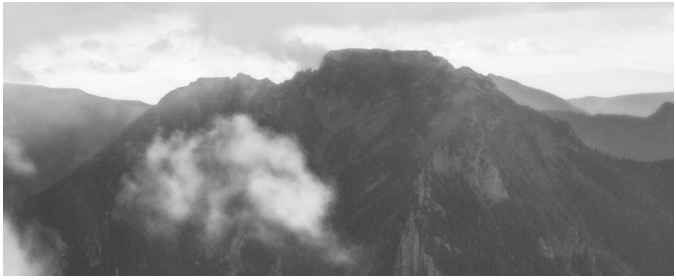
Cognitive Systems Modeling



5th Peripatetic Conference

Zakopane 6–8 October 2016

Conference committee

Program chair: Joanna Rączaszek-Leonardi

Local arrangements: Alicja Radkowska, Magdalena Stępień

Website and booklet: Julian Zubek

UNIWERSYTET
WARSZAWSKI

Wydział Psychologii
Uniwersytetu Warszawskiego

Schedule

Thursday, 6th October

18:00–19:00	Dinner
19:00–22:00	Session I

Friday, 7th October

8:00–8:30	Mind and body exercises
8:30–9:00	Breakfast
9:00–12:00	Session II
12:00–16:30	Peripatetic activity
16:30–17:30	Dinner
17:30–21:00	Session III
21:00–	Discussions by fireplace

Saturday, 8th October

8:00–8:30	Mind and body exercises
8:30–9:00	Breakfast
9:00–13:30	Session IV
13:30–14:00	Evaluation and closing
14:00–15:00	Lunch

Contents

About the conference

The Peripatetic conferences on Modeling Cognitive Systems are organized since 2010 by and for those who appreciate thinking and exchanging ideas while walking and those who, like many before, believe that the rarefied mountain air and the physical exertion bring our brains to another level of functioning.

Cognitive systems are defined through their ability to adapt to the ever-changing conditions of the environment. We observe such processes of adaptation on many different levels: from single cells and tissues, through regulation systems such as the immune system, to people operating on conscious level and whole social groups. The aim of the conference is to present recent research on cognitive systems from multitude of perspectives and methodologies, and to bridge gaps between different disciplines in order to develop common language as well as new methods and paradigms for modeling cognitive phenomena.

Among the organizers and participants of the previous editions of the conference were psychologists, cognitive scientists, computer scientists, linguists, physicists, biologists, mathematicians, anthropologists, sociologists… No matter what is your discipline, what counts is your interest in cognitive systems, in computational methods (but also in how to link qualitative with quantitative, without throwing the former with the bath or making the latter untenable), your openness to talk to others and patiently explain your approach, and your love for the mountains.

Detailed program

Thursday, 6th October

18:00–19:00 Dinner

19:00–22:00 Session I

- The Precious Complexity: On Becoming Interaction-Dominant – Joanna Rączaszek-Leonardi
- Qui Sommes Nous or What do you need your favorite book for – Magdalena Stępień
- Causality relations: from molecular dynamics to biological signals – Franciszek Rakowski
- Ecological context of categorization – Julian Zubek
- Modeling of eye movements during induction of spatial disorientation in pilots and amateurs – Bibianna Bałaj
- Heart-brain interactions in the context of creative thinking and fluid intelligence – Ewa Ratajczak
- HRV-biofeedback and creative thinking – Julita Fojutowska

Friday, 7th October

8:00–8:30 Yiquan yangsheng gongfa – health preservation and relaxation exercises from a chinese martial art with Julian (facultative)

8:30–9:00 Breakfast

9:00–12:00 Session II

- From free will to quantification: The challenges of investigating natural language-use – Sebastian Wallot

- Sensory Data Aquisition and Analysis for Human Motion Quantification – Michał Meina
- Machine learning and EEG – approaches that led to winning of two international competitions on brain-computer interfaces – Rafał Cycoń
- Dreams, drugs and ConvNets – Piotr Migdał
- Automatic Movement Extraction from Parent-Infant Interactions – David Lopez
- Behavioral Coordination in Mother-Infant Dyads – Giuseppe Leonardi
- Taking up an active role in play routines – Alicja Radkowska
- Book review: Daniel J. Siegel, "The Developing Mind, Second Edition: How Relationships and the Brain Interact to Shape Who We Are" – Wojciech Sak

12:00–16:30 Peripatetic activity – discussions in subgroups during walk in Kościeliska valley

