deciding about and how many attributes do they evaluate. Our findings shed light on ADHD adults' decision-making, while empirical evidence on this topic has been missing so far. Besides a base for further research, it might be beneficial for broadening the ADHD neurocognitive profiles.

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Frequency-Dependant Local and Remote Immediate Effects by Concurrent TMS-fMRI Setup

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Context

Transcranial magnetic stimulation (TMS) of the dorsolateral prefrontal cortex (DLPFC) is a promising, FDA-approved treatment option for major depressive disorder (MDD), when applied on patients, who did not reach remission after pharmacological intervention. Unfortunately, not all patients show significant improvement of their symptoms after treatment. The main source of this non-response seem to be inaccuracies in the stimulation process itself, in particular stimulation dose, that is consisted from stimulation intensity and stimulation frequency[1]. General rule is that higher stimulation frequencies and higher stimulation dose lead to better outcomes [2].

Method

The study will be performed on a 3T Prisma (Siemens, Erlangen, Germany). TMS/fMRI setup will include a MagProX100 stimulator (Magventure, Farum, Denmark), MRI-B91 MR-compatible TMS coil mounted on dedicated RF-coil and MR-compatible neuronavigation with electromyogram (EMG) incorporated (Brainsight). We aim to include 10 right-handed healthy subjects with no history of neurological or psychiatric diseases. The TMS/fMRI coil-array will be positioned over the DLPFC using newly established MR-compatible neuronavigation setup [3]. Subjects will be stimulated in two blocks, each consisted of same TMS frequency protocols (single pulse, 1Hz, 3Hz, 5Hz, 10Hz, 20Hz and theta-burst stimulation) with 110% of resting motor threshold (RMT). Two blocks will differ in types of coil we will use, meaning in one block we will use sham coil for isolating placebo effect, while in the other block we will use normal coil for real stimulation. In sham condition we will add 3cm thick empty TMS housing coil to prevent TMS pulse of reaching cortex. Blocks will be counterbalanced.

Expected Results

With this study, we are expecting to show the profound immediate impact of frequency used in TMS protocols on the brain modulatory effects. Even though lower-frequencies are considered to inhibit neural activity [2], we are expecting to observe significant activation of stimulated area in all protocols. Furthermore, we also believe that with higher frequency brain activation of stimulated area will be greater.

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Enhancing User Experience Testing Using Electroencephalography

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Differentiating Reasons of the Time spent on a Task Based on Emotions and Mental Workload

Software tools can help people perform time consuming tasks faster and more efficiently only when user interface of a software is designed to be understandable and when working with the software does not require too much effort. An ambition of User Experience (UX) field is to make a software more enjoyable or to allow for a positive experience with the software. Of course, positive experiences or minimizing negative experience can be achieved by minimalizing workload, making work with a tool even more efficient or by making interface nice and enjoyable.

One of tools employed by UX is Usability testing, where participants are asked to use a software, while a UX specialist is watching for possible usability problems. This can be enhanced by tracking user's eye gaze on screen within software interface using technique called eye-tracking. Time on task is measurement to make such testing quantifiable. This is based on simple presumption, that the longer it takes for a user to complete given task, the less usable the interface is. However, one can never know reason why the user spent so much time on the task, whether it is because of too much thinking or simply because user enjoyed interacting with interface.

The resaon of longer time on task could be distinguished using electroencephalography (EEG). EEG data can help uncover reasons of user's gaze focus. Frontal asymmetry is effect which allows to recognize either valence elicited by a stimulus or motivation to approach or withdraw from the stimulus. Ratio of frontal midline theta to parietal midline alpha waves indicates mental workload. These effects were studied in various conditions and can also help at UX research. [1][2][3]

Presented thesis tries to answer whether it is possible to enhance results of user experience testings by electroencephalography. Standard usability testings with eye tracking will be conducted, but also EEG data will be recorded. Eight hypotheses regarding possibility of such enhancement are postulated working with the ratios of brain waves and whether they fit the needs in matters of time and resolution. E.g.: Effect of frontal asymmetry is elicited in a time that the effect can be assigned to particular visual stimuli.

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Ask the Body: Utilizing Movement to Investigate the Communication of Emotion Experience

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Context

Emotion experience: a concomitant of the awareness of one's emotions while those emotions are occuring [1]. Emotion experience is shaped within the confines of the body; the apparatus that paradoxically evades and simultaneously reveals an understanding of self. Still, it is often believed that the body merely eludes to the manifestations of emotion experience, especially when not categorized as an involuntary physiological response [2]. What does an arbitrary bend of the knee have to do with elated joy? More than one could ever imagine…especially in the context of dance.

Purpose

The body's movements and its emotion expressive affordances, enable the investigation of nonverbal aspects of the triadic message exchange between the choreographer, the dancer and the audience [3].To explore the particular intersection of phenomena: emotion experience, movement (dance), and communication, this experiment utilizing a non-verbal communicative choreographic process to investigate the efficacy of the communication of one's emotion experience though movement.

Methods

During the experimentation period, the choreographic process takes place in two parts: the kinematic structure of the movement and the refinement of the movement. Each dancer is surveyed on their emotion experience using a scale-based assessment, as well as interviewed in order to evaluate their ability to understand the intentions and emotions of the choreographers.

Results

The results will reveal the effectiveness of nonverbal communication of emotion experience between the choreographer and the dancer by comparing the survey responses between the two groups of dancers who received verbal communication, and those who did not. Specifically, the results will demonstrate dancers' ability to understand the emotions and intentions of the choreographers.

Implications

This study unfurls the assumptions and uncertainties about the body and its movements as a constituent of thought–elucidating how effective we can communicate even the complexities of emotions, utilizing the body as an explicit tool of communication, and ultimately share those emotional experiences that arise in the body's movements with others successfully.

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Labour, Its Coercion, and How Cognitive Science Has Engaged with Them

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Context

Labour assumes a central position in the life of almost all humans alive today. Given cognitive scientists' contributions to technological advances in automation, one might expect labour to take a similar position in their work, especially considering the origins of the discipline (cf. [1]). In fact, labour, eschewed in favour of 'work', appears rarely addressed explicitly, despite the deep ramifications cognitive science research into process management, expert systems and other technologies has had for it. Here, Norbert Wiener's warning of "the large-scale replacement of labour by machine on the level not of energy, but of judgment" [2] may be a remarkable exception.

Purpose

Following Wiener, the proposed analysis focuses on the automation of cognitive labour. Specifically we investigate whether and, if so, how labour was addressed throughout the history of cognitive science as a distinct discipline. This focus on labour also provides the basis for the second theme of the current work; namely, the possibility of a role for Marx' concept of 'Arbeitszwang' [3]. In contrast to a theoretical analysis in economic terms, we conduct an inquiry of the psychological dimension of this ostensible coercion. We establish a true interdisciplinary credential by repurposing a concept from economics as a tool for a psychological analysis intended to deepen our understanding of labour as cognitive scientists.

Method

The investigation consists of extensive literature research. Divided into two sections, the project is equal parts historical and exploratory. Throughout, we aim to channel the critical approach exemplified by authors in Science and Technology Studies. In this sense, the analysis will also include ethnographic studies from across the globe. This combination of methods and sources leads us to take it to be vital that few assumptions are made about the outcome our research. Moreover, the present work will participate in a self-reflective process directed towards understanding cognitive scientists' obligations with respect to the consequences of their academic work.

Implications

The goal is to make explicit the role of labour to cognitive science. Exploring how previous, particularly defining, publications have engaged with labour opens the door to an immanent consideration of the broader economic, political and social ramifications of research in cognitive science. Their consideration is beyond the scope of the present work, but a crucial element the discipline.

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Organizational Failure and Decision Making

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Introduction

Current research on organizational failure is developing at a high pace, still, no consensus has been reached on what constitutes it and how it can be mediated. More importantly, research in this field is mostly focused on rectifying the negative effects, whereas *learning* from failure has largely been neglected despite the potential benefits of such a shift in focus [1]. What is more, the rebound rate of organizations following such setbacks depends on integrating the lessons from failure and achieving a high level of cooperation [2].

Purpose

The main objective of the study is thus to investigate the effects of positive and negative failure framing on decision making and cooperation in the workplace.

Methods

To manipulate perceptions of failure, I will design and test three conditions. In the first condition, failure will be framed positively; in the second negatively, and in the third neutrally. The manipulation will be instantiated as a role-play describing a commonplace situation characterized by an adverse event, followed by a verbal account on the part of the experimenter who will either highlight the positive or negative effects of such a scenario. The subjects will then be asked to provide own ideas of how such a situation could be remedied. To ensure ecological validity, the experiment will be carried out in the subjects' actual workplace. Decision making and cooperation dynamics will be investigated using a modified version of a public goods game, where subjects will repeatedly have to decide whether and how much to contribute to the public good, which will further serve as a measure of prosociality. Various questionnaires assessing self-efficacy, positive and negative affect as well as social values will be administered following the manipulation to determine whether individual differences moderate decision-making behavior and cooperation.

Predictions

I predict that positive failure framing will increase group cooperation, as such a frame will serve as a prosocial cue. In contrast, a negative frame will highlight the need to perform and act in a self-serving fashion, which will be reflected in the lower contributions to the public good. Similarly, the positive framing of failure will lead to a lessened negative affect and higher self-efficacy, evidenced in the post-task questionnaires.

Implications

The study offers a systematic way of studying the impact of failure handling on real-world cooperation.

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Enaction of Meaning in an Intersubjective Context – from Cognitive Science to Psychotherapy

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In my work I will explore intersubjectivity or social cognition and its effects on personal sense-making. The focus will be on a psychotherapy setting and the idea of shared meaning-making, which emerges through social interaction. In recent years, research of social cognition has shifted from observing individual cognizers to focusing on their interaction. In light of this, De Jaegher and Di Paolo [1] propose an interactive theory of intersubjectivity based on enactivism and dynamic systems theory. They claim that through the interaction process, both individuals' sense-making processes can become linked and allow the creation of novel meanings, which were before unavailable. I will compare their idea of participatory sense-making to the ideas of the Boston Change Process Study Group [2], who emphasize the importance of the unpredictable interactive processes between psychotherapist and patient. They claim that through their interactions, the two exchange personal meanings and co-create new emergent meanings and intentions, the creation of which steers the psychotherapy process towards desired goals [2]. For example, even when the psychotherapist replies with a simple phrase such as "uh-huh", the patient can interpret this in various ways based on intonation, context, relationship history, etc. It can be interpreted as confirmation, rejection, boredom, etc., which profoundly affects the patient's reactions and consequently the psychotherapy process itself.

I wish to discover whether such instances of intersubjective meaning-making are observable during systemic psychotherapy. To research this, I will first define what intersubjective meaning-making is and then analyze and partially transcribe recordings of a number of psychotherapy sessions with two different patients. The sessions will be coded on three levels of analysis: the content of the session, the interaction process between therapist and patient, and the instances of intersubjective meaning-making. The main focus will be on the moment-to-moment activity between patient and therapist, through which they struggle to understand each other, build a relationship and co-create new meanings and goals [2]. The research has yet to be started, but I expect to find that emergence is ubiquitous in the psychotherapy process and that personal interpretations and meaning-making are critical for the psychotherapy process.

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Ethnographic Knowledge Elicitation: A Modelling Perspective on Decision Making in a Neuroscience Laboratory

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The central methodological tool in my background discipline, cultural and social anthropology, is ethnography (EG). EG is a process that employs different qualitative methods to describe a researched group. Contrary to the former locally bounded field sites, the recent focus is on encompassing, e.g., national or global, structures and interactions. One of the answers to the increased complexity of the theories for the social phenomena now under investigation is evaluation with computer-based simulations [1]. A promising computational simulation method is agent-based modeling (ABM), which allows to relate agent behaviors to social structures through interactions. Few anthropologists have applied ABM to build models based on EG data. Nonetheless, these approaches have led to new insights regarding the relation between individual decision making and structural behaviors [1]. In the transition from EG data to ABM, a particular challenge is the elicitation of knowledge and formalization of the data through knowledge modeling. Laboratory EGs are descriptions of social interactions and structures observed in scientific laboratories. Neuroscience laboratories are one of the fields this research focuses on. The research interest of neuroscience laboratory EGs can be categorized into: i) context and technologies; ii) discussions of distributed/extended mind; iii) implications of neuroscience research beyond the laboratory [2]. All of these EGs rely on the traditional EG process and so far have made no use of simulations. Our research field is the sociotechnical system around an fMRI scanner in a neuroscience laboratory, specifically: the decision making of the involved individuals. The EG study will build on insights regarding i) and ii) reported in [2]; modeling of elicited knowledge will employ a specialized framework, such as MAIA [3]. Our analysis of the ABM created from the formalized data will explore behaviors and components sufficient for explaining the target phenomenon. Our research should contribute methodological insights about the viability of developing ABMs based on EG data. We expect further to identify relevant human processes in the field and to obtain a logically sufficient representation of human decision making.

