New Findings in Education: Primary Data Entry in Shaping Intentionality and Cognition.

Igor Val Danilov[1] and Sandra Mihailova[2],
[1]Academic Consortium Academic Center for Coherent Intelligence, Italy
[2]Rīga Stradiņš University RSU, Riga, Latvia
igor_val.danilov@acci.center

IGOR VAL DANILOV,
CHAIR OF THE PDE SPECIAL TRACK

Igor Val Danilov is a cognitive scientist who studies the essence and modalities of social interaction from the viewpoint of physics, developing academic research of the education environment. In specific, he applies expertise and experience to develop e-learning curriculum and study contactless brain-computer interfaces. Igor Val Danilov is an academician at the Academy Angelica Constantine of Rome, member of Cognitive Science Society, research physicist. Igor Val Danilov and Ass Prof. Dr. Sandra Mihailova currently conduct research on the effect of coherent intelligence at the Riga Stradins University (Latvia). Igor Val Danilov is the researcher at the academic consortium "Academic Center for Coherent Intelligence." His previous job was the director of the research department and director of operation Eastern Europe and India of Marconi International University.

CURRENT PROJECTS

We applies expertise and experience to develop e-learning curriculum and study contactless brain-computer interfaces. In specific, Igor Val Danilov and Ass Prof. Dr. Sandra Mihailova currently conduct research on the effect of coherent intelligence at the Riga Stradins University (Latvia) to develop understanding of shared intentionality. This approach promotes developing:

(i) advanced e-learning curriculum for 2- to 3-year children with ASD and GDD;

(ii) contactless brain-computer interfaces in a wide range of applications of the brain-computer intelligence field.

INTRODUCTION

The academic knowledge on the study of mind historically and conceptually has settled three main approaches within cognitive science: cognitivism, connectionism, and embodied dynamicism [1].

1

THE GROUNDS OF THE PDE PROBLEM IN 3 STEPS:

PDE: After birth, an organism meets with reality, which is transcendental, staying beyond any experience and understanding of this pure reason. How can a neonate acquire social knowledge without any previous experience and communication?

Many theories of mind combine all three approaches, where they co-exist in various hybrid forms. The more interesting of them are the Embodied dynamic system [1], the theory of innate intersubjectiivity and innate foundations of neonatal imitation [2], the theory of natural pedagogy [3], and the theory of sensitivities and expectations [4]. All these theories are plausible; the current paper observes different views to engage their gap in knowledge on Primary Data Entry– where does social knowledge come from?

INTRODUCTION

According to embodied cognitivists, the mind is an autonomous system by its self-organizing and self-controlling dynamics, which does not have inputs and outputs in the usual sense, and determines the cognitive domain in which it operates [1] [6][7]. This approach is grounded on the dynamical hypothesis [8].

2

The embodied dynamic system approach tends to solve the above-noted gap by introducing the notion of dynamically embodied information [1]. Although, to introduce this concept, it is necessary to explain the categorization of reality through intentionality.

Why does the dynamic system (embodied cognition) need PDE:

Argument A. According this approach embodied features of cognition deeply depend upon characteristics of the physical body. If the agent's beyond-the-brain body plays a significant causal role, then the primary data yet makes sense.

Argument B. In mathematics, a dynamic systems model is a set of evolution equations. It means that entering primary data is required. The dynamic system may not begin its life cycle without introducing initial conditions corresponding to specific situation inputs and parameters.

Argument C. The dynamical system hypothesis [8] have not claimed the lack of initial conditions. Dynamicists track primary data less than dynamic changes inside. However, it does not mean that primary data do not exist and do not necessary.

INTRODUCTION

In a multi-stimuli environment, the stimulus-consequence pair is unpredictable due to the many stimuli claiming to be associated with the embodied dynamic information randomly. The bond of stimulus-consequence pair of a social phenomenon in the sensorimotor network requires categorizing reality by the nervous system before applying the innate reflex about this social phenomenon to a specific case.

3

There is no hypothesis about the emergence of intentionality through emotion sharing. Meanwhile, emotional contagion can occur between individuals without their awareness [9][19] [21]; it can happen even without awareness of the emotional stimuli existence [21].

Why is intentionality not supported by the innate mechanism of universal emotional expressions?