16:30–17:30 Dinner

17:30–21:00 Session III

- Syntactic language processing through hierarchical heteroclinic networks – Peter beim Graben
- Large Scale Entropy Rate Estimation: A New Law that Governs the Complexity of Language – Łukasz Dębowski
- Book review: Peter Stockwell, "Cognitive poetics" – Adrianna Kucińska
- Taxonomy and structure of polish langugage personality descriptive type-nouns – Małgorzata Charęzińska
- Interactions analysis in the wine study – Magdalena Stępień, Michał Denkiewicz
- Transformative value of coaching: caoach-coachee dyad as a dynamical system based on languaging – Grzegorz Grzegorczyk

21:00– Discussions by fireplace

Saturday, 8th October

8:00–8:30 Morning Yoga with Joanna and Alicja (facultative)

8:30–9:00 Breakfast

9:00–13:30 Session IV

- On radical embodied cognitive science and strong anticipation – Sławomir Nasuto
- Morphological computation (from Pfeiffer to Friston) – Marcin Miłkowski
- Desiderata for a theory of mental representation – Krystyna Bielecka
- Theoretical framework for description and modeling of heterogeneous cognitive systems – Łukasz Jonak
- How confident are you? Individual differences in volitional abilities are associated with confidence judgements – Wojciech Zajkowski
- Intelligence of the immune system – Edgar Filip Różycki
- Book review: Carl Zimmer, "Sophisticated Parasites: How they control the minds of their hosts and survive immune system onslaught" – Piotr Szczęsny
- The secrets of Munc18 interactions in neurotransmitter release – Ewa Sitarska
- Book review: Robin Dunbar, "How Many Friends Does One Person Need?" – Marzena Wójtowicz

13:30–14:00 What's next? Conclusions, Plans, Announcements & Initiatives – Joanna Rączaszek-Leonardi

14:00–15:00 Lunch

Abstracts

Modeling of eye movements during induction of spatial disorientation in pilots and amateurs

Bibianna Bałaj

bibianna.balaj@gmail.com

Nicolaus Copernicus University in Toruń

Spatial disorientation is one of the main causes of aviation accidents, resulting in cognitive impairment, possibly by diverting attention resources to regaining orientation. Main goal of our research was to search for eye movement indices, which can be monitored during flight profiles posing a threat of spatial disorientation. We were looking for differences between experts (pilots) and amateurs (non-pilots) in the performance of the flight task especially for spatial disorientation originating from vestibular system. Expertise is frequently taken into account when examining pilots' eye movements, but not in the context of spatial disorientation.

The experiment was carried out in the Military Institute of Aviation Medicine in Warsaw. The subjects (20 pilots; 20 non-pilots) have undergone a series of tasks in the flight simulator GYRO-IPT regarding piloting the aircraft during flight profiles containing selected situations related to the risk of the emergence of spatial disorientation (eg. slope of the runway, false horizon, somatogyral illusion, leans illusion). During flight eye movements were recorded.

Comparison of Areas of Interest in experts and novices allowed us for designing a cognitive model of visual scanning during different types of flight tasks. Experts effectively collect visual information and cope better with changing requirements of a task.

Desiderata for a theory of mental representation

Krystyna Bielecka
kikab@gazeta.pl
University of Warsaw

The purpose of my talk is to present a systematic list of desiderata for a theory of mental representation that would be both normatively and descriptively adequate vis-a-vis current best research practice. Instead of relying on unexamined intuition to decide what should count as representation, and what kinds of constraints should be put on this notion, we should rather constrain it by relying on systematically connected list of desiderata that reflects the already existing practice. While most theories of mental representation, as I will claim, clearly fail and don't deliver anything close to a satisfying theory of mental representation, I will defend the claim that a number of cognitive representation requires it but this number is probably quite limited as well.

Taxonomy and structure of polish langugage personality descriptive type-nouns

Małgorzata Charęzińska
charezinska@gmail.com
John Paul II Catholic University of Lublin

Lexical studies of personality have concentrated on adjectives, however type-nouns (e.g., macho, hero, donkey) are also important in person description and deserve their own special place in the domain of personality language. Study 1 describes the steps that were followed to arrive at a list of a taxonomy of personality descriptive nouns. In the first step, two judges searched through The Universal Dictionary of Polish Language (100 000 terms) for person-descriptive type-nouns terms. In the second step, 4182 person-descriptive adjectives were classified by 14 judges into 13 different subcategories of the psycho-lexical classification system (Angleitner i in., 1990). About 800 nouns redulted from this study. Study 2 (N=146) describes the determination of the internal structre of the domain of type-nouns through factor analysis obtained from 146 students. The data set was split to investigate the invariance of the factors. The analyses yielded a final 7-factorial structure.