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Prosocial Behavior in Japanese Macaques (Macaca fuscata)

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Prosocial behavior can be generally defined as any voluntary action that benefits another. Prosocial behaviors can be either reactive, in which case the behavior occurs in response to a signal from another, or proactive, in which case the behavior occurs in the absence of an eliciting signal [1]. Prosociality has been explored in a number of different animal species and its evolutionary origin is a hotly debated issue within ethology [2]. At present, the best supported explanation for the evolution of proactive prosociality is the cooperative breeding hypothesis (CBH). The CBH predicts that proactive prosociality in a species is linked to shared infant care, and analyses within the primate order have thus far supported this explanation [2]. Recent studies seeking to extend the CBH beyond primates have tested prosociality in various corvid species and found the same pattern previously found in primates [3]. In order to test prosociality in corvid species, the typically used paradigm needed to be modified to accommodate their specific anatomy. To ensure the comparability of these findings to the conclusions reached in primate species, the modified paradigm must be tested in previously examined primate species with a known rate of prosociality. The present study will use the corvid-modified prosociality paradigm in Japanese macaques, a species previously demonstrated to display a low rate of prosocial behavior [1]. If their rate of prosocial behavior remains low while using this paradigm, it will demonstrate that it is roughly equivalent to the paradigms previously used in primates. The results of the primate and corvid studies will then justifiably be able to be compared to one another. Through allowing for this comparison, the present study will contribute to exploration of the CBH outside of primate species. Further tests of the CBH may wish to extend usage of the prosocial paradigm presented in this paper to additional avian species, or other phyla entirely. Ultimately, large-scale cross-species research of this sort can help to shed light upon the evolutionary development of human psychology and answer what, if anything, makes us truly unique.

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The Role of Linguistic Markers, Expertise and Domain Specificity in Uncertainty Communication

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Uncertainty communication and judgment and decision-making form everyday part of our lives. Empirical findings show the influence of linguistic marker of uncertainty source and speaker´s level of expertise on hearer´s judgments towards speaker and message as well as on decisions about hearer´s future actions.

Based on the effort to maximize effectiveness of uncertainty communication and to improve judgement and decision-making processes, we realised research aimed to experimentally prove, if within two different domains (health, finances) and two different levels of uncertainty (higher, lower) linguistic marker (internal, external) and speaker´s expertise (expert, novice) influence the judgment and decision-making of the recipient. Our work was an extended replica of M. Juanchich et al. experiment 4 [1] with 2x2x2x2 mixed factor design. Independent variables linguistic marker and level of expertise were manipulated between-subject and variables domain and level of uncertainty within-subject. We investigated their influence on judgment of knowledge, wrongness, blame, support and encouragement of speaker, reliability and intuitiveness of their statements and tendency to act of hearers.

Originate in our original study, we assumed that the expert will be rated higher in dependent variables when using internal linguistic marker and novice vice versa, when using external linguistic marker. The findings of our work confirmed the impact of the linguistic marker, the level of expertise and even the level of uncertainty on the judgment and decision-making of the hearer, but they did not replicate the findings of the original study. Moreover, differences in effects of independent variables by domain were observed.

As our research was the pilot one, based on its expanded design and focus and the fact that the results are not consistent through the whole field, we are not allowing us to generalized recommendations for practice so far. But we recommend continuing in this research by its replications and extensions for the subsequent possible use of findings in setting up the communication standards for experts in the domains working with risk.

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Face Recognition and Classification of Mood

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Introduction

Deep learning and especially Convolutional Neural Networks (CNN) have achieved a huge improvement in computer face recognition accuracy. We will review several CNN based methods for face recognition. We will present models that are currently state-of-the-art at face recognition including few-shot learning models. In our diploma thesis we will propose model that can perform a face recognition and a mood classification.

Hybrid Networks

Hybrid networks that are using CNN models achieved significant results with accuracy better than 90% e.g. High Dimension Local Binary Patterns [1]. Hybrid networks model can perform classification of many features like age, gender, and mood as well as do face recognition with greater accuracy.

Few-Shot Learning Model

A majority of image recognition models require large dataset of labeled data during the training phase. On the other hand, few-shot learning models categorize input by using few training examples. One example of successful few-shot learning model is Siamese neural networks [2].

Proposed Solution

In order to reach effective results in accuracy, we propose to use 2 neural networks that will be trained simultaneously. 1st network will be based on few-shot model architecture that will be used for face recognition and identification. The aim of the 2nd network will be to classify the mood from the input. Both above mentioned networks will be based on CNN architecture. The two networks will use back propagation algorithm during the training.

Future Research

We will try to build a specific merged model. Our merged model should be that type of model that contains embedding preprocessing network [3] and our previous two network models in one architecture, which will be trained altogether. When this architecture will be reliable, we will compare how merged model performance and accuracy is advantageous compared to separate models described before. Our expectation is that this architecture can reduce computational complexity and increase speed of recognition and classification in comparison to previous architecture.

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At the Intersection of Neurotechnology and Economics: Social Impact and Ethical Questions

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Neuroethics is a relatively young field that has from its inception motivated critical discussions about the ethical, moral, and social consequences of the use of neuroscientific findings and cognitive neurotechnologies in our lives[1]. Furthermore, through the prism of regulatory, moral, ethical and legal questions in the field's discussions, many authors take a critical position in regards to the precipitated implementations of the cognitive neurotechnologies and consequential prompt changes in social structures[2]. One of the fields where such discussions are rarely given attention, although it has been quite influenced by neuroscientific advancements, is the field of economics and its subfield of neuroeconomics. With the incorporation of new research methods – non-traditional for the field of economics – , methodological and conceptual consensus in the field is lacking[3]. Hence, we plan to critically evaluate the use and application of neuroscientific cognitive technologies and neuroscientific findings in the field of economics.

Understanding that both cognitive (neuro)science and economics are fields that have wider social influence[1][3], the broader aim of our research is to present current state of how recent neuroscientific findings and cognitive neurotechnologies are being introduced in the field of economics. Our first aim is to understand how methodological framework of neuroscience and neurotechnology with their findings impact the field of economics, how they potentially change current social structures (e.g. economic markets and institutions) and concepts (e.g. money), relevant to economics. Our second aim is to understand what are the inevitable arising ethical questions that accompany the integration between economics, cognitive neuroscience and neurotechnology.

Our research thus aims at providing a better understanding of the interplay between the fields of economics and cognitive (neuro)science through the prism of discussions, arising in neuroethics. Moreover, we hope to shed light on how neuroscientific findings and cognitive neurotechnologies are subtly changing the social and economic structures and concepts.

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Experience of Sexual Fantasy

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Up until the second half of the 20th century, many authors suggested that sexual fantasies should be treated as a form of sexual dysfunction and/or sexual deviation. Since then, the study of sexual fantasies has become an important part of understanding human sexuality. As numerous researchers now suggest, sexual fantasizing can be a normal, adaptive, and healthy aspect of sexuality for both men and women [1]. Apparently, almost everyone at least occasionally engages in sexual fantasizing, either to enhance the pleasure of other sexual activities (e.g., intercourse or masturbation) or as a pleasurable act in and of itself [2]. Until now, studies were mainly quantitative and therefore lacking a subjective dimension. Our goal is to expand our knowledge about sexual fantasies with a phenomenological study as we believe it is essential to take into account the subjective dimension of the phenomenon in order to fully understand it.

Our aim is to attempt at unfolding the microdynamics of experience of sexual fantasizing. To do that we will use second-person in-depth phenomenological inquiry [3]. This technique consists of two phases. First, we will interview our participants about their experience of sexual fantasizing and familiarize them with the research question. Second, participants showing enough interest to become co-researchers will be encouraged to observe the phenomenon in their everyday life and keep a diary. Later in short temporal proximity, we will carry out in-depth phenomenological interviews on the basis of journal entries. We wish to highlight the overall process of fantasizing – how a fantasy emerges, how it progresses and is finally dismissed. Along this process, our focus will be on possible different modalities of the experience, triggers, and emotions. We will also be interested in possible effects of daily and major life events (e.g., stress or extreme happiness) on the micro-dynamics of the phenomenon.

Due to the small number of participants which is characteristic of the method used, we will not be able to generalize our results. Rather, we aim to enrich and refine the current understanding of sexual fantasizing and highlight potentially unseen aspects of sexual fantasies. Hopefully, the obtained knowledge will enable better quantitative research designs.

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The Negotiation of Meaning: On Epistemic Vigilance, Plausible Deniability, and Uncertainty in Communication

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"That's not what I meant! You're taking my words out of context." Disagreements on the gist of a conversation are omnipresent in our life, whether it is in the workplace, relationships, or politics. What we say and what we mean can be two quite different things. Since what a speaker says is only an indication of what she means (she provides pieces of evidence for interpretation), hearers have to infer from context and utterance to that meaning [1]. Hence absolute certainty is impossible.

'Plausible deniability' (cf. Lee/Pinker [2]), posits that a person can successfully claim that the hearer "got the message wrong" (i.e. misunderstood), after a conversation took place. Importantly, 'possible deniability' [2] stresses that even an interpretation, judged as implausible by both conversing parties, can be perceived as plausible by outsiders.

Accounts such as Lee/Pinker's [2] emphasize the strategic advantages of using this uncertainty in situations like bribing or come-ons. Construing from the hearer's perspective instead, epistemic vigilance (EV), i.e. the ability to scrutinize the communicated meaning, aims to minimize the risk of being misinformed [1]. Reboul [3] argues that deniable (i.e. implicit) statements allow speakers to effectively circumvent the hearer's EV. Existing literature has not yet tested this in case of falsehoods. Furthermore, it is unclear how hearers deal with seemingly certain statements, for which the most plausible interpretation might still be denied later on.

Contrary to Reboul [3], we argue that PD does not press hearers to tend specifically to the exact utterance, allowing to bypass their EV. Rather, deniability results from providing only sparse (linguistic) evidence that is then available as reasonable proof of intended meaning. While EV is sensitive to changes in communicated meaning (checking its truth value), the anticipation of denial considers the linguistic means used (what is said).

In a series of experiments, we present US American native speakers with everyday scenarios in online scripts. Using a between subject design, participants then have to indicate their agreement with normative and epistemic statements on a Likert scale. By manipulating context and statement in the scenarios, we investigate which factors influence EV and PD, respectively.

Investigating the process of interpretation and its relation the denial in social contexts, allows to better understand how people calibrate their trust, and their strategies to hold others accountable for what they say.

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The Phenomenology and Linguistics of Schizophrenia: A Battle of Selves

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In phenomenological psychopathology, schizophrenia is described as a disruption of ipseity, a primitive form of self-awareness which constitutes our primary presence in the world. Also referred to as the minimal self, it is not a linguistically mediated representation of oneself, but a pre-reflexive, implicit, non-conceptual sense of existing as a subject of awareness. Against this, Hinzen and Rosselló [1] criticise that "a purely phenomenological account of self-disturbance, which were to see human experience as taking place in a completely pre-linguistic experiential space, with language as only a secondary method of 'translating' its contents for others, would be naïve" and argue that the self-disturbance witnessed in schizophrenia is the result of a language pathology. The aim of this master's thesis is an interdisciplinary comparison between linguistic and phenomenological dimensions of the self in schizophrenia, in order to clarify the role language plays in this disorder: Is the self-disturbance in schizophrenia more fundamental than described by recent linguistic research? Or is it essentially a linguistic disorder - maybe even, as psychiatrist T. J. Crow claims, the price Homo Sapiens pays for language?

While phenomenological literature on schizophrenia is quite rich, language and more particularly its relation to schizophrenia is very rarely discussed. While phenomenologists regard the linguistic self as secondary to our primordial sense of self mediated by the lived body, linguists conceive of language as something over and above the minimal self. The result: a gaping abyss between the pre-linguistic and linguistic self, which leaves it unsolved whether language is constitutive for the "I" affected in schizophrenia, and thus how to understand its pathogenesis in general. This could furthermore have repercussions on diagnosis and treatment methods.

My aim is to tackle precisely these questions by establishing an interdisciplinary dialogue between phenomenological psychopathology and linguistics. A dialectical analysis of the phenomenological and linguistic literature on the self in schizophrenia is expected to indicate that what language is supposed to add to the self affected in schizophrenia is already in place in the minimal self. Thus, a critical assessment of their respective arguments will enable to approach the relationship between self, language, and schizophrenia and eventually tell us whether the foundation of phenomenological research needs to be revised, or whether linguistics continues to overestimate the role of language.

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Influence of Amphetamine Sensitisation on the Prediction Error Signal

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Context

Reinforcement learning is a process in which an individual develops a pattern of behaviour by receiving reinforcing feedback (be it positive or negative). The concept stems from behavioural psychology and has its roots in various types of conditioning. It describes the decision-making process as an attempt to maximise the potential rewards (stimuli that generate positive learning and induce approach behaviour) and at the same time minimise the punishments. It is possible to explore this phenomenon from a neurophysiological point of view by targeting the mesolimbic dopaminergic system, most noteworthy the ventral tegmental area along with the ventral striatum, and examining the reward prediction error (RPE) signal, which mediates said learning process. RPE encodes the difference between the expected reward and the received one. The phasic dopamine signal codes specifically the value of reward prediction. It displays an increased signal if the benefit is larger than anticipated, a steady baseline level in case of a fulfilled forecast and depressed activity upon receiving less gratification [1]. This project is a part of a bigger study, which explores the effects of amphetamine sensitisation on dopamine synthesis. Amphetamine, as a stimulant drug, increases the extracellular level of two catecholamine neurotransmitters – norepinephrine and dopamine. Its use in small, repetitive doses leads to an increased reaction to the substance. This sensitization process is applied in neurophysiology and psychiatry in order to closely examine its influence on the dopaminergic neurons [2]. Sensitization to amphetamine may be considered an experimental hyper-reactive state of dopaminergic neurotransmission.

