



# **The Social Brain in the 21st Century**

From Lonely Minds to Broken Hearts

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- **Social Neuroscience Lab, Institute of Psychology, Polish Academy of Sciences**
- **Institute of Psychology, Polish Academy of Sciences**
- **Polish Academy of Sciences**
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- **Agnieszka Pluta**, Faculty of Psychology, University of Warsaw, Warsaw, Poland
- **Anna Zająkowska**, Institute of Psychology, Maria Grzegorzewska University, Warsaw, Poland

SATURDAY, 11.06.2022	
<b>9.00 - 9.20</b>	Opening Remarks, Prof Łukasz Okruszek
<b>9.20 - 10.20</b>	Opening Lecture: Build Back Fairer, Sir Prof Michael Marmot (virtual)
<b>10.20 - 10.40</b>	Coffee break
<b>10.40 - 11.40</b>	Keynote Lecture: Social Connection: An underappreciated determinant of health, Prof Julianne Holt-Lunstad
<b>11.40 - 12.00</b>	Coffee break
<b>12.00 - 13.00</b>	Session 1
	Prof Joanna Rajchert
	Małgorzata Krawczyk
	Szymon Mąka
<b>13.00 - 13.20</b>	Flash talks
	Monika Malon
	Łucja Doradzińska
<b>13.20 - 14.00</b>	Lunch
<b>14.00 - 14.40</b>	Poster session
<b>14.40 - 15.40</b>	Keynote Lecture: The Role of the Vagus in the Social Brain: A Neurovisceral Integration Perspective, Prof Julian Thayer

<b>15.40 - 16.00</b>	Coffee break
<b>16.00 - 17.00</b>	Session 2
	Prof Magdalena Kozela
	Aleksandra Piejka
	Anna Schudy
<b>17.00</b>	Dinner

SUNDAY, 12.06.2022	
<b>10.00 - 11.20</b>	Session 3
	Livia Tomova, PhD
	Marcelina Wiśniewska
	Marta Chrustowicz
<b>11.20 - 11.40</b>	Coffee break
<b>11.40 - 12.40</b>	Lecture: From lonely minds to broken hearts?, Prof Łukasz Okruszek
<b>12.40 - 13.40</b>	Lunch
<b>14.00 - 14.40</b>	Keynote Lecture: Synthesising Research on Loneliness for Policy Makers, Prof Pamela Qualter, (virtual)
<b>14.40 - 15.00</b>	Coffee break
<b>15.00 - 15.20</b>	Flash Talks
	Jakub Wojciechowski

	Agata Koziol
<b>15.20 - 16.20</b>	Session 4
	Agnieszka Pluta, PhD
	Prof Aleksandra Herman
	Prof Michał Bola
<b>16.20</b>	Poster awards ceremony & closing remarks

SATURDAY, 11.06.2022

## Session 1

### **Hostility bias or sadness bias in excluded individuals: Does anodal transcranial direct current stimulation of right VLPFC vs left DLPFC have a mitigating effect?**

Prof Joanna Rajchert, Institute of Psychology, Maria Grzegorzewska University

Exclusion has multiple adverse effects on individual's well-being. It induces anger and hostile cognitions leading to aggressive behavior. The aim of this study was to test whether exclusion would affect recognition of anger on ambivalent faces of the excluders. We hypothesized that exclusion would elicit more anger encoding (hostility bias) than inclusion, but this effect would be mitigated by anodal tDCS of right VLPFC or left DLPFC – regions engaged in negative affect regulation. Participants (N = 96) were recognizing emotions (anger, sadness, happiness) on ambiguous faces of individuals who – as they were told – liked them or not. Results showed that exclusion induced more sadness bias. tDCS to VLPFC decreased anger and increased sadness recognition on excluders' faces comparing to includers faces expressing a mixture of these two emotions. Additionally, stimulation to VLPFC and DLPFC decreased latencies for faces expressing sadness (sad-angry and happy-sad), but increased for happy-angry faces. Stimulation to VLPFC also increased reaction time to excluders faces while stimulation of DLPFC decreased reaction latency to includers faces. Results were discussed with the reference to the form of exclusion, motivational mechanism affected by disliking but also to lateralization (valence vs. arousal theory) and cortical regions engaged in encoding sadness after a threat to belonging.

### **How cognitive modeling can aid research in loneliness**

Szymon Mąka, Social Neuroscience Lab, Institute of Psychology, Polish Academy of Sciences, Warsaw, Poland

It has been hypothesized that lonely individuals demonstrate hypervigilance toward social threats. However, existing measures of vigilance show an inconclusive pattern of results, possibly due to the fact that observable behavior e.g. mean response, is the result of combined effect of multiple latent factors. Computational modeling provides the means necessary to dissociate observable data into relevant components of cognitive mechanisms. We applied the drift diffusion model to data collected from a sample of 25 lonely and 26 non-lonely participants who performed Dot Probe Task. We did not find evidence that lonely participants are hypervigilant. However the lonely group presented decreased drift rate and increased variability in drift rate between trials, which suggest reduced evidence accumulation efficiency perceptual decision-making in lonely compared to non-lonely individuals.