Machine learning and EEG – approaches that led to winning of two international competitions on brain-computer interfaces

Rafał Cycoń

rafal.cycon@gmail.com

FORNAX sp. z o.o. – www.fornax.co

Successfully applying machine learning to electroencephalography (EEG) data is a challenging task due to complexity and volatility of these signals. This talk will shortly describe winning solutions of two international competitions focused on building predictive models on EEG data. One of the challenges was to improve spelling accuracy in a P300 brain-computer interface (BCI) paradigm [1], where we showed that leveraging a Riemannian Geometry framework leads to an accurate and well-regularized solution. The goal of the second competition was to identify hand motions on the basis of EEG signals to enhance performance of prosthetic devices controlled via BCI [2]. To ensure high accuracy on this task we have built a stack of diverse machine learning models. Both competitions were hosted on Kaggle.com, a platform for predictive modelling competitions.

[1] https://www.kaggle.com/c/inria-bci-challenge

[2] https://www.kaggle.com/c/grasp-and-lift-eeg-detection

Large Scale Entropy Rate Estimation: A New Law that Governs the Complexity of Language

Łukasz Dębowski

ldebowsk@ipipan.waw.pl

Institute of Computer Science, Polish Academy of Sciences

Joint work with Ryosuke Takahira and Kumiko Tanaka-Ishii

One of fundamental questions about human language is whether its entropy rate is positive. The entropy rate measures the average amount of information communicated per unit time. The question about the entropy of language dates back to experiments by Shannon in 1951, but in 1990 Hilberg raised doubt in a correct interpretation of these experiments. In the talk, we will analyse 20 corpora of up to 7.8 gigabytes across six languages (English, French, Russian, Korean, Chinese, and Japanese), to conclude that the entropy rate is positive. To obtain the entropy rate estimates, we use an extrapolation function. Although the entropy rate estimates depend on the script kind, the exponent of the extrapolation

function turns out to be constant across different languages and governs the complexity of natural language in general. In other words, in spite of typological differences, all languages seem equally hard to learn, which partly confirms Hilberg's hypothesis.

HRV-biofeedback and creative thinking

Julita Fojutowska
julita.fojutowska@gmail.com
Nicolaus Copernicus University in Toruń

Aside from aiding treatment of psychosomatic disorders, HRV-biofeedback appears as a promising cognitive training technique. It has been previously reported to improve attention-related processes, however, its influence on creativity has not been studied in detail. The current study investigated the effects of HRV-biofeedback training on divergent thinking. Linear and non-linear measures of HRV were analysed. Preliminary data indicate that this technique might be helpful to improve creativity.

Syntactic language processing through hierarchical heteroclinic networks

Peter beim Graben
peter.beim.graben@hu-berlin.de
Humboldt Universität

In his paper "Reanalysis and limited repair parsing: Leaping off the garden path", Lewis [1] presented a computational account to Fodor & Inoue's [2] diagnosis model for syntactic garden path theory [3]. In my presentation I shall demonstrate how the discrete states of Lewis' symbolic repair parser can be represented by activation vectors of a neural network that are connected through heteroclinic sequences in continuous time [4,5]. In this picture, encountering a garden path sentence, such as the famous "the horse raced past the barn fell" [6], corresponds to an undesired fixed point attractor that has to be destabilized by a bifurcation in course of syntactic diagnosis processes [2, 7]. Leaping off the garden path is then described by a change of the network's control parameters reflecting the syntactic processing strategy [7]. In my model, such strategies are represented by a second level of heteroclinic orbits that become stabilized or

destabilized through attention parameters from the third level. Therefore, I need a hierarchical network of heteroclinic sequences [8]. Finally, I shall address some implications for the modeling of representational states in dynamical automata [9].

Literature:

1 Lewis, R. L. (1998). Reanalysis and limited repair parsing: Leaping off the garden path. In Fodor, J. D. & Ferreira, F. (Eds.) Reanalysis in Sentence Processing, Kluwer, 247 – 285.

2 Fodor, J. & Inoue, A. (1994). The diagnosis and cure of garden paths. Journal of Psycholinguistic Research, 23, 407 – 434.