Tomasello [13] introduced the beginning of cognition through the emotion sharing. Many researchers, including the authors, believe that the hypothesis about the universality of emotional expressions is formed by limited experimental methods, since other research designs show the opposite outcome [14]-[18]. There is no evidence of a genetic mechanism that can link meaning in mind with certain social reality to apply an appropriate emotional pattern to a specific situation. Even if one assumes that the hypothesis of universal emotional expressions proves innate emotional patterns together with their meanings; even if newborns may alone recognize the basic facial expressions of caregivers and the specific situation to apply them; but in this case, newborns do not have time for such a "training course", because they demonstrate their achievements already in the first hours of life [19].

PROBLEM: HOW DOES SOCIAL INTERACTION ENCOURAGE COGNITION

Brain-to-brain relationships shape the mind during moment-to-moment interactions [22].

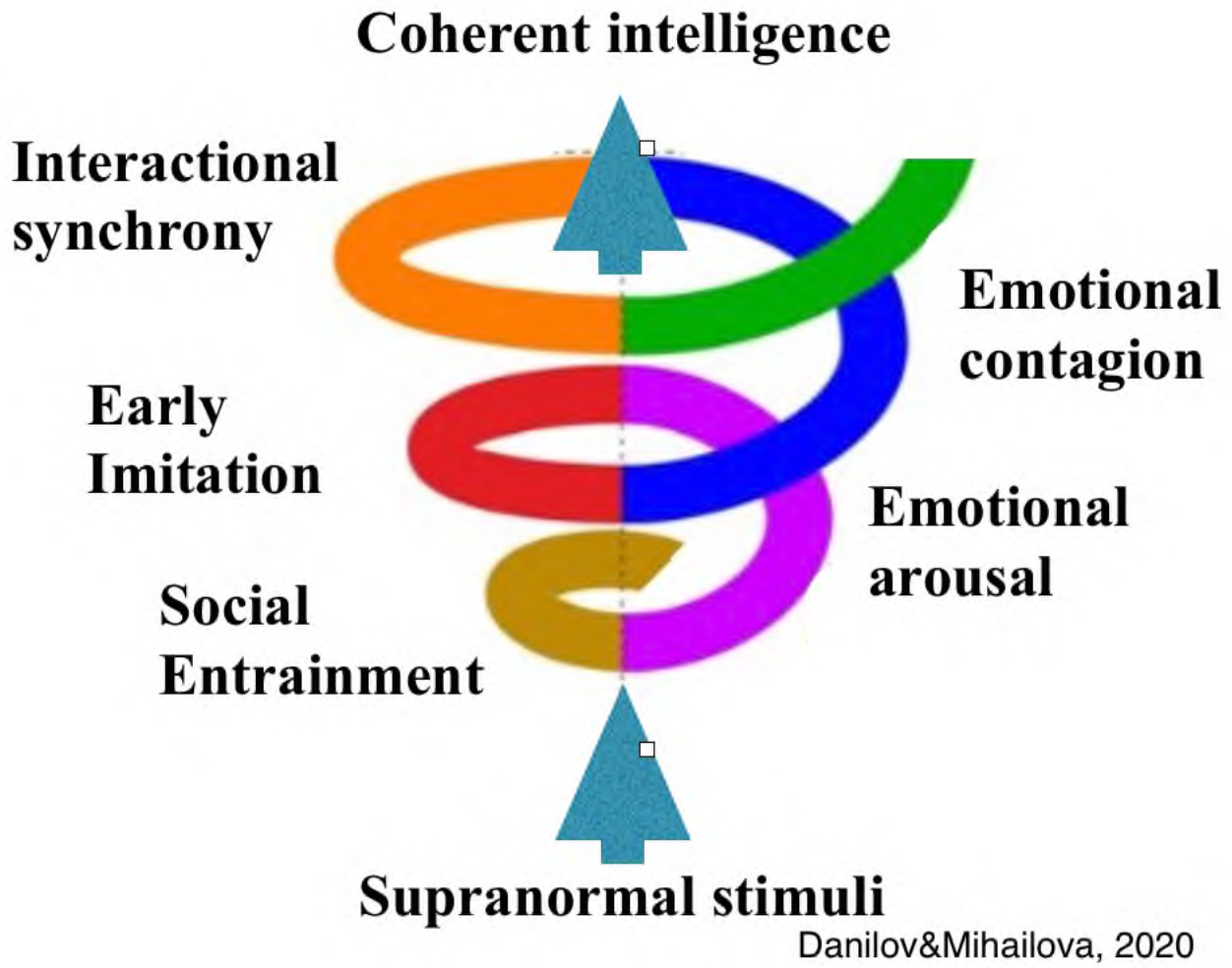
Whether or not social interaction contributes to the increase in results of a group mental activity? Whether or not dyads maintain non-perceptual interaction? What are the neurobiological grounds of intentionality?