Methods

16 healthy participants (8 men and 8 women) will undergo two fMRI scans each - one before and one after sensitisation. Both times they will perform a probabilistic reward learning task (two-armed bandit task), which has been developed to model decision-making processes under uncertainty. The participant chooses between two ambiguous symbols based on positive or negative cues received after previous trials.

Expected Results

It has been suggested that amphetamine sensitisation may cause an increased dopamine synthesis and release capacity [3]. Based on this, I hypothesise that the RPE signal will also be influenced by the process. Specifically, I expect the participants to exhibit an increased activation in the described regions of interest after sensitisation.

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Action Observation and Motor Imagery Effects on Motor Learning

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Introduction

Mental imagery and action observation are often used in combination with overt sports practice to aid in learning and improving performance in motor tasks. Holmes and Calmels [1] suggest that action observation bears some advantages over mental imagery, namely, that participants do not need to generate, maintain and transform imagery content, and that practitioners have more control over the content of an intervention.

Some theories suggest that functional equivalence exists between overt actions and mental imagery or observation of said actions [1]. These actions can supposedly be rehearsed by using mental imagery and action observation.

Experiment

I will directly compare the effects of mental imagery and action observation on learning a novel and complex motor task.

First, I will validate the Visual Mental Imagery Questionnaire 2 (VMIQ-2) [2] in Slovenian language with an online survey on a sample of at least 200 participants who will be invited to take part in the main experiment.

A pilot study will be used to determine, on average, how long it takes the participants to reach the first plateau in performance for the training and experimental tasks. The tasks consist of stacking specially designed plastic cups in determined patterns and sequences.

The participants will acquaint themselves with the main task requirements and equipment by practicing a training task. The main experiment will consist of the pre-intervention phase, intervention condition, and post-intervention measurements. The participants will be randomly assigned to one of the experimental groups: Action observation group, Mental imagery group, and Control group.

In the pre-intervention phase, the participants will first practice and then perform measured trials of the experimental task. Each group will then perform their experimental condition in which execution speed and accuracy will be measured. The Action observation group will watch a video of task execution in first person perspective ten times. The Mental imagery group will imagine executing the task while listening to a pre-recorded script. The Control group will answer standard arithmetic problems to inhibit imagery. Each participant will then perform 10 measured post-intervention trials. Speed and accuracy of pre and post-intervention execution will be compared with ANCOVA for independent samples.

Previous studies [1], [2] show that at least 15 and up to 30 participants per group are required to gather statistically sound results.

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Emergence of Visual Consciousness in ADHD Children

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Introduction

Consciousness has puzzled humanity since the beginning of time. Still today, there are many questions about our conscious experience. How did consciousness evolve? How can our physical brain cause mental events? In our project we are interested in visual consiousness. Francis Crick [1] greatly contributed to the field, suggesting that the thalamic reticular nucleus plays a key role as an internal attentional searchlight, first suggested by Treisman et al. (c.f. [1]), and phrased it as "heating up the warmer parts of the thalamus and cooling down the cooler parts" [2] (p. 4587).

Problem

We posit a critical point in time when visual consciousness (recognition of an image as a whole or non-whole) emerges and that this time is delayed with certain developmental or neurologicalpsychological disorders, namely ADHD.

Goal

Our hypothesis is that a consistent amount of information is needed to put together image fragments with confidence. Hence, the decision point to reach a certain level of confidence for a given image is consistent across healthy subjects. This point can be standardized for a set of pictures and the test can be validated. We wish to find out whether our test is appropriate for detection of disorders implicated in consciousness, attention, mental focus and visual integration processes such as those compromised in ADHD.

Method

Participants sit down in front of a screen on which 4 very similar images appear, divided by black frames, and decide whether the images together form a complete picture. They report their decision by pressing one of three keys (whole image, not whole image, indecision) on the keyboard. Every keystroke decreases the thickness of frames until the entire image is revealed and it becomes clear whether the image segments form a whole image. So far 17 children (10 female), aged 8-9 years, have taken part. Participants were primary school children that took participated voluntarily with parental or legal guardian consent. We are in the phase of testing the control group and will continue by testing an age-matched group of participants with ADHD.

Expected Results

There is an "aha" experience when subjects suddenly see the picture fragments merging. We define this moment as the emergence of visual consciousness. The moment when subjects reach this level of visual consciousness depends on how effectively they process and analyze image fragments. Children diagnosed with ADHD may not be able to integrate the fragments of visual information as effectively as children with normal cognitive control. Hence, with this task we aim to quantify the performance of visual consciousness.

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Posters

Simulating the Emergence of Social Complexity Using Agent-Based Modelling

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Human societies can be usefully viewed as complex systems and studied with the tools and frameworks of complexity science. As one of these tools, agent-based modelling (ABM) has proven successful in simulating complex systems [1]. This project is a replication study of a social simulation that tests the *Circumscription Theory* using ABM [2]. According to this theory, the emergence of states (autonomous political units of higher social complexity) is a predictable response to environmental circumscription (EC), which is supposed to entail warfare of social groups over available land resources [3]. Our research goals are: I. Testing ABM for its practical value for social anthropologists with little prior training in computational methods; II. Acquiring the necessary knowledge and skills to implement the replication study.

After the study of introductions to social simulations and ABM, we use NetLogo as development environment for our replication, the same that was used in [2]. Its strengths include learnability and being accessible enough for novices to quickly produce useful and meaningful models [1]. Such ease of use may be especially helpful for social anthropologists looking to validate theories that are not testable outside of simulations, such as [3].

The primary hypothesis of [2] states that an increase of habitable land in the modelled artificial landscape also increases the time required for one social group to subjugate all other groups in the simulation through warfare and for social complexity to emerge. However, its results do not support this hypothesis, indicating that EC by itself is not a sufficient condition for social complexity to emerge. We expect to corroborate these results in our project, contributing to the validation of the implemented model and the critical assessment of its interpretation.

With little prior training in computational methods before the start of this replication study, our new insights into ABM lead us to conclude that it is indeed accessible enough to quickly allow the specification and meaningful analysis of simulations. Reaching our goals may be a first indication that NetLogo can be an easily learnable tool also for other social anthropologists to conduct simulation-based research.

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The Role of Awareness in the Intercultural Development

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Context

Most of the approaches to intercultural development consider that reflection is at the basis of the ability to interact with others, especially in intercultural environments, that is, those where folks from different cultures or nationalities interact. However, there is no agreement regarding the nature of reflection, i.e., there is more than one concept of reflection in the literature, or its definition is simply taken for granted. As a result, these approaches fail to explain how exactly it supports interaction. The aim of this research is to explore the role of reflection in the context of the development of intercultural competences, i.e., the ability to communicate effectively and appropriately in intercultural situations based on one's intercultural knowledge [1] since they are crucial in the interconnected world.

Purpose

This research proposes that the capacity to reflect about intercultural experiences depends upon the capacity to describe those experiences. Because of that, even if reflective-functioning [2] could be at the basis of intercultural competences, it is necessary to complement it with phenomenological & elicitation approaches to experiences, i.e., those who claim that reflection should be preceded by an intuitive access to experience (awareness). Because of this, the main contribution of this research is methodological: it is proposed that a specific form of reflection in an interview that has been designed to assess descriptive & reflective capacities, could not only help to avoid rational reconstructions experiences but also to describe and put them in perspective [3].

Method

Students are interviewed using a semi-structured interview that contains descriptive and reflective questions. Each student is interviewed twice, pre & post, in order to examine their intercultural development in the period of the semester abroad. The demand (reflective) questions are rated in consonance with Reflective-Function manual [2], while permit (descriptive) questions with a rating system based on elicitation & phenomenological approaches. Both are rated from -1 to 9. The results from the descriptive and reflective questions will be correlated.

Results

As reflective distancing is what allows us to relate critically to our mental states and put them into question [3], it is expected that better descriptions of the intercultural experiences will lead to better reflections of them, that is, to look at them with fewer prejudices and to become aware of the difficulties of interaction in intercultural environments. Thus, it is expected to find a positive correlation between the two variables.

Implications

Cognitive science can provide a better understanding of reflection in the context of intercultural development. It is expected to contribute to the debate of how to qualitatively assess intercultural experiences.

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Reducing Bias Against Algorithmic Forecasting

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Forecasts made by algorithms are consistently more accurate than forecasts made by humans in several areas including forecasting academic performance [1]. Despite evidence demonstrating the superiority of forecasting algorithms, people are reluctant to use imperfect algorithms, a tendency termed as "algorithm aversion". Evidence shows, however, that this aversion might be overcome if people are given a chance to (even slightly) modify the algorithms' forecasting outcome in order to reduce potential errors [1]. In previous research, however, participants were not involved actively in the algorithms' decision-making process by being able to manipulate the input of the algorithm. Therefore, I will include this factor in my experiment. I hypothesize that people will be more likely to choose to use an algorithmic forecaster and have more confidence in them if they can have *some* control over what factors the model should use as input variables.

The experiment will be administered as an online survey. Participants will be undergraduate students who are inexperienced users of forecasting algorithms. Based on Dietvorst et al. [1], I will apply a between-subject research design, where the task is to forecast students' mathematics scores based on seven variables (for example, desired occupation and predicted highest degree). The output variable is the preference for choosing the algorithm's vs. their own forecasts. Participants will be informed that the algorithm can forecast students' scores, but the model's estimates are off by 15 percentiles on average (i.e. the algorithm is imperfect).

Participants will be assigned to one of three conditions. They have to choose either the model's forecasts or their own forecasts. In the *fixed* condition, participants can choose between exclusively using the model's forecasts or their own forecasts. In the *adjust-input* condition, if participants use the algorithm, they can slightly modify which factors the algorithm should use as input variables. In the *adjust-output* condition, if participants use the algorithm, they can slightly modify its forecasts. After completing the forecasts, participants will receive feedback on their performance and will report their confidence in the model's and their own forecasts. The results of the experiment may have important implications for organizations that use algorithmic forecasting and may contribute to devising new strategies to reduce people's bias against computer-based solutions.

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A Hypothetical Mechanism for Subneuronal Change in Brain Networks of Mindfulness Meditators

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Living organisms emit photonic radiation which is dependent on the metabolic rate. The coherent phase of photons might also account for an electromagnetic field guiding synchronous activity[1]. Since long-term meditators exhibit increased neural synchrony and a reduction in overgeneralized memory[2], they will serve as an exemplary model for substantiating a photon-mediated mechanism of neuronal change.

Meditators enter metabolically superfluous brain states, which should increase photon density and the prospect for interactions with fluorescent molecules (e.g. tubulin, DNA, glutamate). Abundant simultaneous encounters could restructure architectures so that reactions require minimum energy consumption. The fact that glutamate perfusions increase photon transmission along axonal fibers[3], speaks in favor of this claim.

When photons are coupled with electrons in tubulin units, they change its electric dipole and the disposition toward coordinated, temporo-spatially delayed photon emissions. The claim that microtubules(M) encode information has been earlier proposed by Penrose and Hameroff. By causing electrical fluctuations, the emission of photons from microtubules or neurotransmitters could affect the activity of gap junctions(J), which have been shown to enable synchronous activity by changing local solute gradients. Conflating the two ideas, one could argue that the increased efficiency of photon transmission between neurons is a result of a decreased distance between M and J, found in minimum-synapse pathways connecting synchronous circuits. The myelin sheath would limit stochastic photon kinetics, so that neurons in the immediate proximity become less prompted for spontaneous action potentials, manifested as a reduction in overgeneralized memory. Meditators should exhibit increased myelination of neurons in marginal layers of DMN and temporal regions. DNA translation is susceptible to light exposure. The transcription factor that regulates myelinogenesis should have more potentially active copies in the related oligodendrocytes - this potential being proportional to the spatial exposure of these sequences. A similar mechanism may induce gene expression connected to neuronal growth within networks intended for cognitive control. In order to elucidate the possibility of this neuroplastic mechanism, we should aim to apply pertinent methods for measuring the relevant features of discussed subneuronal elements.

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Setting the Groundwork for the Research of Pleasure by Using SSVEP

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Introduction

Steady-state visually evoked potentials (SSVEPs) are defined as a distinctive electrical activity generated by the brain as a response to repetitive visual stimuli [1]. Usually, EEG is used to record SSVEPs due to its cost-effectiveness and good time resolution [2]. Characterized as having an excellent signal-to-noise ratio and stable spectrum, SSVEPs are applicable in a wide range of cognitive and clinical domains [2]. Many successful applications already exist [2], but novel practices are still emerging. One domain that could also benefit from SSVEPs is the research of pleasure, which presents a focal theme for this project. Despite the popularity of the topic, a lot remains unknown in terms of how pleasant experiences change the ongoing brain activity. The purpose of this pilot study, therefore, is to search for the correlation between brain activity and the level of pleasantness by using the aforementioned techniques. Specifically, our quest is to find SSVEP frequencies that produce noticeable responses in brain regions linked to emotions and to test whether they could form a basis for distinguishing between experiences of a different valence.