## Flash talks

### **How mental well-being and social cohesion changed over the first year of COVID-19 pandemic in Poland? Cross-sectional and longitudinal investigation.**

Monika Malon, Social Neuroscience Lab, Institute of Psychology, Polish Academy of Sciences; Faculty of Psychology, University of Warsaw

COVID-19 pandemic, similarly to previous global crises, caused tremendous negative changes in social cohesion. As multiple studies have shown that factors like social cohesion and inequality level may affect well-being, the current study was aimed at examining the association between social cohesion and mental well-being (MWB) during the first year of COVID-19 pandemic in Poland. An online survey was conducted during the first month of pandemic state in Poland. A follow-up study was performed a year later. A cross-sectional (n=510) and longitudinal (n=95) analyses allowed to trace changes and interconnections between three social cohesion markers (interpersonal trust, institutional trust, perceived inequalities) and MWB examined by General Health Questionnaire (GHQ-30). The interpersonal trust and perceived inequalities in access to healthcare were identified as significant predictors of MWB. The longitudinal results indicated that institutional trust has significantly deteriorated throughout the follow-up period, however no changes were found in interpersonal trust and perceived inequalities. Moreover, a cross-lagged effect between MWB and interpersonal trust was found - worse MWB at the onset of pandemic predicted lower levels of interpersonal trust at the follow-up. These findings emphasize the importance of social cohesion as a protective factor mitigating adverse effects of crises on citizens' MWB.

### **Awareness, attention, and threats - exploring the limits of unconscious fear reaction**

Łucja Doradzińska, Laboratory of Brain Imaging, Nencki Institute of Experimental Biology of Polish Academy of Sciences, Warsaw, Poland

The ability to quickly and effectively react in the face of danger is crucial for survival. Therefore, it has been proposed that a reaction to threatening stimuli is initiated already on the unconscious stage of perception. However, it is not known whether fear-related stimuli can benefit from unconscious attentional prioritization. In the present study we investigated the ability of invisible signals of threat to selectively capture attention and engage cognitive processing. Participants (N = 42) were presented with images of faces expressing either fear or a neutral emotional state. Faces were arranged in pairs and displayed for 16 ms. In half of the trials visibility of face images was suppressed by a backward mask. EEG signal was recorded during the procedure and event related potentials (ERP) were analyzed to track the neural response to face stimuli across processing stages. We found that unconsciously perceived fearful faces modulated amplitude of the face-specific N170 component, but did not affect ERP markers of attentional prioritization (P2, N2 components), selective attention capture (N2pc), attention engagement (SPCN), or higher order cognitive processing (P3). Thus, our results demonstrate that while signals of threat can be encoded outside of awareness, they do not capture or engage attention unconsciously.

## Poster session

### **How planning social interaction might look like in the brain**

Olgierd Borowiecki, Nicolaus Copernicus University, Toruń, Poland

Background: Each organism lives in its unique environment filled with specific to this organism affordances (Gibson, 2014). Homo sapiens have individualised its environment further in processes described by 4E cognitive sciences. Some of the memory systems identified in the brain have representational format (Constant et al., 2021), i.e. require having a mental model of a structure of a task when planning an optimal path (Dolan and Dayan, 2013). Planning is thus understood as a carefully characterised, distinct cognitive activity (akin to design) (Goel and Grafman, 1995). Such planning, when involving social interactions presumably recycles brain areas computing representational format (Tavares et al., 2015).

Methods: Literature focusing on brain correlates of reinforcement learning (Computational Neuroscience) and theoretical insights related to planning (Clinical Psychology) is reviewed.

Results: Neuroscientific literature reveals a sophisticated mechanism of representing the egocentric and allocentric space in the basal ganglia and in the hippocampus, respectively (Geerts et al., 2020). The hippocampus activity in animal model is involved, among different things, in representing a position in space of the self and conspecifics (Omer et al., 2018). Space computed in the hippocampus is operationalised as cognitive maps and cognitive graphs (Peer et al., 2021). In theory, this allows for neural recycling of brain structures involved in computing allocentric frame of reference into representing an n-dimensional vector space of mutually interacting agents (Bellmund et al., 2018) (supplementary video).

Conclusion: Planning social interactions involve creating a representation of agents and possible causal consequences of their mutual interactions. It is concluded that these processes partly overlap with neural correlates of the allocentric (Model-Based) planning. Obviously, not every social interaction is preplanned. Therefore, psychopathic and narcissistic traits are expected to be positively correlated with an activity of brain areas computing representational format, during the tasks involving social interactions.

### **Resting-State Functional Correlates of Social Cognition**

Ruben Alexandre Castro<sup>1</sup>, Karolina Golec<sup>1</sup>, Agnieszka Pluta<sup>1</sup>, Tomasz Wolak<sup>2</sup>

1 - Faculty of Psychology, University of Warsaw, Warsaw, Poland

2 - World Hearing Center, Institute of Physiology and Pathology of Hearing, Bioimaging Research Center, Kajetany, Poland

There is plenty of literature on the insights that functional magnetic resonance imaging (fMRI) can bring in regards to social cognition, namely the biological underpinnings of social behaviour and cognitive processing when it comes to navigating social situations. Multiple studies suggest that resting state fMRI (rs-fMRI) and the functional connectivity measured at the so-called resting state (also known as resting state connectivity - RFC) can be a predictor of how the brain performs in social situations and how the information is processed. In our study we employ rs-fMRI to study 60 healthy subjects and analyse whether there is an association between resting state functional connectivity and individual differences in social functioning measured by self-reported questionnaires and more objective measures as A Movie for the Assessment of Social Cognition (MASC).