3 Frazier, L. (1987). Sentence processing: A tutorial review. In Coltheart, M. (Ed.) Attention and Performance XII. The Psychology of Reading, Lawrence Erlbaum, 559 – 586.

4 Rabinovich, M. I.; Huerta, R.; Varona, P. & Afraimovich, V. S. (2008). Transient cognitive dynamics, metastability, and decision making. PLoS Computational Biology, 4, e1000072.

5 beim Graben, P. & Potthast, R. (2012). A dynamic field account to language-related brain potentials. In Rabinovich, M.; Friston, K. & Varona, P. (Eds.) Principles of Brain Dynamics: Global State Interactions, MIT Press, 93 – 112.

6 Bever, T. G. (1970). The cognitive basis for linguistic structures. In Hayes, J. R. (Ed.) Cognition and Development of Language, Wiley, 279 – 362.

7 beim Graben, P.; Jurish, B.; Saddy, D. & Frisch, S. (2004). Language processing by dynamical systems. International Journal of Bifurcation and Chaos, 14, 599 – 621.

8 Kiebel, S. J.; von Kriegstein, K.; Daunizeau, J. & Friston, K. J. (2009). Recognizing sequences of sequences. PLoS Computational Biology, 5, e1000464.

9 Carmantini, G. S.; beim Graben, P.; Desroches, M. & Rodrigues, S. (to appear). A modular architecture for transparent computation in recurrent neural networks. Neural Networks.

Transformative value of coaching: caoach-coachee dyad as a dynamical system based on languaging

Grzegorz Grzegorczyk

grzegorz.grzegorczyk@ug.edu.pl

University of Gdańsk

Evidence shows that coaching as a collaborative relationship based on interactivity through languaging results in transforming client's cognitive patterns. It relies almost entirely on the linguistic factor manifesting itself in a coaching conversation where the coach and the coachee establish a specific relationship whose effects may be said to result from "dynamical, time-bound properties and functional capacities of the co-orchestrated neural and bodily dynamics of persons-in-interaction." (Thibault, 2011a, p. 4). Understood in this way, the coach-coachee dyadic coordinated relationship appears to be a pattern-forming dynamical system in that it exhibits the features of multistability (in Gestalt sense), phase transitions, crises (with more or less noticeable appearance of strange attractors) and intermittency. We assert that coaching as a form of interactivity, i.e. sense-saturated coordination, is entirely based on multi-scalarity of languaging and links formal constraints, cultural processes and the dynamics of persons. The face-to-face non-ritualised embodied activity in which wordings play a part (Cowley 2015) appears to be transformative in many different ways through evoking and prompting the interactants' orientation to wordings. This view helps us form a research question of how the development and cultivation of languaging in dynamical system of coach-coachee dyad contributes to the transformation of client's cognitive patterns. Part of the answer might be in saying that linguistic structures are constraints "which due to their selected controlling role are able to influence existing dynamics" (Rączaszek-Leonardi & Nomikou 2015).

Literature:

Cowley, S. (2015) Verbal patterns: taming cognitive biology. Biosemiotic perspectives on language and linguistics. Velmezova, E., Kull, K. & Cowley, S. (eds.). Springer, p. 123-150.

Thibault, P. (2011). Languaging behaviour as catalytic process: Steps towards a theory of living language (Part I). The Public Journal of Semiotics 3(2): 2-79.

Rączaszek-Leonardi, J., & Nomikou, I. (2015). Beyond mechanistic interaction: value-based constraints on meaning in language. Frontiers in Psychology, 6, 1579. http://doi.org/10.3389/fpsyg.2015.01579.

Theoretical framework for description and modeling of heterogeneous cognitive systems

Łukasz Jonak
lukasz@jonak.info
University of Warsaw

The talk will cover an approach to analyzing heterogeneous cognitive systems currently under development by Julian Zubek, Łukasz Jonak, Joanna Rączaszek-Leonardi and Dariusz Plewczyński. We propose the framework which uses the notion of shared contexts and mutual constraint of degrees of freedom as a common denominator in systems comprising of heterogeneous cognitive agents.

Book review: Peter Stockwell, "Cognitive poetics"

Adrianna Kucińska
adrianna.diana.kucinska@gmail.com
University of Warsaw

How to build a text?

Behavioral Coordination in Mother-Infant Dyads

Giuseppe Leonardi
giuleonardi@gmail.com
Adam Mickiewicz University in Poznań

Mothers and very small infants show signs of behavioral coupling very early in development. We present two examples of such coupling in a sample of mother-infant dyads, using lag dependent recurrence profiles from Cross-Recurrence Quantification Analysis. In the examples gaze and vocalizations of mothers and infants seem to progressively coordinate in modality specific ways. We discuss these results and set the stage for future research with multimodal behavioral streams.