Method

We conducted an EEG experiment with 28 subjects (8 women, mean age = 25.11) by using the SSVEP protocol. A subject was first interviewed for basic demographic data and medical condition. After the interview, the first part of the experiment began, which required from the subject to concentrate on square shaped visual stimuli that alternated color with different frequencies so that SSVEP responses could be measured. In the second part, the subject underwent the same procedure, with an additional requirement of drinking samples of different concentrates of sweetness and saltiness before concentrating on the visual stimuli. After each iteration, the subject had to rate the pleasantness of the taste experience on a scale from one to ten.

Expected Results

As the analysis still has to be done, we can only provide an estimate of the results. We predict that most SSVEP activations in the brain are going to be limited to the visual cortex, yet some might be linked to emotional areas. From the latter, we would ideally discover a differentiation between a positive and a negative gustatory experience. We hope that the acquired knowledge helps us lay a foundation for future research on how pleasure manifests itself in the brain.

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'The Code Is the Mirror of the Soul': Profiling Programmers Through Code Analysis

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Introduction

Research on machine learning assisted psychological assessment has shown that an individual's traits and characteristics can be decoded from a variety of data, ranging from their use of language to Facebook likes [1]. Building upon these realizations and merging them with recent methodological advances in text and source code authorship attribution [2], we set to find out how specific attributes of an author could be predicted based on source code they have written. Authorship attribution methods use machine learning algorithms to reveal the author of a specific work, based on characteristic features gathered from other works they have authored. In the case of authorship attribution of source code, a range of features can be focused on, such as occurrences of specific keywords, the use of spaces and tabs, or Abstract Syntax Trees, which capture the underlying structure of source code, less dependent on its external form. As machine learning algorithms have shown to be able to learn the characteristic coding patterns for specific individuals, we hypothesised that so can be done for groups. To test the concept, we started by predicting the sex of programmers.

Method

In our work, we build upon a method described by Dauber et al. [3]. Specific layout, lexical and syntactic features were extracted from 2358 programs, written by 241 students (88% male, 12% female) working on the same assignments. The features of each program were then compiled into a sparse matrix, where each element represented a specific feature. For classification, a random forest classifier with 500 trees without depth limitation was used. The results were verified by 10-fold cross-validation, with the same authors never being in the test and learning set in a trial. Similarly to [3], the results of a particular code sample were averaged for each author.

Results

94.6% classification accuracy and an AUC score of 0.79 were achieved. Precision and recall were 1.0 and 0.58, respectively. Further improvements showed to be possible by changing the classification threshold.

Discussion

As far as we know, this is the first such attempt at profiling based on source code. We showed that a source code author's sex can indeed be predicted at an above chance level. The method would, of course, have to be tested on different samples before further conclusions on sex-characteristic coding patterns could be reached. However, our results seem to convey a proof of concept which could be tested on similar data with different classification problems.

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Predictive Processing-Based Needs Theory: An Empirical Investigation

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The current study empirically investigates a formulation of human needs in the framework of Predictive Processing (PP). PP postulates that the human brain embodies a hierarchical generative model, constantly trying to minimize prediction error throughout the levels of the hierarchy [1]. The key question is whether need satisfaction can be modeled based on the mechanisms of PP. This includes the relative use of priors and likelihood, as well as the influence of previous experience on perception of satisfiers. The term *needs* appears in the PP literature but is used vaguely and not studied systematically. Studies on needs outside of PP are typically concerned with creating lists of needs rather than investigating mechanisms of needs satisfaction [2]. We propose an experimental setup to test the formulation of needs in the PP framework. The setup consists of two consecutive tasks completed by participants assigned to two groups. The first task is a dot motion task with a probabilistic cue. In this task, participants learn to associate a certain color (cue) with goal achievement. The design of the task allows to model the relative use of prior information (probabilistic cue) and of current perceptual data (dot stimuli) on an individual level. The two groups differ in the prior information given to them about the probability with which the cue precedes the relevant stimulus. The second task is a simple maze game. During this task participants repeatedly have to choose between two alternatives which are equal with regards to the task at hand. They differ however as one of them has the appearance of the cue of the first task (color). Achieving the goal of the maze task is what is conceptualized as needs satisfaction in this experiment. The experiment will be analyzed using path analysis. We hypothesize that the group condition (belief about the cue) will predict the strength of the use of the cue in the first task. The use of the cue in the first task will, in turn, predict the frequency of choosing the cue-related alternative in the second task. In short, it is shown how prior expectations impact learning of cue relevance and how experience with stimuli influence how they are perceived as satisfiers. This design has strengths in internal validity which come at the cost of weaknesses in ecological validity. It should be considered as part of a larger endeavor of conceptualizing needs in the framework of PP. Together with related theoretical work and computational modeling it can contribute to first steps of a new understanding of human needs.

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The Influence of Hyperglycaemia on the Capacity of Visuo-Spatial Short Term Working Memory

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Introduction

Diabetes mellitus is a chronic disease where the body is unable to produce enough insulin or cannot properly respond to the produced insulin. When present in children, it can compromise their optimal intellectual development. Cognitive abilities, such as verbal and nonverbal intelligence, information processing, visuospatial ability, attention and learning and memory abilities were studied by many researchers whose results suggested, that the diabetic children's test scores are lower by cause of chronic hyperglycaemia, severe hypoglycaemia or other diabetes-related organic factors [1]. This study focused on hyperglycaemia's effects on children with diabetes type 1. Compared to healthy individuals; do diabetic children have any cognitive limitations because of the elevated glucose level – hyperglycaemia? [2] In search for answers the participants were tested for differences in processes of planning, visuospatial memory and working memory, while being scanned in MRI. Due to the complexity of the study, I only analysed the results measuring the capacity of visuospatial short term working memory.

Method

Participants, aged from ten to nineteen, were divided into groups of diabetics and controls. They were all tested in two fMRI sessions of Corsi block-tapping test, which had two versions; with load of two and load of four items. The diabetic group entered the first session with a regulated glucose level, took a half hour break and afterwards, just before the second session, their glucose level was intentionally elevated via glucose infusion. For the control group both sessions were the same.

Results

Obtained data showed that on average the working memory capacity of the diabetic group is lower than the capacity of controls. Also, comparing the first and second session, the capacity of the hyperglycaemic group dropped in both tasks, while the capacity of working memory in controls increased. The range of both; drop and increase, from first to second session was bigger in the four unit test.

Conclusion

In general, the hyperglycaemic group showed a lower capacity of visuo-spatial short term working memory than the control, healthy group. The strong influence of elevated glucose level was showed in the second session, whereby the capacity of hyperglycaemic group dropped significantly. Results imply that diabetes all together influences the development of this specific cognitive ability and show how the working memory gets limited when the glucose level is extremely high.

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Slovak Programming Keyboard Versus Layout Switching

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A computer keyboard is a common input device. Keyboard layouts for Latin-script alphabets use mainly the QWERTY design which was created in 1873 by Sholes to avoid jamming of the type bars on a typewriter [1]. The alphabetic part of the keyboard remains almost the same across different languages, while the rest of the keys are subjected to localisation. The standard English (US) QWERTY keyboard layout has punctuation characters and signs that are used as symbols in programming languages. Localised QWERTY keyboard layouts have often different positions of these symbols and many of them are not present in favour of accented characters of a particular language. That is the case of the standard Slovak keyboard layout.

Anyone who does programming is forced to switch between the Slovak keyboard layout when they want to write Slovak text, and the English layout when they want to write code. Therefore, layout switching is a naturally occurring phenomenon of multitasking among Slovak people who work with code or spreadsheets. Frequent task switching leads to higher error rate and switching-time cost than in non-switching condition [2]. In my project I decided to study these effects on layout switching with addition of a subjective psychological measures.

I use a within-subject design. Using modern web technologies, I developed an online application for participant testing. The advantage of an online application is possibility of remote testing of participants. The application measures typing speed and error (the percentage of mistyped characters). Participants will be rewriting presented sentences from different testing sets. The control condition will not require layout switching while in the experimental condition layout switching would be necessary. I will ask participants also to rate their subjective comfort of switching. Expected results are decrease in typing speed, increased error rate and high subjective discomfort.

In the second part of the project I introduce a new layout - the Slovak Programming Keyboard. It includes all characters required to write both Slovak and code and is meant to help Slovak people who write code. The layout utilizes the 3rd and the 4th key levels for Slovak accented letters. For a cost of slightly slower access to accented letters this eliminate the problem of layout switching. The implementation was done independently from the research on layout switching. Empirical evidence for efficiency of this typing method is subject to future research.

Acknowledgments

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Enhancing the Concealed Information Test via Emphasis on Semantic Associations

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Context

The *Concealed Information Test (CIT)* is a modern technological deception detection method, with increasing scientific interest in the recent decades. In this test, several items are repeatedly presented in a random sequence, with one item being the probe — an item that only a guilty person would recognize (e.g., name of an accomplice), and the rest are irrelevant items similar to the probe (e.g., other names) and thus indistinguishable from the probe for an innocent person. Compared to the irrelevant items, the occurrence of the probe in case of the guilty examinee typically results in a *slower reaction time* (RT) when examinees respond with a key press for each item, and a *larger P300 event-related potential* when the reactions are measured with the EEG [1].

Method

In this study, the probe items are items personally relevant to the "guilty" participants (e.g., their first name). The aim of the project is to propose an improvement to the CIT by including probe- and irrelevant-related *inducers* in the task, and therefore increasing attention to the *semantic context* in the test. For instance, when the probe is the participant's name, the irrelevant-related inducers could be items like "other name" or "theirs," while probe-related inducers could be items like "my name" or "mine". These two categories have to be responded to using two different response keys.

Expected Results

Inducers lead to a greater response conflict for the "guilty" participants when the probe appears, making their RT even slower [2]. Moreover, the complex task increases cognitive load, which likely facilitates deeper processing of the stimuli, and also results in a slower RT. Since the saliency of the probe is due to its meaning, and a more salient probe leads to larger probe-irrelevant P300 differences [3], using inducers is also likely to lead to larger P300 differences.

Implications

Advances in this research area could lead to real-life application of the EEG-CIT – which, if it improves as significantly as the RT-CIT [2] with the introduction of inducers, has the potential of becoming an accurate and widespread lie detection method.

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Effect of Short-Term Multiple Object Tracking Training in Non-Athletes, Dancers and Tennis Players

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Introduction

In 1988 Z. Pylyshyn developed Multiple Object Tracking task (MOT) to examine ability to track multiple objects at the same time. People track 4-5 targets. Pylyshyn proposed in FINST theory (FINgers of INSTantiation), that mechanism responsible for this ability works in automatic pre-attentive way and enables us to assign indexes, which stay attached to objects independently of their properties [1]. Other researchers used MOT for testing split sustained attention demanding on peripheral vision. J. Faubert used MOT as a context-free task, testing attentional skills in complex dynamic visuals scenes, relevant for sport domain [2]. He found that performance in MOT improves by long-term practice. How quickly one improves distinguishes specifically skilled professional, an amateur and a non-athlete. To our best knowledge, similar comparison in short-term training is missing. We expect a professional in a field explicitly requiring object tracking (tennis) to perform better in MOT, than professional in field, which it requires not (dance) or non-athlete.

Method

The participant observes the screen, on which 4-10 same objects appear. Some of them are highlighted for 1330ms (targets) and after highlighting disappears, all identical objects start to move randomly around the screen, while participant should visually track motion of targets. In this project we examine differences in non-athletes, dancers (Breaking) and tennis players on MOT task in short-term training. Each group consisted of 4 volunteers, each seated 60cm from screen with MOT. It consisted of 4 sessions, each corresponding to number of tracked targets (2, 3, 4 and 5). Every session had 30 trials lasting 8s. Session started with lowest out of 10 speed levels, which was increased every time when the participant tracked all targets correctly. Targets were always counterbalanced with distractors. Both subtended 2 visual angles.

Findings

One way ANOVA indicate significant differences only in 5 targets. Breaking performed above other groups and reached highest speed level, steepest slope of improvement curve, and also reached peak in their performance fastest.

Conclusion

Significantly different results in breaking group may be due to the fact that field of expertise in this group is highly demanding on peripheral vision. Professional dancers on competitions dance in circle created by constraints (people, cameras, judges …). Next to complex movements, split attention in peripheral vision is crucial. Their MOT performance can be epiphenomenon, which is not directly linked to learning complex combinations of movements, but arises from constrained environment in which motion takes place.

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Human Decision-Making and Learning: A Hierarchical Approach

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It has been a challenge for many years to fully understand and explain the higher functions of the brain, such as decision-making, human behavior, and learning. Advanced understanding and neural modeling in this area would shed new light on these concepts, while also enabling us to use this knowledge in the fields of robotics and artificial intelligence in the future. Reinforcement learning (RL) is a learning technique which has a long history of rich interaction between computational theories and neuroscientific understanding [1]. There are multiple limitations of RL, especially its inability to scale up to complex problems and the knowledge transfer between different tasks. The biological brain excels in both of these tasks. Hierarchical Reinforcement Learning (HRL) introduces higher level abstractions into basic RL, often consisting of multiple levels, where the higher the level is in the hierarchy, the more abstract it is. An action is an abstraction which can consist of multiple sub-actions: for example, "go to school" would consist of sub-actions required to reach this goal ("leave the house", "get to the bus stop", "catch a bus", etc). Each sub-action can yet again consist of other sub-actions until the lowest level of the hierarchy is reached [2]. The potential of HRL lies also on the similarity with the brain brain itself; it has been shown that some functions of the brain are hierarchical in nature [1], the underlying neural mechanisms thought to reside within, at least in part, the dorsolateral prefrontal cortex (DLPFC). Recent research has proposed a topological organization exists in the DLPFC, where progressively higher levels of behavioral structure are represented [3]. This finding has placed a new constraint on computer models of hierarchical behavior. One of such models, when trained on a hierarchically structured task, spontaneously came to code information selectively for temporal context information and current stimuli. This has shown how a functional-representational gradient like the one observed in the brain could emerge spontaneously through learning, given only an initial architectural constraint [3].