## **Statistical learning as a basis for intuitive cognition**

Hanna B. Cygan - Institute of Physiology and Pathology of Hearing, Warsaw, Poland

Martyna Bryłka - Institute of Physiology and Pathology of Hearing, Warsaw, Poland

Tomasz Wolak - Institute of Physiology and Pathology of Hearing, Warsaw, Poland

Statistical learning (SL) is the ability to learn from the regularities in the environment. This mode of learning is believed to underlie intuitive actions. The neural mechanism of SL involve structures in the basal ganglia and frontal lobes of the brain. Subcortical structures are responsible for the unconscious statistical learning and frontal areas transfer it into a conscious set of behaviors and the control of action based on "intuitive" statistical knowledge.

## **Shared book reading in the service of grammar comprehension: Relations between parental input and grammar comprehension in deaf children with cochlear implants in comparison to their peers with typical hearing**

Katarzyna Gajos (1), Magdalena Krysztofiak (1), Tadeusz Dołyk (1), Karolina Golec (1), Joanna Wysocka (1), Agnieszka Pluta (1)(2)

(1) Faculty of Psychology, University of Warsaw, Warsaw, Poland

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Past research has reported that deaf children with cochlear implants (CIs) who are raised by parents communicating in spoken language may show difficulties in grammar comprehension. One of the factors that may contribute to the child's grammar comprehension is parental input. Specifically, shared book reading may provide considerable linguistic experience. However, hearing parents often report difficulty engaging their deaf children with CIs in successful shared book reading. The aim of this study is to investigate parents' extratextual talk during book reading with their preschool-aged deaf children with CIs in relation to children's grammar comprehension and in comparison to their peers with typical hearing (TH). So far 38 deaf children with CIs and 52 children with TH aged from 2;9 to 7;10 years took part in the study and more data is expected to be collected. This poster will present initial results of the study. We hypothesize that parents' inferential open- and close-ended questions or statements will be significantly related to children's grammar comprehension. Moreover, we hypothesize that there will be contingencies between mothers' utterances and children's responses. This study may help us to gain a better understanding of the ways of supporting language development in young children with CIs.

This work was supported by NCN [2017/25/B/HS6/01624]

## **Does the social brain differentiate the representations of others' beliefs and intentions? FMRI study.**

Karolina Golec<sup>1</sup>, Agnieszka Pluta<sup>1</sup>, Jakub Wojciechowski<sup>2,3</sup>, Łukasz Okruszek<sup>4</sup>, Maciej Haman<sup>1</sup>, Joanna Wysocka<sup>1</sup>, Tomasz Wolak<sup>2</sup>

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Neurocognitive basis of the Theory of Mind (ToM) as the key ability from the scope of social cognition still remains underexplored. In the current study we aimed to inform the ongoing debate concerning functional architecture of the dedicated ToM network by investigating the representational content of its key nodes.

To this end we examined if the structure of social information in these regions depends on the form of mental state inference. Using both classic mass-univariate whole-brain and multivariate representational similarity analyses of the fMRI data we explored the activity patterns associated with 5 well-recognised ToM tasks engaging social-cognitive processes of varying degrees of complexity which shall induce either belief-reasoning or action understanding. Despite different perceptual properties of the stimuli within a category, we expected to observe distinct representations of others' mental states originating from belief-reasoning and action understanding, also within the "core" of the ToM network.

We demonstrate that the left temporo-parietal junction and the left inferior frontal gyrus represent others' mental states differentially depending on what is the complexity of the source social cues inducing the processes of forming such representations. Our results might indicate that the "core" of the ToM network is functionally heterogeneous and probably hierarchically organized.

### **Neural activity related to verbal False Belief Task performance in preschoolers: fNIRS study**

Joanna Wysocka (University of Warsaw), Karolina Golec (University of Warsaw), Maciej Haman (University of Warsaw), Agnieszka Pluta (University of Warsaw), Tomasz Wolak (Bioimaging Research Center, Institute of Physiology and Pathology of Hearing)

Theory of mind (ToM), defined as the ability to attribute mental states to others, is typically measured by false-belief tasks (FBT). In the verbal version of FBT, subjects are asked to give an explicit answer regarding the agent's belief. The evidence on the neurocognitive basis of ToM in the period of its intensive development (between 3 and 5 years of age) is limited. The vast majority of previous neuroimaging studies on ToM were performed with adults and school-aged children, who have already mastered FBT performance. The main objective of our study was to correlate behavioral results obtained in verbal FBT with brain activity measured by functional near-infrared spectroscopy (fNIRS) in 60 children (age range 3-5). The preliminary results revealed a belief-specific pattern of activation in ToM network structures, comparable to the one observed in adults. The cross-condition (false belief, true belief, no belief) comparison will be presented as well as the activation observed in FBT passers and non-passers.