Automatic Movement Extraction from Parent-Infant Interactions

David Lopez

david.lopez@psych.uw.edu.pl

University of Warsaw

The analysis of parent-infant interactions is crucial for understanding early human development. However, coding behavioral data from video recordings is one of the most time-consuming tasks in infancy research, taking up to 10 times the length of a video (Lasecki et al., 2014). To automatize this process, new techniques are being developed to extract relevant information from them, like the detection of movements (e.g. Motion Energy Analysis, MEA, Ramseyer and Tschacher, 2011; or Tracking-Learning-Detection, TLD, Kalat et al., 2010) in real-time or in pre-recorded videos. TLD, specifically, is capable of tracking an object, learning its shape and detecting it frame by frame (Kalat et al., 2010). Here, we applied for the first time TLD in combination with Cross-Recurrent Quantification Analysis (CRQA, Coco and Dale, 2014) in order to investigate the complexity of movement coordination from parent-infant interaction videos. To do that, 21 videos were selected from our database. The mean age of the infants was 149.19 days (SD = 14.56). During the interactions parents were instructed to play with their babies the same way they did at home. Predefined episodes, at least 15 seconds long, were selected from these interactions. In these episodes, parent and infant were oriented face to face while the parent was animating an object. TLD was used to track, first, the infant gaze by following the movement of his/her face and, second, the object which the mother holds in front of the infant during the interaction. TLD returned a set of coordinates for each tracked feature that was translated into categorical time series indicating the direction of movement (e.g. left, up-left, down-left). Lag profiles of recurrence rate were computed using diagonal-wise CRQA and the maximum recurrence was observed at a lag of -240 ms suggesting a parent-leading situation. In other words, the parent moved the object in front of the baby and after 240 ms the infant followed it with gaze. This coupling was not produced accidentally or by random looking at the object, as can be checked through a comparison with randomised baseline profiles of the same time series, a standard procedure in CRQA. To our knowledge, this is the first time that TLD has been used in infancy research. TLD succeeded in tracking the infant gaze and the toy that the parent was manipulating. Furthermore, TLD in combination with CRQA showed a coupling between the gaze and the moving toy, which was not produced by chance or by random looking. This coupling is supported by the idea that infants at that age are able

to follow moving objects using anticipatory head and eye movements (Jonsson and von Hofsten, 2003). Thus, we believe that these techniques can be successfully applied to extract movement dynamics (e.g. gaze dynamics, leg or arm movements of both parent and infant) and to enable efficient analysis of movement features from recorded interactions. These analyses may help to better understand the role of interpersonal co-ordination in early human development.

Sensory Data Aquisition and Analysis for Human Motion Quantification

Michał Meina

michal.meina@gmail.com

Nicolaus Copernicus University in Toruń

Methods of kinematic data acquisition based (mainly) on inertial measurements units will be briefly discussed along with real life examples and potential applications. State-of-the art methods of analysis in such fields like posturograpy or gait variability measurement will be covered and some limitation will be disclosed. Preliminary research for stress detection and gait variability & spatial navigation will be summarized.

Dreams, drugs and ConvNets

Piotr Migdał

pmigdal@gmail.com

deepsense.io

Recent progress in artificial neural networks (especially convolutional and recurrent neural networks) led to artifacts similar to these of human cognition. I will talk about generating abstractions of objects (deep dreams), context-style separation in images (neural style), synesthesia (channel mixing) and McCollough effect (retraining). Moreover, some everyday effects (objects are the same even if shifted or of a different scale) need to be taught to natural and artificial neural networks alike.

Morphological computation (from Pfeiffer to Friston)

Marcin Miłkowski

marcin.milkowski@gmail.com

Institute of Philosophy and Sociology, Polish Academy of Sciences

Proponents of embodied cognition sometimes reject traditional computationalism, while claiming that there is a special place for morphological computation. The purpose of this talk is to analyze what is meant by 'morphological computation' by various authors, from Pfeiffer Paul, Dodig-Crnkovic, Nowakowski, to Friston. In particular, two questions seem particularly interesting: (1) Is there anything special to morphological computation, i.e., why stress morphological computation in contrast to other forms of computation? (2) Is morphological computation, were it special, a form of pancomputationalism? This seems to be particularly problematic for Friston's account of Bayesian inference. My hypothesis is that morphological computation is not special at all, and that a more careful understanding of physical computation shows that it requires physical processing and constraining of physical energy in functioning mechanisms.