Though the hierarchical models for modeling and explaining the relationships in human behavior and decision-making are on the rise and hold potential, more research needs to be done in order to solve some of the new questions, such as how abstract action representations emerge through learning, the interaction of different models together and how they are organized in the human brain.

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Investigating Brain Functional Connectivity with Simultaneous EEG and fMRI Recordings

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Introduction

Cognitive processes are based on brain systems which involve activation of spatially disperse regions. The execution of cognitive functions requires integration of brain activity and functional connectivity between different brain areas. A functional network is a set of brain areas that show synchronous activity while an individual is facing a specific task or just resting.

With studies using only fMRI methods, which are primarily used for their high spatial resolution, we already have a vague picture of how these organised brain systems relate to cognitive functions. But the main obstacle of using the fMRI method in investigations of functional connectivity is its low temporal resolution. At this point the EEG method might come of beneficial use. EEG complements the fMRI method with its high temporal resolution, which would enable us to better investigate fast changes in neural activity.

The aim of the project is to investigate patterns of brain functional connectivity using simultaneous EEG and fMRI measurements. We also aim to study individual differences in patterns of functional connectivity and how these relate to an individual's cognition or neuropathology.

Goals

The goal of the project is to acquire comprehensive data regarding spatiotemporal characteristics of brain networks, during resting state and task related activity by combining EEG and fMRI measurements and to reveal longitudinal variability of these brain network characteristics. Another important goal is to understand and describe how intra- and inter-individual differences relate to the stability of functional networks, which could be used to recognise specific patterns that reveal individual characteristics or neuropathology.

Methods

The research is conducted on two groups of participants, 30-40 young individuals and 60-70 adults from general population, both balanced for gender and age. Exclusion criteria include psychiatric or neurological disorders, the use of psychoactive substances and any contraindications for EEG and fMRI. Each participant will firstly attend a behavioral testing, where we will perform psychological and cognitive testing using standard tests. Following, participants will be asked to attend several simultaneous EEG and fMRI sessions, where we will record brain activity during rest or while performing cognitive tasks using EEG and fMRI. Data analysis will include preprocessing to remove different artefacts in the EEG and fMRI signals. Preprocessed data will be used to calculate functional connectivity between brain areas. Functional connectivity calculations will be related to the psychological and cognitive behavioral measurements.

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Understanding Enabling Education

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Context

Following W. von Humboldt, Education is understood as a self-regulated and lifelong process of individualization in response to endeavours for world appropriation [1]. Educational settings differ in how well they enable the process of education. Peschl & Fundneider's concept of 'enabling spaces' offers a theoretical framework for investigating what enabling means in the context of education[2].

Relevance

'Enabling' is an attitude that facilitates development rather than controls[2]. It is important to understand how educational settings should be designed to better enable an individual's education. This research contributes to this question by exploring what enabling means and how enabling factors can be determined in education. In doing so, it opens the discussion for changing education settings by introducing the concept of 'enabling spaces'.

Research Question

What are 'enabling spaces' in the context of education?

Approach

Children's playgrounds are common arenas for qualitative and quantitative research not only in psychology, sociology and architecture[3]. Many studies focus on child development and educational purposes of playgrounds[3]. Further, playgrounds are closed spaces that have a fixed technological and built structure, in which social and emotional situations occur. Peschl's et al. concept of 'enabling spaces' understands cognition to be extended, i.e. taking place in intrinsic immersion and interaction with the environment[2]. Thus, this theoretical approach offers a good framework for researching enabling on playgrounds, because emotional, social, cultural, cognitive factors can be considered.

Method

(Participatory) observation and ero-epic conversations on playgrounds across Vienna are used to collect material to explore enabling education on playgrounds. This explorative method is a first test in understanding the concept of enabling. In addition, based on a literature review in regard to enabling, a theoretical conceptualization for enabling education is developed.

Outcome

It is challenging to gain a practical, precise understanding of enabling. The theoretical approach of 'enabling spaces' cannot be transferred into an implementation guide for deisgning enabling educational settings. Reflecting the applied method offers exciting insights for a clearer conceptualization of and suitable method for researching enabling.

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Grounding Meaning in Sensorimotor Cognition Using UBAL Algorithm

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One of the perennial problems of cognitive science is the process of understanding language. There are multiple theories proposing different ways to process language. Many of those are subject to the symbol grounding problem. This problem focuses on the connection between symbolic representation(word) and meaning. However, one of the theories states that all meaning is grounded in sensorimotor cognition avoiding the symbol grounding problem.[1] Children have a period of time during which they explore the environment around them via their sensorimotor systems, commonly linked with linguistic input from their parents. This provides an opportunity to learn associations between sensorimotor perception, interaction and linguistic input. Linguistics provides evidence that most languages use verbs and nouns. Nouns are linked to objects in the environment, whereas verbs are linked to the actions in the environment. This is the basis of linguistic repertoire and enables to express meaningful information via language. This was well demonstrated by Marocco et. al.[1], who used a fully connected recurrent neural network trained via standard Backpropagation-through-time learning algorithm to demonstrate how simple a cognitive system can be to learn these associations effectively. Input of the network was linguistic input, proprioceptive information, tactile information and preprocessed visual information.

Our model is based on a learning algorithm called UBAL - universal Bidirectional Activation-based Neural Network Learning Algorithm that is an extension of BAL algorithm proposed by Farkaš & Malinovská.[2] This algorithm is able to train a neural network with similar properties as a network trained by backpropagation, using a model that has higher biological relevance. Depending on setup, this type of neural network can perform association tasks. Linking perceptual inputs, proprioception or motor properties and associating them with linguistic labels gives us a model that grounds meaning of language in sensorimotor cognition. This is tested on a canonical 4-2-4 encoder task used by O'Reilly[3], that autoassociates 4 different bit patterns through 2 hidden neurons. We also tried heteroassociative tasks with satisfying results. This demonstrates that our model can associate inputs from different domains. Whether this is a sufficient model for demonstrating neurologically plausible model of learning language needs further testing.

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Can Economic Models Be Epistemic Vehicles?

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Scientific models are representations of phenomena or data which function in a relevant sense in the same way as what they aim to explain. The explanatory power of scientific models depends on the nature of the representation itself. The aim of my theoretical project is to present a feasible analysis for the interpretation of economic models, to determine the nature of their explanatory power, and to analyze whether qualitative models utilized in neoclassical economic theory can be used as epistemic vehicles.

Neoclassical theory has been critiqued as using idealizations, ceteris paribus clauses and modal explanations and in consequence as lacking true explanatory power. However, as the fictional representation view from philosophy of science argues any scientific model can be understood as a fiction that engages interpreters in a make-believe on the truthfulness of a proposition [1]. If this view is correct, models include model explanations [2], where the counterfactual dependence of the model mirrors in relevant respects the counterfactual dependence in the target system. However, a justificatory step is needed to show that phenomena in the real world fall within the domain of the model, unless explanations based on these models are not justified.

Following Gallegos [3], I believe that scientific models resemble Peirce's icons: they must bear some similarity to their target, but they can also function as indexes and symbols namely as epistemic or symbolic vehicles for understanding. In the first case, they have a causal connection to their target, whereas in the second, their reference is conventional. I believe, in order for a model to be conceptually fruitful and since models are used primarily because cognitive manipulations and epistemic processes are performed on them only epistemic vehicles can enrich conceptual scientific knowledge. Following the modal view from the epistemology of economics, applied economic models can only explain as long as they refer to real phenomena, to which the neoclassical theory is committed.

Considering this, my project will be a critical reevaluation of qualitative economic models in the neoclassical theory of economics. The aim of the project is to analyze the assumptions and preconceptions behind the theory and their relations to the proposed explanation from a pragmatic standpoint influeced by Peirce's semiotics, which reconstructs the line of the applied argumentation and the role played by the economic model.

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Why Does My Workout Take Forever? The Influence of Interoception on Subjective Time Dilation During Muscular Activity

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Introduction

Interoception, defined as the sense of the body's physiological condition, gained major attention after the introduction of Craig's theoretical model suggesting that the anterior insula cortex is significantly involved in human awareness [1]. Its integration of interoceptive and emotionally salient stimuli plays a crucial role in the formation of a mental meta-representation of the body's state, which he calls "global emotional moment". Rapid occurrences of salient moments might lead to a higher number of global emotional moments in a given time interval, causing subjective dilation of time perception. Empirical support was found in a study where participants performed isometric contraction of their forearm while their upper arm's blood vessels were occluded [2]. The neural response to the consequent accumulation of metabolites in the forearm might have increased the amount of global emotional moments, resulting in dilated time perception in comparison to the control condition without occlusion. Nevertheless, there were limitations such as ceiling effects of the time estimation task and no control for the effect of occlusion or muscular activity alone or individually different hand-grip-strengths.

Aim

Our aim was to refine Benko's experiment [2] by introducing an experimental design accounting for the above-mentioned constraints, enabling more accurate results and visibility of smaller effects. The main hypothesis in line with Craig's model was that time will be perceived as passing more slowly during isometric contraction and occlusion of the upper arm's blood vessels, especially in participants having high interoceptive sensitivity.

Methods

First, interoceptive sensitivity was identified using people's ability to count their heartbeat. To investigate their performance in time estimation during isometric contraction, participants were then assigned to one of three conditions: They either had to squeeze a hand grip strengthening device while having their upper arm's blood vessels occluded by an inflatable cuff, squeeze a hand gripper without occlusion, or having their blood vessels occluded without using a gripper. As a control, the time estimation task was performed in a baseline condition without using a hand gripper or having their blood vessels occluded.

Results

Preliminary results suggest that participants estimate time intervals as longer during isometric contraction with occluded blood vessels compared to the other conditions. Shortest estimations are expected to occur in the baseline condition. Moreover, correlation of interoceptive sensitivity with time dilation magnitude is presumed.

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Comparing Motor Resonance Between Observed and Imaginative Movement in Professional Dancers Using EEG

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Motor resonance (MR) is the activation in motor areas elicited by a sole observation of movement. It is influenced by the expertise of an individual. The depth of understanding of what an individual sees seems to be based on how well the perceived action is mapped onto his motor repertoire. MR can be observed in the brain by using EEG, specifically by observing the mu rhythm, which is an oscillation between 8-13 Hz and 15-25 Hz. It reflects mostly the sensorimotor processing in frontal and parietal networks and it is an important link between perception and action [1]. Calvo-Merino et al. (2004) used fMRI to study to what extent the MR generalizes observed complex movement by showing professional ballet dancers videos of capoeira dancers performing a similar type of movement to their own and vice versa. The results have shown that generalization in the MR system is minimal because ballet dancers showed little activations when observing capoeira dancers and vice versa [2]. The aim of this project is to find if there are differences in MR when professional ballroom dancers are observing a ballroom dance choreography and when the dancers are imagining that they are dancing themselves, by measuring desynchronization in their mu rhythm activity via EEG. We created an experiment in which dancers were presented with a series of 3 min. videos. The experiment consisted of 3 conditions. In the first, the dancers were watching a video of a static TV noise. This was the control condition. In the second, the dancers were presented with a video of a dancing pair performing a choreography of Samba. In the last condition the participants were asked to close their eyes and try to imagine themselves dancing the choreography. In the last condition auditory stimulus was present in the form of a song from the previous condition. In all measurements the international 10-20 electrode placement system was used. Signals were recorded from locations FC3, FCz, FC4, C5, C1, Cz, C2, C6, CP3, CP4, Pz, O1, and O2. Ground electrode was placed in the Fpz area and reference electrode was placed on the left earlobe. Our results are showing that there seems to be no significant difference between the observation of dancing choreography and imagining its performance, suggesting that observing and imagining a complex movement in dancer's area of expertise does not elicit significantly different mu rhythm desynchronization.

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Emotion Recognition in the Wild: A Machine Learning Challenge

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Currently, artificial emotion recognition exceeds 90% precision in laboratory settings, nevertheless, emotion recognition in the wild is as low as 75.2% of precision for state of the art implementations. Emotion recognition in the wild is understood as the ability to recognize emotions from facial expressions in unconstrained environments where data can be noisy, illumination conditions and head pose may differ, and occlusion can be present [1].

The most popular methods for emotion recognition involve convolutional neural networks (CNN). One promising CNN-based solution is the multi-column deep neural network (MCDNN). It is a committee architecture, which means that there is a specific amount of independent CNN's with varied network architecture, input normalization and random weight initialization that processes the inputs [2]. However, MCDNN used several CNN's that by now are surpassed by more recent CNN architectures. One of the new architectures are residual networks that reduce the training error by creating a residual function from the initial inputs and outputs of the network. The other are "Inception" networks based on fire together wire together Hebbian theory and multi-scale processing.