### **Novel Approaches to Study Hostile Attributions in Depression**

Adrianna Jakubowska (Institute of Psychology, Maria Grzegorzewska University), Katarzyna Czajkowska-Lukasiewicz

In order to investigate factors that maintain depressive symptoms, growing body of studies examine cognitive biases in people with depression. Recently hostile attribution (HA), a tendency to interpret

others' behaviours as intentional and blameworthy, has gained more attention. The most used method to examine HA are vignettes describing ambiguous social encounters. Although the reliability of the tool has been confirmed, its translation into everyday life is questionable. Inconsistencies in findings using that tool prompt us to use additional methods and include physiological measures such as electroencephalography (EEG) or eye-tracking to gain more behaviour insight. Therefore we present a multi-method assessment of HA in depression; Hostile Expectancy Violation Paradigm, Blame Update and Morphed Faces. Additionally we show the initial results of the study (N = 1241) on hostile attribution and depression using morphed faces. Utilizing eye-tracking and EEG method permit us to deepen the understanding of the relationship between HA and depression. The use of multi approaches in investigating HA can be further incorporated into psychotherapeutic treatments in depression.

### **The relation of motor development and overflow: a quantitative study using wearable sensors**

Agata Alicja Koziół, BA Cognitive Science, UW

David López Pérez; Institute of Psychology Polish Academy of Sciences Warsaw, Poland

Zuzanna Laudańska; Institute of Psychology Polish Academy of Sciences Warsaw, Poland

Anna Malinowska-Korczak; Institute of Psychology Polish Academy of Sciences Warsaw, Poland

Karolina Babis; Institute of Psychology Polish Academy of Sciences Warsaw, Poland

Przemysław Tomalski; Institute of Psychology Polish Academy of Sciences Warsaw, Poland

In developmental psychology, infant motor abilities are an unjustly neglected topic (Rosenbaum, 2005). However, infants display a diversified range of skills and it is becoming accepted that motor development does not depend solely on neural maturation, but also on socio-cultural factors, environmental conditions, and the complexity of the motor challenges (Adolph & Hoch, 2019). Early in life infants exhibit motor overflow, which can be defined as the generation of involuntary movements accompanying purposeful actions (Addamo et al., 2007). Research has shown that the frequency and amount of motor overflow in typically developing infants decreases with age (Lazarus & Whitall, 1999), however, the relation with the maturity of the motor system is not fully understood. Here, we present the results of a quantitative movement study exploring motor overflow in 4-months-old infants. To this end, we used wearable sensors to measure infant movements during a babygym task designed to capture overflow during purposeful reaches. Infants' motor abilities were assessed using Alberta Infant Motor Scale and related to overflow dynamic measures. This is the first study quantifying motor overflow using wearable data. The results are discussed in relation to environmental and social influences.

### **Hostile attribution bias and HRV in lonely individuals**

Marcin Lewandowski (Faculty of Psychology, University of Warsaw, Warsaw, Poland); Monika Malon (Faculty of Psychology, University of Warsaw, Warsaw, Poland)

Neurovisceral integration theory posits that resting-state heart rate variability (HRV) is a marker of an organism's flexibility and adaptability. In the context of social cognition, it has been proposed that low HRV is related to deficits in emotion recognition and emotion regulation abilities. This poster presents exploratory findings regarding the association between hostile attribution bias (HAB), which is defined as increased tendency to perceive others' actions and intentions as hostile and threatening, and

HRV in lonely individuals. HAB may be proposed as a mechanism which serve as a mediator between reduced vagal tone and loneliness. HRV indexed by RMSSD was measured in a group of lonely (n=22) and non-lonely (n=23) subjects. Subjects completed AIHQ and DACOBS questionnaires measuring HAB. Preliminary findings discovered a larger magnitude for the relationship between HAB and resting HRV in the group of lonely individuals ( $r=-0.2$ ), compared to non-lonely ( $r=0.05$ ) individuals. However neither of the effects was statistically significant given the current sample size. The results are placed within the context of generally lower levels of HRV and higher proneness to information processing biases (sensitivity to threat, hostile intentions attribution) in lonely populations.

### **Psychedelics use predicts more positive emotional reactivity and greater self-awareness: the mediating role of ego dissolution and mystical experiences**

Paweł Orłowski, Jan Szczypiński, Michał Bola - Nencki Institute of Experimental Biology

Psychedelics are able to acutely alter emotional reactivity and self-consciousness. However, whether regular, naturalistic use of psychedelics can be linked to more persistent, trait-level changes in these domains remains an open question. Aim of the present study was to test three hypotheses: i) psychedelics use is related to more positive emotional reactivity; ii) psychedelics use is related to enhanced inward-focused self-consciousness and diminished outward-focused self-consciousness; iii) these relations are mediated by the intensity of past ego-dissolution and mystical experiences. Data from 2,516 participants (1,661 psychedelics users) were collected via an online survey. The survey included questions about the history of psychoactive substance use, questionnaires measuring trait-levels of emotional reactivity and self-consciousness, and questionnaires for retrospective assessment of ego-dissolution and mystical experiences. A higher number of lifetime psychedelic experiences predicted greater positive and lower negative emotional reactivity. In the domain of self, it predicted greater reflection and internal self-awareness, and reduced rumination tendency and public self-consciousness. Finally, intensity of past mystical and ego-dissolution experiences mediated almost all observed relationships. Lifetime psychedelics use predicts an adaptive pattern of trait-level emotional reactivity and self-consciousness. The past ego-dissolution and mystical experiences are essential in understanding the long-lasting psychological effects of psychedelics use.