On radical embodied cognitive science and strong anticipation

Sławomir Nasuto

s.j.nasuto@reading.ac.uk

University of Reading

Recently Chemero outlined the theory of radical embodied cognitive science (RECS) which is firmly rooted in Gibsonian psycholgy. He contrasts RECS with embodied cognitive science, which he argues is a form of cognitivism in spite of its superficial departure from traditional representations. RECS calls in question any representationalism, instead postulating direct perception resulting from dynamical coupling between agent and its environment.

Yet, in neuroscience, psychology and cognitive neuroscience an increasingly popular framework, predictive brain, proposes that the brain is an active inference engine which uses internal computational models in order to perform an active inference about the state of the world, imperfectly captured by the sensory input stream. Predictive capacity renders distinct advantages to the agent and is typically interpreted in

the context of internal representations which are needed in order to carry the predictive simulations.

I will argue though that RECS is compatible with the forms of dynamics, recently termed strong anticipation, that offer possibility of anticipatory coupling with the environment without necessarily postulating internal computational models or representations. Forward looking has been increasingly recognised as an important and uncontroversial feature of cognition but its importance may extend far beyond merely one of many cognitive characteristics, with some postulating anticipation to be a fundamental dynamical coupling mode between living things and their environments.

Thus, embracing strong anticipation may purchase us an explanatory capacity, which in traditional brain sciences has been accounted for with representational machinery and internal models. After discussing some examples of strong anticipation, the presentation will introduce an experimental platform that may help in elucidating the dynamical processes underpinning strong anticipation.

Taking up an active role in play routines

Alicja Radkowska
alicjaradkowska@gmail.com
University of Warsaw

How infants learn to become participants in social interaction? In social routines children are increasingly taking up an active role. This engagement is a reflection of children getting a grasp on the meaning of the interaction. In this study we consider a special form of recurrent interaction, a widely known play routine of peek-a-boo as a social context in which the development of infants' engagement and coordination is observed.

We filmed 20 Polish mother-infants dyads playing peek-a-boo, when the infants were 2, 3, 4, 6, 8, 10 and 12 months of age. It was assumed that infants who experience more scaffolding in early interactions should be able to take up an active role in the routine earlier than infants experiencing less scaffolding behavior. The scaffolding behavior was operationalized as the slots the mother provides for the infant to take up a role in the activity. Our assumption was that providing more time for the infant to react at key junctures of the activity provides more opportunity for the infant to participate. We analyzed whether the slots provided by

mothers relates to infants' early initiations of play routines i.e. taking up an active role in peek-a-boo. Obtained results suggest a relationship between mothers' structuring of the activity and infants' agency. Mothers' use and duration of "preparation phase" during play as well as use and length of "acknowledgement phase" were positively related with infants' more active and successful participation.

Causality relations: from molecular dynamics to biological signals

Franciszek Rakowski
rakowski@icm.edu.pl
University of Warsaw

I will report in brief one of the methodologies for studying causal relations among time series. The method is called Directed Transfer Function, and it is an extension of the Granger causality method. The discussion on the interpretation of the statistical causal relation will precede, the presentation of the selected results. The method might be applied in various contexts: here in, the two will be described: the molecular dynamics data and EEG signals. At last, the possible extension of the method, for studying the cross-frequency relation will be presented.

Heart-brain interactions in the context of creative thinking and fluid intelligence

Ewa Ratajczak
trufliczka@gmail.com
Nicolaus Copernicus University in Toruń

Gruzelier adapted Campbell's „Blind Variation – Selective Retention" Theory to creativity studies. Taking this approach one step further, creative idea generation may be modeled as a BVSR process within the neural network, represented on the electrophysiological level as complexity of the electroencephalographic signal. Moreover, due to bidirectional heart-brain connections, brain neurodynamics are interrelated with heart rate variability (HRV). Past theories separated creativity from intelligence. However, more recent studies discovered a relationship between creative thinking and fluid intelligence, while attempts at explaining the underlying mechanism point at common executive functions.