As for face detection, constrained local neural field (CLNF) is an improved effective facial detection method for images with two main parts, the Local Neural Field patch expert which captures more complex information and exploits spatial relationships between pixels, and the Non-Uniform Regularized Mean-Shift which takes the patch expert reliabilities into account. The reliabilities are represented by a parameter that extracts vertex features and while there is less variance inside the patch more reliability is achieved [3].

Based on my current research, I propose to update MCDNN with residual networks and "Inception" networks because committee architectures were shown to be more precise in emotion recognition than individual networks and combine the outcome with CLNF which is specialized in face detection. CLNF allows preprocessing of 'in the wild' data that can further be processed by the updated MCDNN having as an outcome or faster processing times or major accuracy in emotion recognition than when using previous face detection methods.

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Gender Differences in Incentive Sensitivity

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Introduction

In the modern workplace, an organization's success depends greatly on their employees' willingness to engage in challenging tasks - problems to be solved in uncertain conditions. Since not all employees are equally as willing to do that, incentives are introduced as a way to make sure that these problems are taken care of. However individuals may respond to incentives differently. Gray and McNaughton believe that incentive sensitivity is dependent on an individual's motivational disposition [1]. We believe that this can be linked to two psychological systems - the behavioral activation system (BAS - increasing sensitivity to positive incentives) and the behavioral inhibition system (BIS - increasing sensitivity to negative incentives). The aim of our project was to investigate the differences in incentive sensitivity between men and women, seeing as some studies show women tend to perform better and achieve better results in schools, but usually take less demanding jobs.

Methods

With that in mind we used a modified Sternberg task [2] (short term recall of letter sequences of varying length) with three rounds, corresponding to three difficulty settings (easy, medium, hard), based on the number of letters in the sequence. Each round had the participant choose between an easier and a challenging task of the same difficulty setting (a shorter and a longer sequence of letters). This was done in an incentivised setting and a nonincentivised one. BIS and BAS were measured using the Carver and White BIS/BAS scale [3].

Key Findings

A notable finding of our study is that while women tend to score higher on BIS than men, there is no difference between the genders when it comes to BAS. Additionally, men are more likely to choose the more challenging task, but the difference is not statistically significant. Contrary to our expectations, when performing moderately hard tasks, women were more highly motivated by monetary rewards. Perhaps most surprising was the fact that the best explanatory variable when it comes to determining the choice between easy and challenging tasks was prior outcome - success or failure on prior tasks.

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Academic Writing and the Enactive Approach: An Empirical Pilot Study

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Context

Writing is the fundament of any academic work. It constitutes the main channel of communication between researchers. However, most fields related to cognitive science employ an understanding of writing as a "representation of the world". This view takes up the notion that "things in the world out there" can and need to be depicted accurately. Thus, academic writing is often seen as fulfilling the purpose to accurately depict a researcher's findings and thoughts.

Purpose

While the referring epistemological notion is challenged by the enactive framework in cognitive science, a corresponding revision of academic writing is still waiting. In this regard, first theoretical foundations have recently been laid out [1]. According to this enactivist account, academic writing is understood as a process in which a writer enacts a world together with others. This world-making is shaped by artefacts (e.g. texts), by the writer's epistemology, and by the academic community. The project's aim is to empirically explore the potential of enactivism for reconceptualizing writing processes and writing didactics.

Method

To empirically explore this theoretically grounded view, empirical data was acquired through two methods: (1) Phenomenological interviews; Conducting and qualitatively analysing phenomenological interviews focusing on the lived experience during writing; (2) Descriptive behavioural observations; Collecting and categorizing behavioural data from observing writers while they were working. The focus was on artefacts used. Academic writers have been observed in the context of a so-called "writing marathon" during which academic writers, in this case university students, work on real projects such as their master thesis. Thus, the writing environment was structured, standardised, and controlled and at the same time real projects were investigated. This aspect of the study design distinguishes this study from other work on academic writing as most of the previous studies investigated the production of dummy texts. Furthermore, research methods were employed which are as non-invasive as possible to minimize interruptions of the writing process. The aquisition, analysis, and interpretation is embedded in an academic writing research project with Brigitte Römmer-Nossek, Erika Unterpertinger, Frano Rismondo, Klara Dreo, Claudia Hackl, Marcela Hubert, Jadpreet Kaur.

Implications

This pilot study and according follow-up studies may have an impact on academic work on two pathways. First, the results could inform new writing didactics which support future generations of researchers in their writing. Second, the epistemological reframing of academic writing could trigger more general discussions about underlying presumptions of academic work.

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Computerized Mental Rotation Test with Dynamic Rotating Stimuli

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Ability to mentally rotate objects is an essential skill that we use in everyday life, whether we are navigating across town, arranging furniture or parking a car. Moreover concept of mental rotations is crucial in many fields (for example aviation) and therefore has been an interest of many researchers that try to find ways to improve it [1], and to this day many variations of mental rotation tests have been designed. It was first introduced by Shepard and Metzler [2] and their well-known experiment in which they presented participants with pairs of 3-D differently rotated objects, and asked them if they are the same or mirror images of each other. Their research showed that reaction time in which participants have to decide if objects are the same is linearly increasing with an angle of rotation, indicating the existence of an internal "mental rotation" process. With the rapid advancement in technology, computerization of paper tests is increasing, and therefore we have decided to create a computerized version of mental rotation test. In addition we decided to improve it by adding dynamic rotating stimuli condition, since such stimuli may influence the mental rotation process differently [3]. Our test consists of rotating and static conditions that randomly alternate throughout the test, and in the end participant's results are recorded. In each trial pairs of 3-D objects (as in [2]) are presented and the participant has to decide if objects are similar as quickly and as accurately as possible. Underlying mechanisms of mental rotations are still the subject of research. However after experiments participants often report that they rotate the end of one object until it matches the other one, and then after this "mental rotation" decide whether objects are different or identical [2]. Therefore we expect that performance in rotating condition will be worse since such comparison will be more difficult to accomplish with dynamic stimuli. We will collect some data from our new test to explore whether dynamic rotating stimuli have any influence on performance compared to static stimuli. Our main goal is to develop a computerized new version of mental rotation test, which can be easily and quickly configured to create different variations of the test, and possibly be used in further research on the topic.

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The Morphology of Creativity: Structural Correlates in the Human Brain

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Individual creativity is one of the key human cognitive faculties underlying personal and societal success. In the past decade, several anatomical imaging studies have tried to identify *in vivo* the brain regions associated with creativity [1].

Research Question

Despite the general finding that some brain structures, in particular the prefrontal cortex (PFC), show correlations with measures of individual creativity, no consistent picture of the regions of interest has emerged in the literature so far.

Rationale

In this study, we aim to address this problem by investigating the relationship between brain structure (measured as gray matter volume, GMV, and gray matter density, GMD) and various aspects of creativity using several psychometrical measures, including the Creative Achievements Questionnaire, Runco Ideational Behavior Scale, self-reported creativity in everyday life and the remote associates task. All analyses will be controlled for differences in general intelligence (Raven Advanced Progressive Matrices), verbal fluency (word generation test), mindset (Dweck's mindset questionnaire), affect (Positive and Negative Affect Scale) and personality (Ten Item Personality Inventory).

Methods

For the first time, this comparison will be made with brain data acquired at ultra-high-field (7 Tesla) allowing for high-resolution structural images which were sampled during a related fMRI experiment about creativity [2]. Using Statistical Parametric Mapping for voxel-based morphometry, our goal is to:

- segment the scans of 50 healthy volunteers (25 female, 22-38 years of age, mean age 26.34) in gray matter, white matter and cerebrospinal fluid,
- derive GMV and GMD and
- compute a voxel-wise regression to the behavioral creativity parameters.

Predictions

We expect to find a significant relationship between GMV or GMD and creativity measures, especially in the PFC, as the previous literature suggests.

Implication

This research will help to resolve the ongoing debate about the neural anatomical correlates of human creativity and showcase how a crucial, yet very complex, cognitive capacity imprints structurally onto the human brain.

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An Attempt at a First-Person Account of Languaging

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Context

Languaging, as understood by Cuffari, Di Paolo and De Jaegher [1], is a form of participatory sense-making that emerges from a coupling between two or more autonomous agents. Because the interaction itself gains a form of autonomy, a primordial tension emerges between the individual and the interactional levels. One such tension relates to norms, which may differ between the two levels. An agent must in this case forego their own norms to the benefit of the interaction or suffer its breakdown. Similarly, at the level of social agency, the agents must accept that the mutual coupling be co-regulated by the other. Different acts by the agents can thus catalyse or frustrate the interactional processes. Pertaining to coordination there is another kind of tension - a tension between creative and rule-based frameworks. Different acts can take the form of novel, exploratory moves or revert to learned, habituated ones. In total, there are 7 levels of tensions that offer predictions on behavioural and experiential levels during the interactional process (such as experiencing a pull away from the individual towards the interactional at the level of social agency).

Purpose and Method

The aim of the present study is to explore how this model of languaging relates to actual social situations involving the use of language. We are most interested in the experiential aspects - do the different tensions relate to observable phenomena? The experiment will be set up as a spontaneous conversation between two interlocutors that have not met before. The exact configuration of the experiment is to be determined during the pilot study, however the first part will concern the setting up and filming of the conversation. We will then conduct elicitation interviews with the participants as developed by Petitmengin [2]. Next, we will perform thematic analysis on the video so as to determine categorical codes [3]. Based on the conversation, we will try to construct an historical experiential account of the interaction and compare it to the theoretical predictions set forth by the model [1]. The experimental setup will also allow for other forms of analysis, such as that of nonverbal communication.

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The Importance of Hand Images as Stimuli

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Context

A reaction of arousal systems is a key indicator of the importance of stimuli. We are especially sensitive for face stimuli [1]. Hands seem to be an important stimulus as well, for example for gaining knowledge about manipulating tools or in interpersonal communication. Research about gestures is conducted [2]. However, there is a lack of studies covering electrodermal activity in response to hand images and there is no clarification about how important hands are as a stimulus in general or if they are significant at all.

Purpose

Our hypothesis was that if hands are indeed important stimuli for gaining our knowledge about world and also for communication, then there should be a greater response for hand picture stimuli than for photos of daily use objects (such as a can, keys or a fork). Answer to this rudimentary, but still not resolved question is non trivial and could lead to new insight into research about gestures, nonverbal communication or even sign language.

Method

To test this assumption, we measured skin conductance and heart rate using AdInstruments PowerLab T26 while exposing subjects to pictures of hands and regular objects. GSR (Galvanic Skin Response) data was prepared for further analysis using deconvolution [3]. Participants were looking at each photo for 10 seconds, everyone was presented with full set of stimuli (both - photos containing hands or daily use objects). We presented these images via computer projector. The images of daily use objects contained only group of things we could grab and use freely with one hand.

Findings

Our results suggest a higher sensitivity in GSR peak value for hand images than for regular items ($p < 0.05$), which might indicate that this stimuli is indeed important in our lives. Furthermore, a variation of response on specific images in both groups (hand and non-hand images) also riveted our attention. We assume that images in non-hand category, which caught our attention were too detailed and subjects reacted to them so highly, because of the number of things they wanted to pay attention to. We decided to eliminate those photos from further experiments. When it comes to specific images of hands we noticed that reaction to photos which contained gestures with possible pejorative connotation is lower (lower peak value) than the reaction to the rest of presented gestures.

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Implementing Cryptocurrencies in a Decentralized Market Place

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Introduction

The following project is concerned with the "Web of Needs" [1] that was established in 2012 in the Smart Agent Technology-Lab within the Research Studios Austria.

The foundation of the WoN (=Web of Needs) is the paradigm of the market principle. Although it is economically a non-answered question, whether our current economic system is driven by supply or demand, it is observable that a fundamental asymmetry in the agorical setting arises. A demand must be met by finding an offer. But offer and need differ massively in their ontological status. Where an offer is articulated easily in form of a good or a service, a need is always a matter of abstract thinking.

The WoN aims to interfere with the market principle by giving a user the opportunity to describe his/her need. This need is then matched by an algorithm or/and a human to an offer. Each of them can propose a good that could fit for the person, who articulated the need. The asymmetry gets compensated. The claim is to create a global market place that empowers the person of demand. The expectancy is finding more fitting supplies, lower prices and a community driven spirit of matching needs and offers.

Project

My project is concerned with the connection between economic theory and digital concepts. The most difficult matter concerning the WoN is user traffic. As the WoN profits from positive network effects, incentives must be found to make its actual usage attractive to users of all kinds. Moreover, a reward for using the WoN could be a great advantage for the sustainability of the network. I.e. for the person who found a fitting match for another person. As I see the possibility of this task to be accomplished by a cryptocurrency or a Blockchain-Application I settled for the following research question:

"Which Cryptocurrency can be used to enable incentives for users and support general usage of the 'Web of Needs'?"

Method

The main exercise in this project consists of finding connections between the WoN and cryptocurrencies.

Firstly, understanding the theoretical economic implications of the WoN are fundamental. Moreover, the technical implications, especially the consensus process between operating parties. This will be accomplished by reading the published papers made by the acting developers and researchers of the project and through conduction of expert interviews using the qualitative method.

Secondly, parameters for the cryptocurrencies will be defined. I.e. usability, anonymity, security, professionality, popularity. On this basis, three candidates of cryptocurrencies will be chosen.