### **Could a change in attitudes towards discomfort increase behavioral and emotional regulation?**

Maria Redmerska, Weronika Furman - University of Warsaw

A number of theories point to the idea that developing skills for dealing with negative emotions could be an essential tool for promoting growth and strengthening well-being. Among others, according to cognitive dissonance theory the need to escape negative experiences of psychological distress may have detrimental consequences, such as making irrational decisions, avoiding challenges or deciding to act immorally. Growth mindset theory defines fixed attitude and growth attitude to one's performance. The former is characteristic of people who ascribe their results to stable characteristics, and the latter of people who interpret their results as a function of how much effort they put in. Some evidence shows that growth mindset people don't internalize their mistakes, are less afraid of challenges and more willing to learn from failure. Drawing from those concepts a psychological intervention in the form of a mobile application has been put forward. The application will try to normalize the negative feelings of discomfort and help the users accept it as possibly leading to

positive outcomes. It'll be further investigated if such change in conceptualizing discomfort will connect to increased abilities to regulate one's own behavior and to cope with negative emotions.

### **Social cognition and Functioning in Huntington's Disease**

Miriam Schaepers (University of Cambridge), Sarah L. Mason (University of Cambridge)/ Roger A. Barker (University of Cambridge)

Impaired social functioning greatly impacts quality of life and independence of individuals with Huntington's disease (HD). Previous research suggests a very early deterioration of social cognition in HD, potentially preceding the onset of motor symptoms. This body of research relies on few and simplistic tasks of social cognition providing little insight of clinical relevance. The current project aims to bridge this gap by employing more ecologically valid tasks of social cognition and relating those to in-depth measures of social functioning. Pre-manifest and manifest HD gene carriers as well as controls are invited to complete a variety of cognitive assessments and questionnaires during two visits. The aim is to answer the following questions (i) Are there differences in social cognition /functioning between the different participant groups? (ii) What is the relationship between these more ecologically valid assessments of social cognition and the tasks traditionally used? (iii) How is social cognitive performance related to social functioning? (iv) How is social cognition/functioning related to loneliness? Loneliness was chosen as a measure as we hypothesize that a lack of insight might reduce patient's ability to identify problems of social functioning, but loneliness could be a potential symptom resulting from those underlying issues.

### **Social perception and attitudes towards people with autism - the importance of the frequency of contact and emotions experienced during this contact**

Tkacz, N. (Faculty of Psychology, University of Warsaw), Banasiak, A. (Wydział Nauk Społecznych Uniwersytetu Humanistyczno-Przyrodniczego w Częstochowie), Mikołajewska, J. (Faculty of Psychology, University of Warsaw), Danielewicz, D. (Zakład Psychologii Klinicznej Dzieci i Młodzieży, Akademia Pedagogiki Specjalnej im. Marii Grzegorzewskiej w Warszawie), Pisula, E. (Faculty of Psychology, University of Warsaw)

According to Allport's Intergroup Contact Hypothesis, contact between majority and minority groups members and the emotions experienced during this contact (...) can reduce prejudice and improve intergroup relations. This study investigated how the frequency of contact and the emotions experienced during this contact affect social perceptions and attitudes towards people with autism spectrum disorders (ASD).

Participants (N = 898, mainly students) varied in the frequency of contact with people on the autism spectrum. They completed the Multidimensional Attitudes Towards People with Disabilities Scale (Findler et al., 2007), the Social Attitudes Towards Autism Scale (Flood et al., 2012), and the Perceived Warmth and Competence Scale (Fiske et al., 2002).

Significant correlations were found between (1) frequency of contact and perceived warmth and social attitudes, (2) emotions experienced in contact, perceived warmth and competence, and social attitudes. Groups with different frequencies of contact with people with ASD differed in their perceptions of warmth and social attitudes towards people on the autism spectrum. The study results may help to better understand the social situation of people on the autism spectrum.

## **Reaction to threat-associated social stimuli and its relation to loneliness - an eye-tracking study.**

Joanna Wąsowicz, Cognitive Science student, University of Warsaw

It has been hypothesized that perceived loneliness and social isolation have an impact on social stimuli processing. Many studies have shown hypervigilance for social threat in lonely participants. To further investigate the relationship between loneliness, social anxiety and social attention, we conducted an eye-tracking study. During the experiment participants performed a simple comparison task. It consisted of three types of trials - displaying pictures of fearful human faces, angry faces and circular shapes. Participants were asked to select a picture, shown in a bottom row, identical to the picture shown in the top row with the use of the appropriate key. Level of perceived loneliness as well as anxiety were measured with the use of numerous questionnaires, including the Revised UCLA Loneliness scale (R-UCLA) and the Liebowitz Social Anxiety Scale (LSAS). The results have shown a different pattern of change in pupil diameter in relation to Faces and Shapes stimuli. However, there was no difference in the pattern between the reaction to angry and fearful faces. No difference was found neither in length nor number of fixations between Faces and Shapes stimuli. Further research is required to explore the implications of these findings.