According to Valencia and Froese [22], their review of studies based on EEG- and fNIRS hyperscanning shows evidence of inter-brain synchronization, supporting the possibility of extended consciousness.

The near-infrared spectroscopy study (non-hyperscanning) on asleep newborns shows an increase of the neural response to a familiar (English language) versus unfamiliar language (Tagalog, a Filipino language) spoken by strangers in both conditions [28]. We believe that this outcome may mean the implicit modality of newborns' interaction with caregivers since any other explanation of this outcome is excluded.

THE MODEL OF COHERENT INTELLIGENCE

Ongoing social dynamics create a coherent mental process in dyads (primary group) where movement coordination is cyclically enhanced under ever-growing arousal.

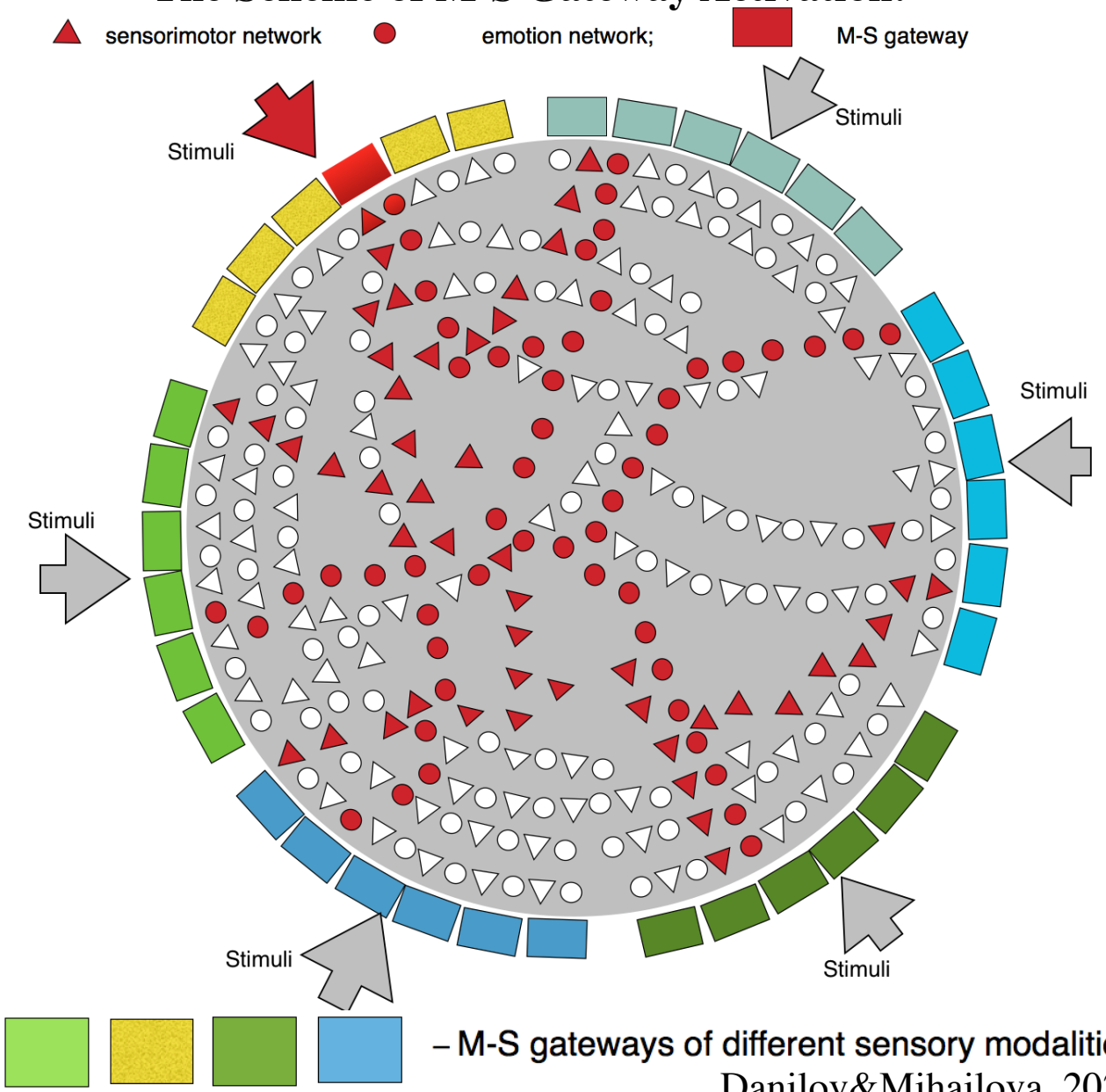


MCI NEURAL FOUNDATION

Depending on different social interaction modalities, the Intention Processing Network is complemented by activation of additional brain areas, reflecting different Modality-Specific (M-S) input gateways. The engaged M-S gateways retain a certain stimulus, while other M-S gateways remain depressed without keeping information of other stimuli.

Even though the ensemble of emotion-motion integrated networks weakly stimulates the intersected neurons in their junction with M-S gateways. If all M-S gateways also simultaneously receive weak stimulation from the receptors (due to the chaos of stimuli received by the pure nervous system), then this multi-signal contributes to LTP in the neurons of particular M-S gateway at the junction of this emotion-motion ensemble due to the effect of the synaptic cooperativity, because of the following. LTP can be induced either by strong tetanic stimulation of a single pathway to a synapse, or cooperatively via the weaker stimulation of many. Neurons from the gateways in the connections of these networks receive cooperative stimulation. Induction of cooperativity can ensure LTP.