Lastly, an elaborated analysis of the chosen candidates will lead to a final recommendation of a single cryptocurrency, which shall fulfil as much necessities implied by the research question as possible.

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Explanation of Robot Plans in AI: Block Manipulation Example

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The motivation for explaining AI systems stems from the need for understanding what, why and how an AI does what it does. Our project is a re-examination of explanation of robot plans in a blocks manipulation domain proposed by Cvetkov [1]. A complete explanation accompanying the robot's execution of a plan was verbalised in terms of the causes between actions and goals. However, for long plans such an approach can be too complex and hard to follow. The goal of our project was to review relevant literature as to what makes for a good explanation, and to propose a better explanation process for this specific example.

Miller [2] states that we usually ask for an explanation to reconcile the inconsistencies between elements of our knowledge structures: the whole process need not be stated. Thus a more intuitive way of providing an explanation is in the form of a question and answer dialogue, a solution embraced both by Miller [2] and Fox et al. [3]. Research [2] also suggests that explanations should be contrastive and selected. In view of this we propose that the explanation consist of the user asking selected types of questions and the robot answering these questions. When people select a cause as an explanation they, in most cases, look at the difference between the event that happened and an event that did not [2]. We propose limiting the question to the form "Why did you perform action A (I) and not action B (II)?" (A is an action the planning algorithm included into the plan, and B is a proposed alternative action by the observer), following [3].

Our intended method for answering the question will require regression planning and methods for detecting causal relations between different actions and their effects. To answer (I), the purpose of A in the plan has to be detected and expressed in terms of A's effects in relation to either final goals of the plan, or in terms of the preconditions of later actions in the plan. Answering (II) can be done by injecting action B into the plan in place of A. The consequences of this for the rest of the plan can then be explained in terms of a goal (or a precondition) achieved by A and not by B, or in terms of a goal (or precondition) required for the rest of the plan "deleted" by B and not by A.

An answer may also include a comparison between the rest of the plan after each action in terms of the optimisation criterion. This may be better presented in the form of an animation of the suggested path and the realised one. Lastly, the comprehensibility of the generated explanation will be tested.

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Learning from Two Perspectives: AI and Psychology

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Our research questions are: What does the term “learning” entail in the scientific fields of Psychology and Artificial Intelligence (AI), and what are key differences in how the two disciplines address it?

The ability to *learn* is indispensable for us humans to interact successfully with our environment. In the field of psychology, understanding the human learning mechanisms is a means to better understand human behaviour. For the field of AI, the topic is of equal importance: A systems designer may not be able to anticipate and specify solutions for all scenarios an agent might have to cope with. Since the fields of Psychology and AI are interwoven, progress in psychological explanations of the human learning ability can open up new approaches for designing AI systems with improved learning abilities; progress in AI may likewise inspire new psychological theories about the human ability to learn.

In our comparison, we focus on two concepts of “learning” for each of the two disciplines: In the field of Psychology, we address *conditioning*, the process by which certain kinds of experience make particular actions more or less likely [1], and *task learning*: the acquisition of competence in carrying out new tasks. In the field of AI, we address *Deep Learning*, the learning of more complex concepts out of simpler ones, and *task learning* in SOAR, as an example realization in a seminal Cognitive Architecture [2] and as an instance of terminological *overloading* across disciplines.

Against the background of canonical textbook material about the studied variants of *learning* in the two disciplines, we conduct our analysis from a functional computationalist view as proposed by Marr [3], i.e., with respect to. i) the *Computational Theory* level: What is the goal of the computation? ii) the *Representation and Algorithm* level: How is i) implemented? What representation is used for the input and output, and what is the algorithm for the transformation? iii) the_ Hardware Implementation_ level: How is the representation and algorithm realised in the physical world?

After addressing each field individually, we will conduct comparisons across the disciplines, aiming to elaborate on the nature of the trans- and crossdisciplinary scientific fertilisation.

Acknowledgements

I would like to thank Paolo Petta for supervising this project.

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Smarter Together: Interventions to Increase Collective Intelligence

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Todays' complex challenges are no longer manageable by individuals. The need for specialized skills leads to the necessity of effective group actions. Involving stakeholder groups into innovation processes became more relevant. New methods in collaborative innovation were developed to optimize the performance of groups and collective intelligence.

Historically, additionally to the g-Factor, the c-Factor was introduced, to measure the ability of a group to perform in various task disciplines. Hoffmann [1] demonstrated already 1965 that a lack of freedom to express one's own opinion led to suboptimal group performance. Current research shows, that collective intelligence (CI) is not predicted by and more than the average IQ of the group members [2]. What predicts collective intelligence and how can CI be supported in practical group settings?

Predictors of collective intelligence are social perception and equal distribution of speaking time between the group members. The ability of taking the perspective of the other group members seems to be a central factor for effective group performance ("perspective taking"). In a developmental psychology context this concept is termed "theory of mind" and it is also related to concepts of empathy. When stakeholder work together an important factor is to have a shared mental model as representation of the world. This means it is necessary to exchange knowledge and perspectives. Successful exchange processes with stakeholder will become a core competence of effective organizations.

The project is intended as a explorative work of theory formation. A semi-controlled mixed-method field experimental setting was used to test the effect of "Lego – serious play" on perspective taking, shared mental models, subjective and objective group performance as a preliminary study to improve the materials for the upcoming research project. The context of the experiment was an internal decision meeting of the city of Vienna about current questions of open data use in governmental processes. To conduct the experiment the 50 stakeholders were randomly distributed between 10 groups, which were split into test group and control group, which used normal notes instead of Lego. Statistical analysis of the data is currently conducted.

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The Knowledge Level in Cognitive Architectures

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The philosophical questions studied in epistemology and metaphysics have contributed to insights in the domain of Artificial Intelligence (AI) through frameworks, structures, and terminology essential to articulate challenges and characterize achievements (e.g., in the development of the BDI model of practical reasoning for multi-agent systems); on the other hand, the results of AI's empirical inquiries have proven of interest also for philosophers (cf. Dreyfus' involvement in Heideggerian AI). Our examination of the metaphysical status of the *Knowledge Level* lays a bridge from our own philosophical background into the field of AI and provides the opportunity for a first hands-on acquainting with cognitive architectures.

Allen Newell's hypothesis of the Knowledge Level: *"There exists a distinct computer systems level, lying immediately above the symbol level, which is characterized by knowledge as the medium and the principle of rationality as the law of behavior."* [1, p.99] has catalyzed the debate on the nature and place of knowledge in AI systems and promoted awareness of key challenges and deficiencies of cognitive architectures to date [2].

The key questions we aim to address in this project are: - Is the introduction of the Knowledge Level a necessary development in AI? - How has it shaped the development of Cognitive Science? - What are particular contributions contemporary epistemology and metaphysics can make?

To obtain a working understanding of the current state of the matter, we conduct a critical analysis of key publications, complemented with the empirical study of concrete exemplars (ranging from basic problem solving to social/teamwork scenarios) in cognitive architectures (including Newell et al.'s Soar [3]). Equipped with the answers to the first two key questions, we try to bring in our philosophical expertise to bear on the third one.

Beyond the personal opportunity to improve our transdisciplinary grasp of the matter and to get acquainted with interdisciplinary challenges and cultures in practice, we do expect our snapshot of the current situation on this standing question, exposing scientific as well as social motivations and delivering a critical summary of key results of the debates, to be useful to a broader audience: Next to supporting and orienting our student peers, we hope to spark interest for collaborations, based on the formulated proposals for further investigation.

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Many thanks to Dr. Paolo Petta at OFAI for supervising this project.

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Transforming Belief, Inspiring Action: The Cognitive Gap of Collective Sustainability

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Ever since the Brundtland Report of 1987,[1] nations have been scrambling to work towards global sustainable development. Still, many of the key measures such as the carbon dioxide saturation of the air, global temperature, and the sea level are steadily worsening, causing ecological and economic problems, such as increased number of droughts or more powerful hurricanes.[2] Although many initiatives, institutions and movements have been formed and proposed many specialized solutions, the scientific research backing those endeavours still hasn't come around to tackle one central issue: The cognitive gap between these global problems and the daily routine of an individual.

Problem

This project aims at closing this gap, by investigating the cognitive basis of a sustainable lifestyle. Although there are many practices such as communal living, car-sharing, urban gardening etc. there is little research on generalized deductions on motivational patterns that lead to the formation of belief, which in turn causes the sustenance of these practices and the translation of said belief to other areas of life.

Approach and Method

A first step will establish a working definition of sustainability by way of literature review, comparing both the results of global work such as the Brundtland Report as well as specialized literature that focusses on a certain aspect of life. A preliminary look into existing research revealed that sustainable living is oftentimes most vigorously and coherently expressed via organization as a community around a specific topic – such as Foodsharing or Transition Towns.[3] Also, there are significant parallels between the social structures, interactions and rules of these sustainable communities and hunter-gatherer tribes.

In a second step, this project looks at the cognitive process of belief formation, which can be further divided into two cognitive phenomena: Activity-based learning and collective group action. In the case of activity-based learning, the cognitive mechanisms of individuals deducting rationales from immersive activities and experiences are examined. In the case of collective action, this project looks at the mental or physical artefacts that motivate people to join and stay in groups, align their actions to act in accordance with each other towards a common goal.

In a third step, this project synthesizes the findings of the previous steps to conceptualize a semantic space for the cognitive basis of sustainability. The method of all steps is mainly theoretical research, spanning neuroscientific and psychological research on motivation and learning over to economic literature on group dynamics. This project also sheds some light on the subjective dimension by including autoethnographic accounts of the author's experience.

Impact

This work will contribute to research that embeds a cognitive phenomenon in a broader scientific context such as its ecological, economic and social dimension. Furthermore, it wishes to show that autoethnographic accounts are a worthwhile complement to literature based research, that any cognitive research project might consider.

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Adapting Cognitive Control Challenge Task for Electrophysiological Studies

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Introduction

Better understanding of wide multimodal ability of flexible cognitive control is important since one has to be able to adapt behaviour according to changes in the environment throughout one's whole life. The fronto-parietal brain network (FPN) was shown to be the most relevant network supporting the cognitive flexibility [1]. We adapted and analysed the properties of newly developed behavioural/fMRI Cognitive Control Challenge Task (CCCT), which demands quick shifts in mental strategies and control processes, for electrophysiological studies like electroencephalography recordings. We intend to use this paradigm for research on flexible cognitive control and cognitive inflexibility in early stages of different neurodegenerative disorders.

Methods

Two female participants completed the CCCT task during electroencephalography (EEG) recording, with high density 64-channel EEG (BrainAmp) with active electrodes (actiCAP). Each participant completed two practice blocks of trials. In the recording session participants completed the whole CCCT paradigm which consists of two conditions, a stable one with one set of rules valid across all 10 trials in each of the 16 blocks and second a flexible condition with rules changing for each of the 10 trials in 16 blocks. Trials in CCCT consist of auditory and visual stimuli, both in the left and right side and of three-part rule (sensory-semantic domain, logical-decision domain and motor response domain) [1]. The task was computer based and each event (rule or stimulus display) and response (correct, incorrect, timeout) was implemented and presented with the behavioral software PsychoPy and recorded together with EEG signal with Brain Vision Recorder software.

Results and Further Research

The main aim of this pilot testing was to identify the number of trials in CCCT that have to be recorded to achieve stable results in oscillatory (time-frequency domain) types of analysis. The time frequency analysis showed that 50 trials were enough for reasonably stable results in all frequency bands, with 100 trials and beta frequency band giving the most stable results for all conditions. These results will be taken into account in further CCCT paradigm adaptation which will be used in later experiments where changes in oscillatory measures over localised parts of the cortex and changes in synchronisation of activity in distributed brain networks will be analysed [2].

Acknowledgements

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Linguistic Expressions of Spatial Relations and How to Model Their Semantics

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Purpose

In this project, I wish to explore the potentials of Grounded Language Learning in a multi-modal setting where visual input is coupled with verbal descriptions of particular actions performed in an experimental environment and how to develop the semantics of prepositions based on multi-modal input data.

Problem and Approach

This incorporates the challenges of spatial semantics. Grounding spatial concepts to the physical world directly produces a lot of ambiguity or undetermination, because a specific physical situation may satisfy several concepts being expressed by many different linguistic expressions such as 'next to', 'left of', 'in between'. The approach followed in this project is to achieve representations of the physical world from visual input to be paired with instances of linguistic expressions that trigger clustering these representations. Using machine learning techniques, models can be derived that correspond to spatial concepts, and link themselves to prepositions or more complex linguistic expressions expressing spatial relations.

Context

Pairing concepts of spatial relations with linguistic descriptions may enable a language-specific partition of these (semantic) concepts. Modeling spatial concepts and learning the meaning of words expressing these concepts hopefully fosters a bridging between embodied cognition and grounded language learning, which seems highly relevant from a interdisciplinary perspective. This project will be carried out in the context of two projects at the Austrian Research Institute for Artificial Intelligence (OFAI): ATLANTIS ("ArTificial Language uNdersTanding In robotS") and RALLI ("Robotic Action-Language Learning through Interaction"). ATLANTIS aims at understanding and modeling the very first stages in grounded language learning, and how first grammatical generalizations emerge from multimodal input [1]. Similarly, RALLI tackles the critical problem of learning and modeling actions and the words expressing those actions.