### **Eye-tracking measures of loneliness**

Krzysztof Żaboklicki - University of Warsaw  
Łukasz Okruszek - Polish Academy of Sciences,  
Marta Chrustowicz - Polish Academy of Sciences,  
Szymon Mąka - Polish Academy of Sciences,

Loneliness is a feeling that the quantity or the quality of one's social relationships does not match one's social needs. Evidence coming from numerous studies suggests that loneliness is associated with hyper-vigilance to social threat. Lonely people have visual attention biases and they are prone to negatively misjudge social stimuli. Additionally, having less complex social networks is linked to reduced cognitive control. An eye-tracking study was conducted to further investigate connections between loneliness, attention to social stimuli and social cognitive skills. One hundred participants (mean age = 25.69; SD = 4.64; 19–35 years in age; F = 62; M = 38) completed cognitive reappraisal task while being presented with scenes from Social Perception and Interaction Database (SoPID). Revised UCLA Loneliness scale (RUCLA) questionnaire as well as several other questionnaires measuring social anxiety and the depressive symptoms were completed by all of them. Pupil dilation, was used as a measure of attention and cognitive load during the SoPID viewing. A negative correlation between RUCLA score and pupil dilation during cognitive reappraisal task was found, which gives further support to the thesis that lonely people have reduced cognitive control.

### **Social interaction matters: Human behavior and cognition beyond the individual**

Bolis, Dimitris 1,2; Ciaunica, Anna 1,3; Schilbach, Leonhard 2,4,5

1 Centre for Philosophy of Science, Faculty of Science, University of Lisbon, Campo Grande, 1749-016 2 Lisbon, Portugal

2 Max Planck Institute of Psychiatry, Munich, Germany

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5 Department of General Psychiatry 2, LVR-Klinikum Düsseldorf, Düsseldorf, Germany

Do the dynamics of real-time social interactions, in and of themselves, shape our behavior and cognition beyond our awareness? Or merely believing we interact is enough to induce analogous processes? These questions are part of a hot debate cutting across various fields, from neuroscience to philosophy. However contradictory the arguments may have been so far; they are all largely grounded in strong hypothetical assumptions. To operationalize and put to the test the questions at hand empirically, here, we deploy ‘two-person psychophysiology’, as an empirical framework which aims at measuring and analyzing the multiscale dynamics of social interaction. More concretely, in our experiments, participants sit ‘face-to-face’, working on perceptual decision-making tasks, while being able to interact via gaze through a micro-camera communication system; either in real time (online) or offline, i.e. ‘interacting’ with a replayed recording of the other. In brief, our results demonstrate that real-time social interaction does indeed matter. Interacting humans align with each other more than when merely reacting to others as observers, across multiple levels of description, from interpersonal gaze behavior and decision making to individual metacognition. These findings, we argue, open up new avenues on how to go about not only conceptualizing and operationalizing human behavior and cognition beyond the individual, but also psychopathology and psychiatric disorders, here thought of as interpersonal misattunement and disorders of social interaction respectively.

## Session 2

### **Psychosocial determinants of incidence and mortality from cardiovascular disease – Central European Perspective**

Prof Magdalena Kozela, Department of Epidemiology and Population Studies, Institute of Public Health, Faculty of Health Sciences, Jagiellonian University Medical College, Kraków, Poland

Cardiovascular disease is the main cause of mortality in Poland, accounting for nearly half of all deaths in Poland. Despite the decreasing trend observed since the beginning of the 90s, the cardiovascular disease mortality rates in Poland remain almost twice as high as in Western Europe.

To this day, despite efforts, the effectiveness of prevention (control of main risk factors: hypercholesterolemia, hypertension, smoking, obesity) has remained much below expectations and burden of cardiovascular disease cannot be substantially reduced. The search for other determinants that may affect the incidence of cardiovascular disease has led to psychosocial factors. In case of countries of Central European region it seems even more justified as the reversal of the mortality trend coincided with profound social changes during the transition.

The presentation will concentrate on the results from the studies conducted on random population samples from Central and Eastern Europe aiming at assessment of the relations between depressive symptoms, perceived control over life and other psychosocial factors with cardiovascular disease incidence and mortality. Possible implications will be discussed.

## **Lonely Heart in the Wild. Real-life behavioral and physiological correlates of loneliness.**

Aleksandra Piejka, Social Neuroscience Lab, Institute of Psychology, Polish Academy of Sciences, Warsaw, Poland

Due to its association with increased cardiovascular risk, a lot of focus has been put on examining physiological mechanisms underlying loneliness. It was shown that heart rate variability (HRV) may serve as an index of reduced parasympathetic regulation and threat perception. While initial evidence for the associations between loneliness, reduced HRV, and increased social threat has been previously demonstrated, most of the findings come from laboratory studies. Thus, the current study examined the relationship link between real-life HRV markers and appraisals of everyday social encounters in lonely (LI) and non-lonely individuals (NLI). One-hundred and five participants completed a week-long experience sampling study. During each prompt participants were asked about their feelings, characteristics of a current activity and company, and appraisals of their current situation. Participants' physiological activity was captured with Empatica E4 wearable device. LI experienced more negative and less positive affect, and declared less positive and more stressful and threatening appraisals of both being accompanied by other people and being alone. Moreover, we observed decreased HRV levels in LI. Interestingly, we also found an interaction effect between group and HRV in the presence of strangers - while HRV was positively related to the company of unknown people in the NLI group, the relationship was negative in the LI. The presented findings corroborate the notion that loneliness can affect real-life physiological functioning and appraisals of daily activities.