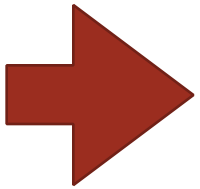
The Scheme of M-S Gateway Activation.



Danilov&Mihailova, 2021

NEURONS LEARN THE CODE TO MODULATE CERTAIN SYNAPTIC STRENGTH

How can neurons of an immature organism (even a newborn) learn the structural organization of excitatory inputs that support STDP?

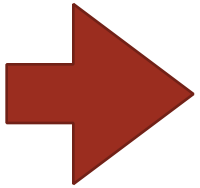


The hypothesis is that the quantum entanglement state of neurons can contribute to training them the code to modulate a certain synaptic strength, e.g., simultaneous LTP in neurons.

The PDE problem in a chaos of stimuli requires a training mechanism in organisms from the very beginning. The entanglement state of neurons is a possible option of how newborns' neurons learn spike-timing-dependent plasticity. In the entanglement state, the behavior of the neurons of a mature organism determines and trains the neurons of a newborn.

CONCLUSIONS

We believe that the MCI shapes intentionality in intimately related individuals. Coherent Intelligence is the integration of M-S gateways of particular brain areas, which contributes to different organisms' sensibility to similar sensory inputs.



The MCI hypothesis promotes research on:

(i) advanced e-learning curriculum, especially for 2- to 3-year children with developmental delay;

(ii) contactless brain-computer interfaces in a wide range of applications of the brain-computer artificial intelligence field.

We believe that this approach is the basis for the further development of an advanced e-learning curriculum and the study of contactless brain- computer interfaces.

REFERENCES:

1. E. Thompson, Mind in Life : biology, phenomenology, and the sciences of mind. The Belknap press of Harvard University press. Cambridge, Massachusetts London, England. 1st Harvard University Press paperback edition. 2010.
2. J. Delafield-Butt and C. Trevarthen, Theories of the development of human communication. 2012. [Online]. Available from: https://strathprints.strath.ac.uk/39831/1/ Delafield_Butt_Trevarthen_2012_Theories_of_the_developm ent_of_human_communication_final_edit_060312.pdf [retrieved: March, 2021].
3. G. Csibra and G. Gergely, "Natural Pedagogy," Trends Cogn. Sci., vol. 13, pp. 148–153, 2009.
4. S. R. Waxman and E. M. Leddon, "Early Word-Learning and Conceptual Development". The Wiley-Blackwell Handbook of Childhood Cognitive Development. 2010. [Online] Available from: https://www.academia.edu/12821552/Early_Word- Learning_and_Conceptual_Development [retrieved: March, 2021].
5. I. Val. Danilov, "Imitation or Early Imitation: Towards the Problem of Primary Data Entry." The Journal of Higher Education Theory and Practice (JHETP). In press.
6. F. J. Varela, Principles of Biological Autonomy. ISBN-10:0135009502, ISBN-13:978-0135009505. 1979.
7. F. J. Varela and P. Bourgine, "Towards a practice of autonomous systems. In Towards a Practice of Autonomous Systems." The first European conference on Artificial Life, ed. F. J. Varela and P. Bourgine, pp. xi–xviii. Cambridge: MIT Press. 1992.
8. T. Van Gelder, "The dynamical hypothesis in cognitive science." Behavioral and Brain Sciences, vol. 21 (5), pp.615-628. 1998. DOI: 10.1017/s0140525x98001733.
9. I. Val. Danilov and S. Mihailova, "Knowledge Sharing through Social Interaction: Towards the Problem of Primary Data Entry." The 11th Eurasian Conference on Language & Social Sciences which is held in Gjakova University, Kosovo. p.226. 2021. [Online] Available from http://eclss.org/publicationsfordoi/ abst11act8boo8k2021a.pdf. [retrieved: March, 2021].
10. J. Delafield-Butt and C. Trevarthen, Development of human consciousness. 2016. [Online]. Available from: https:// strathprints.strath.ac.uk/id/eprint/57845. [retrieved: March, 2021].
11. J. R. Searle, W. S. Slusser, and M. Slusser, Intentionality: An Essay in the Philosophy of Mind. Cambridge University Press. 1983.
12. T. Crane, "Intentionalism." The Oxford Handbook to the Philosophy of Mind. Oxford: Oxford University Press. pp. 474–493. 2009.
13. M. Tomasello, Becoming human: A theory of ontogeny. Belknap Press of Harvard University Press. 2019. https:// doi.org/10.4159/9780674988651.
14. R. E. Jack, "Culture and facial expressions of emotion". Visual Cognition vol. 21, pp. 1248–1286, 2013, https://doi.org/ 10.1080/13506285.2013.8353.
15. C. Crivelli and M. Gendron, In e Science of Facial Expression (eds José-Miguel Fernández-Dols & James A. Russell) Oxford University Press, 2017.
16. L. F. Barrett, R. Adolphs, S. Marsella, A. Martinez, and S. Pollak, "Emotional Expressions Reconsidered: Challenges to Inferring Emotion in Human Facial Movements." Psychological Science in the Public Interest, vol. 20, pp. 1–68. 2019. https:// doi.org/10.1177/1529100619832930.
17. K. Hoemann et al., "Context facilitates performance on a classic cross-cultural emotion perception task". Emotion. (Washington, DC). vol. 19, pp. 1292–1313. 2019.
18. M. Gendron, K. Hoemann, A. N. Crittenden, S. M. Mangola, G. A. Ruark, and L. F. Barret, "Emotion Perception in Hadza Hunter-Gatherers". Scientific reports, vol. 10, pp. 3867 , 2020. https://doi.org/10.1038/s41598-020-60257-2.

REFERENCES:

19.I. Val. Danilov, "Social Interaction in Knowledge Acquisition: Advanced Curriculum. Critical Review of Studies Relevant to Social Behavior of Infants". The Twelfth International Conference on Advanced Cognitive Technologies and Applications COGNITIVE2020. 2020.

20.J. Decety and P. L. Jackson, "The functional architecture of human empathy". Behavioral and Cognitive Neuroscience Reviews, vol. 3, pp. 71-100. 2004.

21.M. Tamietto et al., "Unseen facial and bodily expressions trigger fast emotional reactions". PNAS, vol. 106: pp. 17661-17666, 2009.

22.A. L. Valencia and T. Froese, "What binds us? Inter-brain neural synchronization and its implications for theories of human consciousness". Neuroscience of Consciousness, vol. 6(1), 2020. doi: 10.1093/nc/niaa010.

23.I. Val. Danilov and S. Mihailova, "Emotions in e-Learning: The Review Promotes Advanced Curriculum by Studying Social Interaction". The International Conference on Lifelong Education and Leadership for All (ICLEL). pp.8-17. ERIC Number: ED606507. 2020. [Online] Available from: https://faf348ef-5904-4b29-9cf9-98b675786628.filesusr.com/ugd/d546b1_2d77ecc9e07f4b0fb2cccce23af201f7.pdf. [retrieved: March, 2021].