Method

Within both projects, a specific corpus was developed, the Action Verb Corpus (AVC), currently comprising multimodal data in total 499 instances of action/utterance pairs, such as take, put, push. [2] Recorded are audio, video and motion data, while participants perform an action and describe what they do. The main focus of this project will be on how learning the meaning of linguistic expressions that denote spatial relations can be achieved. Grounding Language Learning will be used, but also the question of how non-grounded abstract concepts will be explored.

Implications

Beyond the goals of human language understanding, which is highly relevant for human-robot interaction, this project may also benefit from and have relevance for research for people with disabilities, such as blindness explored in Gleitman's work [3]. Notable is the case Autism researcher Temple Grandin, who learned how to visualize non-visual concepts.

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Impact of Cognitive Load on Visual Attention

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Introduction

Attention is crucial ability, enabling organisms to survive in dynamically changing environment. However, human attention can be easily disrupted. Working memory cognitive load is common cause of impaired attention. Overloaded working memory can cause dangerous situations, such as distracted driving. We tried to find link between different amount of cognitive load and slowed reaction time. We tested the assumption, that different difficulties of secondary tasks (cognitive load) would have different impact on visual attention and reaction time. Based on previous studies [1] [2], we sorted our conditions by potential working memory load: silence, listening, recitation, conversation, word game.

Methods

We tested participants (N = 10) in within-subject design. Each participant had to complete Attention network test (ANT) in every condition mentioned above. ANT consists of flanker task with centered, spatial, or double cue before the onset of flanker. Conditions were randomized for every participant and after 3 trials participants took obligatory brake, in order to prevent adaptation and fatigue. We examined reaction time, error rate, and effect of alerting, orienting and conflict resolution (core parts of ANT) for each condition.

Results and Conclusion

Conditions show increase in reaction times in ANT, corresponding to their working memory load, so the order remains the same. The most significant difference in reaction time is between word game and silence or word game and listening. For alerting, orienting and conflict resolution effects, the most prominent difference is also between silence and word game. These results provide some evidence for differences in activation of attentional networks in brain for these two conditions (the most different conditions according to cognitive load) and also for slowing of reaction time depending on cognitive load. Recent computational modelling study [3] provides plausible interpretation of this mechanism, that Prefrontal cortex (related to working memory) is bidirectionally connected with brain regions involved in attention process (Lateral intraparietal area, Frontal eye fields) and working memory load (higher activity in Prefrontal cortex) may influence connections among Prefrontal cortex, Lateral intraparietal area and Frontal eye fields.

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Research on the User Experience of the Thesaurus of Modern Slovene

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Introduction

Lexicography has changed a lot since the Dictionary of the Slovenian Standard Language was published at the end of the 20th century, between 1970 and 1991. [1] Until 2016, when a one-volume thesaurus was published only in printed form, describing only Slovene from the middle of the 20th century, no thesaurus in Slovene had been available. [1] Then, in 2018, a new type of dictionary called the responsive dictionary, the Thesaurus of Modern Slovene [2], was introduced by The Centre for Language Resources and Technologies. It is the largest automatically generated open-access collection of Slovene synonyms. The Thesaurus is based on The Oxford®-DZS Comprehensive English-Slovenian Dictionary and the Gigafida reference corpus of written Slovene, that both contain language material created after 1991 and as such offer a description of modern Slovene. Its creators say that it is "a dictionary made by the community for the community" [1] because the language community can contribute with changes and opinions to this type of dictionary, which means it is never finished as it evolves over time. [3] Since this is a new concept in lexicography, with novelties that have not been evaluated yet, the aim of the research is to collect real-time feedback from its users in order to improve it.

Method

For the research, we used a think-aloud protocol and a half-structured interview. We interviewed 10 Slovene language students and 10 translation students. At the beginning of the session, the student used the thesaurus for approximately 10 minutes and was thinking aloud at the same time. We also recorded the computer screen, so we can see where his mouse pointer was at any moment during the session. After that, we interviewed each student about their view on lexicography, online dictionaries, crowdsourcing and the applicability of the thesaurus.

Future Research

The interviews are still being conducted and the research will continue with students from other fields of study. The data gathered so far from the first thirteen participants shows promising results. With the majority saying they welcome similar modernizations of language sources. Once the in depth analysis of the research results is done, it will serve as a guide to improve the dictionary.

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State-Dependent Modulation of Human Social Reward

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Rewards are powerful motivators of behaviors, and depending on the state in which the individual approached them (being in an appetitive or in an aversive motivational state), they can be processed differently [1]. Scientific studies have also led to the identification of two distinct neurobiological components of reward: a motivational component (wanting) and a hedonic component (liking) [2]. However, to date, no study has investigated how the state of the individual is specifically modulating wanting and liking of a reward. The aim of this study is, therefore, to investigate at the behavioral level how the different components of social reward, wanting and liking, are modulated by aversive and appetitive motivational states in humans. Participants are divided into three groups in which either aversive, appetitive or neutral motivational states are induced via modified versions of the Trier Social Stress Test [3]. The effectiveness of the manipulation is assessed through subjective and physiological measures. After the manipulation, participants perform a task in which they can obtain social rewards, i.e. different types of social touch. Objective assessment of wanting is realized through subjects' squeezing of a hand dynamometer while facial electromyographic activity is used as an objective measure of liking. The expected results are that during aversive motivational states, participants' will seek for the social reward in order to down-regulate stress and negative emotions and this will result in an increase in wanting. During appetitive motivational states, social contact will be sought as a source of pleasure and this will be reflected in an increase in liking. The results of the study will crucially extend the existing knowledge on social reward in humans and will be also important to assess the suitability of the paradigm for future studies in the social neuroscience domain. Moreover, investigating the brain mechanisms involved in social reward will lead to a better understanding of disorders characterized by a deficit in reward processing, such as behavioral and substance addictions and clinical conditions such as autism and depression.

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The Effect of Binaural Beats on Sustained Attention

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Neural entrainment is the capability of the brain to synchronize its brainwave oscillation frequencies with a frequency of an external stimuli. This ability allows us to artificially induce desired type of brainwaves that match a particular neural activity corresponding to an intended brain-state. The inducing external stimuli can be either visual, tactile, or auditory. Sound stimuli in my study uses binaural beats, perceptual phenomenon induced by two tones of different frequency listened to by each ear separately. The resultant tone caused by the disparity affects the frequency of brainwaves and creates neural entrainment. Our aim was to evoke Beta brainwaves, which has been proven to have a positive effect on long-term and visuospatial working memory [1, 2], and measure its effect on sustained attention, which has not been examined yet.

30 participants with no attentional malfunctions were split into two groups of 15. At first, each group underwent a control sustained attention task without any sound stimuli. Subsequently the participants listened to either binaural beats or pink noise and underwent the same test again. For the experiment a track was created composing of Beta binaural beats of 16 Hz and overlaid with musical tune that makes the listening more pleasant. The control group listened to pink noise, an audio spectrum with an acoustic energy distributed evenly by octave. Since none of the reviewed studies using binaural beats for less than 5 minutes showed any significant effects, the track was played for 10 minutes before the cognitive task began to ensure there was enough time for the brain to adjust. Subsequently, the level of sustained attention was tested while the sound stimuli persisted. Sustained attention to response task (SART), a go/no-go test measuring sustained attention was used. The test evaluates the scores of reaction time, the number of omissions and the number of false calls.

The results display significant improvement of sustained attention while listening to the binaural beats in comparison to pink noise and introduce the 16 Hz track as an effective tool in inducing sustained attention in healthy subjects. Further examination detects that the main difference occurred in the reduced number of errors. The reaction time didn't change significantly. These findings are substantial in a discussions regarding its possible use in real-life tasks. Following studies should focus on defining the most optimal frequencies and time limitations as well as long-term use effect.

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Step up Your Talk: The Effect of tACS on Verbal Fluency

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Prospect

Transcranial alternating current stimulation (tACS) is a non-invasive brain stimulation technique that exposes outer cortical areas to alternating current. The theory is that the frequency, amplitude and phase of such current can interact with natural neural oscillations of functionally connected brain areas, effectively strengthening or interrupting their synchronization.

Electroencephalography patterns during verbal fluency (VF) tasks show a simultaneous increase in theta power (4 - 7.5Hz) in the frontal lobe and the temporal lobe [1], implying a resultant functional connectivity. With tACS showing promising results in past attempts to manipulate cognitive function [2], we seek to apply such findings to VF. In this study, we focused specifically on the temporoparietal region and the left dorsolateral prefrontal cortex, hypothesizing that a synchronised theta stimulation on these two areas would enhance VF while desynchronization will disrupt the connectivity, thus having a detrimental effect.

Method

12 healthy adults participated in a double blind within-subject experiment with 3 stimulation conditions; synchronized, desynchronized and sham on weekly intervals. An Association Chain Task (ACT) was employed during 6Hz online stimulation. The task was divided in 4 stages, all time dependent. Stage 1 required listing nouns within a category, stages 2 and 3 required a list of associated and disassociated nouns respectively while stage 4 alternated between association and disassociation within the list.

For desynchronization, 5x5cm rubber electrodes were centred on F3 and CP5 while for synchronization, an additional 7x5cm reference electrode was centred over Cz and CPz. Currents of 1.5mA and 3mA were used respectively.

Preliminary Results

Synchronized stimulation was found to significantly enhance category fluency and word association during the alternating association stage of the ACT task while desynchronization significantly impeded these two conditions.

Interestingly, desynchronization significantly increased the performance of the association stage. The possible mechanism for such results will be further discussed in the poster.

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On the Bright Side of Existential Angst

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Context and Purpose

This study aims to investigate the impact of the belief in free will on pro-social and altruistic behavior. To this point, research has demonstrated that the disbelief in free will (i.e. belief in determinism) is associated with more impulsive and antisocial behavior (e.g. cheating)[1]. Moreover, the determinism-belief has been indicated to reduce helping and further to correlate with a willingness to exert self-control [2]. These adverse behaviors have been argued to emerge due to existential angst, which is provoked by the thought of meaninglessness and might be conveyed by the concept of determinism [3]. Yet, research so far has failed to elaborate the potential positive influences the (dis-)belief in free will might have on our perception, thinking and behavior. This implies not only a beneficial account for ourselves, but further, introduces the possibility of a wider literally pro-social scope. Can the belief in free will prevent antisocial behavior and self-serving thinking and as such be a crucial mediator of agency and altruism?

Method

In our study we primed participants with the belief in free will or in determinism. Afterwards participants answered different comprehension types of comprehension questions about the text, which they had received in their condition. Then, while participants were led into a different room to perform the last task of the experiment, the researcher dropped their pens, seemingly by accident. Numbers of picked up pens by the participants were counted as an indicator for the presence/ absence and dimension of pro-social behavior of the primed participants. We expected participants of the Free Will Condition to be more likely to pick up pens and additionally to pick up a significantly higher amount of pens compared to the Determinism Condition.

Implications

If, indeed a free will belief positively correlates with pro-social and even altruistic behavior, then our findings do not only highlight a strong social relevance but also offer novel insight and benefits in the scientific understanding of the nature of free will beliefs. Belief in free will may then be an essential aspect or even mediator of agency and altruism and would have to be taken into account in research. Finally, given that agency plays a major role in our everyday life, the support of a free will/ determinism- belief could be particularly relevant in the advertisement and education sector of our society.

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Readability Model Based on ccGigafida and Šolar Corpora

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Introduction

Readability can be defined broadly as an effective communication of ideas. More precisely, the readability studies can be defined as the analysis and determination of those properties of written texts that help or inhibit the effective transmission of information [1]. Readability models can be used by writers or they can help in assessment of the textbook difficulty in an educational process. The traditional approach to determining the readability of text are readability formulas, e.g., Dale-Chall Formula, Flesch Reading Formula, The Fry Graph, etc. They provide a numerical value that reflects the degree of difficulty of the text.

Method

In our research, we were interested in whether ccGigafida and Šolar corpora can be used to determine the degree of text readability using machine learning methods. The texts from both corpora were tokenized, lemmatized and turned into a bag-of-words form. From metadata we determined four readability categories in the following progressive order: 461 elementary school texts from Šolar (from 6th to 9th grade), 1489 secondary school texts from Šolar, 1485 general newspapers from ccGigafida (mostly from Delo, Dnevnik and Dolenjski list) and 1210 technical texts from ccGigafida (DZS, Krtina, Studia humanitatis, Študentska založba and many others). Within each class, each word was weighted with tf-idf weights. This value determines the "importance" of the word for the document within the corpus [2]. The following machine learning algorithms were then applied: Logistic Regression, k-Nearest Neighbors, Support Vector Machine and Naive Bayes. The task of the learning algorithms was to predict the readability category based on their tf-idf transformed bag-of-words vectors. Results were evaluated by their classification accuracy on the test data (33% of all data).

Results

Although all models perform relatively well (above 90% accuracy), it is dubious how well they generalize to completely unrelated texts. For example, very important words in corpus Šolar are exclusively proper names. This indicates that models might not generalize well for data obtained from other sources. Important words from the newspapers indicate general political, sport and economic topics, while in the technical literature there are many page references, which is demonstrated by the abbreviation "str." (Slovenian abbreviation for English word "page").

Conclusion

Based on this, we can conclude that in our classification approach we can use the ccGigafida corpus for constructing readability models, while the Šolar corpus is probably too specific and therefore not appropriate.

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