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### Session 3

#### **Neural markers of social information processing and associated parasympathetic response in relation to loneliness**

Marcelina Wiśniewska, Social Neuroscience Lab, Institute of Psychology, Polish Academy of Sciences, Warsaw, Poland

Loneliness has been linked to altered patterns of neural activity during the processing of social stimuli, as well as to reduced parasympathetic regulation, measured by changes in heart rate variability (HRV). Study 1 aimed to test effects of a short-term loneliness induction on neural activity during social information processing and the associated parasympathetic response. Study 2 compared neural activity during social information processing in lonely and non-lonely individuals. In the first study (N=59, 29F; 24.37y ± 4.25) participants were randomly assigned feedback concerning their future social relationships to induce either loneliness (Future Alone group, FA; n=29) or feelings of belonging (Future Belong group, FB; n=30). Next, they were presented with positively and negatively valenced pictures with social or non-social content (Social-Nonsocial Affective Task, SNAT) while their neural and cardiac response was measured with functional magnetic resonance imaging (fMRI) and photoplethysmography. In Study 2, ninety-four adults (N=94, 47F; 24y ± 4.28) who either had a low (L; n=48) or high (H; n=46) loneliness score underwent a fMRI session including SNAT. In the Study 1, a significant effect of the loneliness induction on the parasympathetic response was found, with a decrease in HRV between baseline and SNAT observed only in the FB group. The comparison of neural activity measured while watching social when compared to non-social scenes revealed no significant between-group differences in Study 1, nor in Study 2. These results suggest that even a brief induction of loneliness has an impact on physiological response to social stimuli, whereas patterns of activations among the social brain observed in the previous studies were not replicated.

#### **Effects of Loneliness on Behavioral and Neurophysiological Response to Social Affective Stimuli**

Marta Chrustowicz, Social Neuroscience Lab, Institute of Psychology, Polish Academy of Sciences, Warsaw, Poland

Connecting the evolutionary theory of loneliness and event-related potential technique we conducted two studies that examined the association between loneliness and explicit assessments and implicit neural responses to social affective stimuli.

The results of the first study (N = 51; lonely individuals = 26, non-lonely individuals = 25) indicate that lonely individuals declare lower arousal ratings of affective stimuli compared to non-lonely individuals. However, the mass univariate analysis of the electroencephalographic activity during task, revealed increased activity indicated higher differences between the social negative and neutral stimuli in lonely than in non-lonely individuals. In the second study, based on the results from a sample of 100 young adults (full spectrum of UCLA-R), it has been observed that negative pictures are more arousing and more negative than neutral, independent of stimulus social type. Similarly, higher LPP amplitudes have been observed in social stimuli than nonsocial ones, and negative ones than neutral ones, and in the consequences, the most exciting are social negative ones. However, no significant association between behavioral or neurophysiological variables of interest and loneliness

was observed. This inconsistent pattern of findings stress out the importance of taking into account the sample power and design (loneliness as categorical vs continuous variable) in loneliness research.

## Lecture

### **From Lonely Minds to Broken Hearts**

Prof Łukasz Okruszek, Social Neuroscience Lab, Institute of Psychology, Polish Academy of Sciences, Warsaw, Poland

Loneliness has been increasingly recognized as a major societal and public health problem. It has been shown that loneliness has similar impact on mortality rates as well known health risk factors. At the same time, little is known about precise physiological mechanisms through which loneliness may negatively impact the health outcomes. Loneliness is believed to elicit specific cognitive mechanisms, which can lead to increased vigilance for social threats and reduced ability to adopt other's perspective, due to the increased focus on one's own needs. These mechanisms may be linked to structural and functional abnormalities which may be observed in lonely individuals in key brain structures that are involved in the processing of social information. In addition, several studies suggested that decreased level of heart rate variability, which may serve as an indicator of the ability to regulate activity in response to unknown and potentially threatening stimuli that appear in the environment, may be observed in lonely individuals. During the last three years, we have completed a series of studies which have examined cognitive, physiological and neural mechanisms underlying the impact of loneliness on bottom-up and top-down mechanisms associated with social information processing. The lecture will present the main findings of the studies and try to answer the question whether lonely individuals see social snakes.

## Flash Talks

### **Behavioral and Functional Alterations in Conditioning and Extinction in Compulsive Sexual Behavior Disorder**

Jakub Wojciechowski, Laboratory of Emotions Neurobiology, Nencki Institute of Experimental Biology, Warsaw, Poland; Institute of Physiology and Pathology of Hearing, Kajetany, Poland

The prevalence of problematic pornography use (PPU) in both adults and adolescents is increasing however there is no consensus whether it is strictly compulsive or addictive behavior. The latest ICD-11 finally included PPU under Compulsive Sexual Behavior Disorder (CSBD) unit, however the conditioning process among those patients seems to be altered, similar to addiction. Our study focused on the Ventral Striatum (VS) and Amygdala, which are parts of the reward system, and their activation during appetitive instrumental conditioning and extinction in tasks with both erotic and monetary rewards in functional magnetic resonance imaging (fMRI).

Age-matched CSBD patients and healthy control subjects (n=32 in each group) participated in the study. In addition to measuring fMRI brain activity and reaction times in tasks, subjects also rated their arousal and valence toward cues before and after conditioning. Statistical analysis of reaction times, arousal and valence and ROI were conducted using 3-way ANOVA: (2) Group (CSBD vs control) \* (3) Condition (erotic vs monetary vs neutral) \* (2) Task Phase (early vs late).