Intelligence of the immune system

Edgar Filip Różycki
edgar.filip.rozycki@gmail.com
University of Białystok

Current study investigated performance of 27 young healthy volunteers on Raven's Progressive Matrices test. Following fluid intelligence measurement, the participants underwent EEG and ECG recording upon resting-state and computerized Alternative Uses Task (AUT). Divergent thinking upon AUT was analyzed with respect to fluency and originality. Complexity of the bioelectric signal was analyzed with respect to both EEG and ECG by calculating Higuchi's Fractal dimension and linear and non-linear indices of HRV, respectively. Relationships between physiological and behavioural indices are discussed.

The Precious Complexity: On Becoming Interaction-Dominant

Joanna Rączaszek-Leonardi
joanna.leonardi@gmail.com
University of Warsaw

Why are we here? What are we looking for? Where are we going? What is most important?

Book review: Daniel J. Siegel, "The Developing Mind, Second Edition: How Relationships and the Brain Interact to Shape Who We Are"

Wojciech Sak
wojciech.r.sak@gmail.com
Nicolaus Copernicus University in Toruń

This book provides complex system theory approach to psychology and gives some bold ascertainments about how to use these approach to gain personal (or rather interpersonal) well-being. It also gives interesting definition of mind and holistic vision of interpersonal neurobiology. Because of that I think it fits in the subject of the conference.

The secrets of Munc18 interactions in neurotransmitter release

Ewa Sitarska

ewczee@gmail.com

University of Warsaw

The ability of neurons to communicate with one another via neurotransmitters is absolutely crucial for brain function. Neurotransmitter release is a very well controlled process that involves several steps. This sophisticated machinery consists of many proteins that often have homologues in most types of intracellular membrane traffic. The key players are the SNARE proteins (Syntaxin, Synaptobrevin, SNAP-25), Munc18, Munc13, Synaptotagmin, NSF-SNAP and Complexins. It was thought that the starting point for neurotransmitter release is the syntaxin-SNAP-25 complex, but recent data suggest an alternative model. Two X-ray structures of Vps33 (Munc18 homologue) bound to two SNAREs homologues were reported. When superimposed, the two SNAREs seemed to lay in the correct orientation and register as in the SNARE complex, suggesting that Vps33 and its homologues may act as templates for generating partially zipped SNARE assembly intermediates. The well described interactions of Munc18 are those with syntaxin and the SNARE complex, but not with synaptobrevin. If Munc18 acts as a template for SNARE complex formation, interactions with both syntaxin and synaptobrevin should be crucial. In this study different Munc18 mutants were designed to perturb interactions with synapobrevin. Using Nuclear Magnetic Resonance spectroscopy, we identified a mutation that weakens the Munc18-synaptobrevin interaction, another that strengthens it and another that has no effect. Importantly, these results correlated very well with the effects of the Munc18 mutations in membrane fusion reconstitutions experiments. These results strongly support the notion that Munc18, Vps33 and their homologues function as templates to mediate SNARE complex assembly.

Interactions analysis in the wine study

Magdalena Stępień, Michał Denkiewicz

stepien_m@wp.pl,m.denkiewicz@cent.uw.edu.pl

University of Warsaw

We present a subset of results from a study on the impact of language-based coordination on the recognition and description of complex sensory stimuli. In our experiment the participants were to sample three distinct red wines in order to recognize them later, from a larger set of wines. The participants worked either in pairs or solo – in this presentation we focus on the former case. Communication between partners in a pair was free and unstructured, and the contents of the conversations were recorded. In one group, participants described each wine using a provided sommelier card – a short form containing dimensions pertaining to various qualities of wine's taste and smell. Those dimensions constituted cultural grounding, as they come from professional sommelier knowledge.

Various measures of communication quantity and quality – such as type to token ratio or common vocabulary – were obtained. Categories were assigned to words and phrases, indicating their function. We found that consistency in language pertaining to wine description – both temporal and interpersonal – correlated with performance, but only when the card was absent. Additionally, the sommelier cards themselves induced a more concise and consistent vocabulary. The recognition performance for both groups was similar, with slightly (ns) higher median scores and lower variance for the card group. This shows, that the card facilitates the discovery and focus on task-relevant dimensions and descriptions, whichotherwise would not always emerge. Our study provides an interesting outlook on the role of language constraints in communication.

Book review: Carl Zimmer, "Sophisticated Parasites: How they control the minds of their hosts and survive immune system onslaught"

Piotr Szczęsny

piotr.m.szczesny@gmail.com

Nicolaus Copernicus University in Toruń

Book review of Carl Zimmer – Parasite Rex: Inside the Bizarre World of Nature's Most Dangerous Creatures, with emphasis on chapters concerning immunlogy and mind-altering capabilities of parasites.