Preliminary results suggest that conditioning and extinction processes are indeed altered in CSBD patients on both behavioral and functional level, although in a puzzling way. Supported by NCN Grant 2016/21/N/HS6/02635.

### **The relation of motor development and overflow: a quantitative study using wearable sensors**

Agata Koziół, University of Warsaw, Faculty of Psychology

In developmental psychology, infant motor abilities are an unjustly neglected topic (Rosenbaum, 2005). However, infants display a diversified range of skills and it is becoming accepted that motor development does not depend solely on neural maturation, but also on socio-cultural factors, environmental conditions, and the complexity of the motor challenges (Adolph & Hoch, 2019). Early in life infants exhibit motor overflow, which can be defined as the generation of involuntary movements accompanying purposeful actions (Addamo et al., 2007). Research has shown that the frequency and amount of motor overflow in typically developing infants decreases with age (Lazarus & Whitall, 1999), however, the relation with the maturity of the motor system is not fully understood.

Here, we present the results of a quantitative movement study exploring motor overflow in 4-months-old infants. To this end, we used wearable sensors to measure infant movements during a babygym task designed to capture overflow during purposeful reaches. Infants' motor abilities were assessed using Alberta Infant Motor Scale and related to overflow dynamic measures. This is the first study quantifying motor overflow using wearable data. The results are discussed in relation to environmental and social influences.

## Session 4

### **Does Hate Speech Deteriorate Empathy? The Effects of Exposure to Derogatory Language on Neuro-cognitive Correlates of Ability to Attribute Mental States.**

Agnieszka Pluta, PhD, Faculty of Psychology, University of Warsaw, Warsaw, Poland

The widespread ubiquity of hate speech affects people's attitudes and behavior. Exposure to hate speech can lead to prejudice, dehumanization, and lack of empathy towards members of outgroups. However, the impact of exposure to hate speech on empathy and propensity to attribute mental states to others has never been directly tested empirically. In this fMRI study, we examine the effects of exposure to hate speech on neural mechanisms of empathy towards ingroup (Poles) versus outgroup members (Arabs). Thirty healthy young adults were randomly assigned to 2 groups: hateful and neutral. During the fMRI study, they were initially exposed to hateful or neutral comments and subsequently to narratives depicting Poles and Arabs in pain. Using whole-brain and Region of Interest analysis, we showed that exposure to derogatory language about migrants attenuates the brain response to someone else's pain in the right temporal parietal junction (rTPJ), irrespective of group membership (Poles or Arabs). Given that rTPJ is associated with processes relevant to perspective-taking, its reduced activity might be related to a decreased propensity to take the psychological perspective of others. This finding suggests that hate speech affects human functioning beyond intergroup relations.

## **Studying complex phenomena-related emotions using an embodied approach.**

Prof Aleksandra Herman, Laboratory of Brain Imaging, Nencki Institute of Experimental Biology of the Polish Academy of Sciences, Warsaw, Poland

Bodily sensations are one of the major building blocks of emotional experience. However, people differ in their ability to recognise and name their emotions, especially those in response to complex phenomena such as climate change or the COVID-19 pandemic. Therefore, we investigated whether we can use the bodily sensation maps (BSMs) approach to study emotions related to phenomena that are likely to evoke various, and perhaps even conflicting, emotions in people. Using a unique topographical self-report method - the emBODY tool, 548 participants marked where in the body they feel sensations (activations and deactivations) when they experience distinct emotions (e.g. happiness) and when they think about different phenomena, namely climate change, COVID-19 pandemic, war, nature, friends, and summer holidays. We revealed maps of bodily sensations associated with different emotions and phenomena. Importantly, each phenomenon was related to a statistically unique BSM, suggesting that participants were able to perform the task well and differentiated between feelings associated with distinct phenomena. For example, while both COVID-19 and climate change were related to strong activations in the head, chest, and abdomen, the COVID-19 map also showed strong deactivations in the legs, while the climate change map showed activations in the hands. Yet, we also found that BSMs of phenomena showed some similarity with maps of emotions. Together, these findings indicate that the emBODY tool might be useful in uncovering the range of emotions individuals experience towards complex phenomena.

## **Is naturalistic use of psychedelics related to emotional reactivity and self-consciousness?**

Prof Michał Bola, Laboratory of Brain Imaging, Nencki Institute of Experimental Biology of Polish Academy of Sciences, Warsaw, Poland

Psychedelics (gr. *psyche*—soul, mind; *delos*—to reveal, manifest) are psychoactive substances able to profoundly change the state of consciousness. Both subjective reports of users and results of laboratory studies suggest that psychedelics are able to acutely alter emotional reactivity and self-consciousness. In an ongoing research project we aim to address whether the regular naturalistic use of psychedelics can be linked to more persistent trait-level effects in both domains. The first stage of the project was a cross-sectional online survey study, in which data of 2516 participants (1661 psychedelics users) were collected, including basic demographic information, questions about the history of psychoactive substance use, and questionnaires measuring trait levels of emotional reactivity and self-consciousness. The next stage involves laboratory experiments in which reactivity to emotional and self-related stimuli is measured with EEG or fMRI in the matched subsamples of users and non-users. In my talk I will present results of the already published questionnaire study (Orłowski et al., 2022, *J Psychopharm*) and discuss preliminary results of the neuroimaging work.