From free will to quantification: The challenges of investigating natural language-use

Sebastian Wallot

sebastian.wallot@googlemail.com>

Max Planck Institute

Research on reading is one of the biggest areas of psychological research, basic and applied. Most well developed models of reading seem to assume that reading is fundamentally related to objective text features (sub-lexical, lexical, and/or syntactic), and that the fundamental semantics of language exist at the word-level, with in turn are fixed properties of individual words. I want to problematize these assumptions: First, I propose that such a conception of language is logically inconsistent. In effect, it leads to a meaningless language and, secondly, is hence incompatible with science and a scientific description of language. Second, basic fluctuations of reading performance observed in reaction times and eye-movements suggest that reading behavior is not readily reducible to/explainable by a relatively limited set of linguistic concepts, further suggesting that the current stability-assumptions of theories of reading are not adequate. Rather, reading seems to be a kind of language-use – not a perception-reaction relationship, and needs to be treated as a more complex language phenomenon. I will sketch out a few thoughts on possible conceptual revisions and routes to conduct empirical research of reading that are more in line with such complexity

---

Book review: Robin Dunbar, "How Many Friends Does One Person Need?"

Marzena Wójtowicz
marzenawojtowicz@interia.pl
The John Paul II Catholic University of Lublin

Book review: Robin Dunbar, "How Many Friends Does One Person Need?"

How confident are you? Individual differences in volitional abilities are associated with confidence judgements

Wojciech Zajkowski
traumatictiltexperience@gmail.com
SWPS University of Social Sciences and Humanities

People differ in terms of volitional abilities. People who have trouble flexibly enacting and adjusting their intentions are referred to as state oriented. Even though many studies have shown that state oriented persons have deficits in cognitive control, little work has been done to show how they fare in decision paradigms and whether volitional deficits translate to impairments related to decision making.

Here we studied two groups of participants – action and state oriented, in three perceptual decision tasks. In all the tasks participants also responded how confident they are in their current decision. We modelled decisional processes using Drift Diffusion Model – a model that enables the extraction of meaningful decisional variables, such as response caution, speed of information accumulation or choice bias. Our preliminary results show that all else being equal, state oriented individuals had significantly lower confidence scores in the most difficult condition. This indicates that even though simple perceptual decision making is unaffected, state and action oriented people differ in post-decisional processing.

In this talk I will discuss potential interpretations of this finding and its relation to volitional theory. I will focus on how to test the exact mechanisms of post-decisional processing: is it driven by a confirmation bias or an unbiased process, and the role of observed individual differences. I will also address how does post-decisional processing in perceptual tasks relate to other types of choices, such as preference or value-based decisions.

Ecological context of categorization

Julian Zubek
zubekj@gmail.com
University of Warsaw

Categorization is a process of recognizing object as belonging to a certain category. It seems to be an indispensable part of many cognitive processes. Through the years various models of categorization were proposed, such as classical Aristotelian categories based on formal definitions, prototype models storing only information on central tendency or exemplar models memorizing all encountered objects. A significant portion of the conducted research focused on fitting the models to experimental data in order to find out which categorization strategy is used by humans. This led to a long-lasting and still not fully resolved debate between proponents of prototypes and exemplars.

Recent research suggests that incorporating ecological perspective may inform the debate on categorization models. Categorization is always performed within some context and remains goal-oriented. Successful categorization is necessary for good orientation in one's surroundings, which is evolutionary desirable. Different categorization strategies are optimal in different circumstances. It is reasonable to expect that specific organisms will use strategies optimized for the structure of their environment and the task at hand. Indeed, some research indicates that humans are able to choose their categorization strategy depending on the context. Instead of performing experiments on artificial sets of stimuli, it is possible to investigate the optimality of different models in ecologically relevant tasks, and check which kinds of tasks are prevalent. This would allow to build a fuller picture of categorization.

Scientific discourse itself is a kind of ecological niche in which certain strategies are preferable. Within science we strive to provide strict definitions for all terms, even though this strategy is considered insufficient to cope with the richness of everyday language. I postulate that this preference for formal definitions is due to the tools used by science: formal logic and mathematical models. Representing concepts formally allow to use these tools effectively. With new computational methods becoming available, allowing to analyze multi-dimensional data in an algorithmic, nonparametric fashion, this situation is prone to change: is is possible to perform quantitative research without enforcing rigid definitions. I illustrate this perspective with examples.