24.C. Szymanski et al., "Teams on the same wavelength perform better: Inter-brain phase synchronization constitutes a neural substrate for social facilitation". Neuroimage, vol. 15, pp. 425–436, 2017.

25.F. A. Fishburn et al., "Putting our heads together: interpersonal neural synchronization as a biological mechanism for shared intentionality". Soc Cogn Affect Neurosci, vol. 13, pp. 841–849, 2018.

26.Y. Hu et al., "Inter-brain synchrony and cooperation context in interactive decision making". Biol Psychol, vol. 133, pp. 54–62, 2018.

27.L. Astolfi et al., "Neuroelectrical hyperscanning measures simultaneous brain activity in humans". Brain Topogr, vol. 23, pp. 243–256, 2010.

28.L. May, K. Byers-Heinlein, J. Gervain, and J. F. Werker, "Language and the newborn brain: does prenatal language experience shape the neonate neural response to speech?" Front. Psychology, vol. 2, pp. 222, 2011, doi: 10.3389/fpsyg.2011.00222.

29.T. Andrillon and S. Kouider, "The vigilant sleeper: neural mechanisms of sensory (de)coupling during sleep." Current Opinion in Physiology, vol. 15, pp. 47–59, 2020.

30.A. Ibanez, V. Lopez, and C. Cornejo, "ERPs and contextual semantic discrimination: degrees of congruence in wakefulness and sleep." Brain Lang, vol. 98, pp. 264-275, 2006.

31.G. Legendre, T. Andrillon, M. Koroma, and S. Kouider, "Sleepers track informative speech in a multitalker environment." Nat Hum Behav, vol. 3, pp. 274-283, 2019.

32.R. Cox, I. Korjoukov, M. de Boer, and L. M. Talamini, "Sound Asleep: Processing and Retention of Slow Oscillation Phase-Targeted Stimuli." PLoS ONE, vol. 9(7), pp. e101567. 2014, https://doi.org/10.1371/journal.pone.0101567.

33.C. H. Cooley, Social organization: A study of the larger mind , (pp. 23-31). New York, NY: Charles Scribner's Sons, xvii, pp. 426, 1909.

34.I. Val. Danilov, S. Mihailova, and V. Perepjolkina, "Unconscious social interaction, coherent intelligence in learning." The 12th annual conference. ICERI 2019. doi: 10.21125/iceri.2019.0606.

35.M. L. Commons, "The fundamental issues with behavioral development." Behavioral Development Bulletin, vol. 21(1), pp. 1-12, 2016, http://dx.doi.org/10.1037/bdb0000022.

36.S. Oldham, C. Murawski, A. Fornito, G. Youssef, M. Yucel, and V. Lorenzetti, "The anticipation and outcome phases of reward and loss processing: A neuroimaging meta-analysis of the monetary incentive delay task." Human Brain Mapping, vol. 39, pp. 3398-3418, 2018.

37.D. Martinsa et al., "Mapping social reward and punishment processing in the human brain: A voxel-based meta-analysis of neuroimaging findings using the Social Incentive Delay task." 2021, bioRxiv preprint doi: https://doi.org/ 10.1101/2020.05.28.121475.

38.I. Enrici, M. Adenzato, S. Cappa, B. G. Bara, and M. Tettamanti, "Intention Processing in Communication: A Common Brain Network for Language and Gestures." Journal of Cognitive Neuroscience, volume 23, issue 9, pp. 2415-2431, 2011, https://doi.org/10.1162/jocn.2010.21594.

39.M. Tettamanti, M. M. Vaghi, B. G. Bara, S. F. Cappa, I. Enrici, and M. Adenzato, "Effective connectivity gateways to the Theory of Mind network in processing communicative intention." NeuroImage, vol. 155, pp. 169-176, 2017, doi:10.1016/ j.neuroimage.2017.04.050.

REFERENCES:

40. L. Nummenmaa et al., "Emotional speech synchronizes brains across listeners and engages large-scale dynamic brain networks." NeuroImage, vol. 102, pp. 498-509, 2014.

41. M. Bateson et al., "Agitated honeybees exhibit pessimistic cognitive biases." Curr Biol., vol. 21;21(12), pp. 1070-1073, 2011, doi:10.1016/ j.cub.2011.05.017.

42. W. C. Abraham, "How long will long-term potentiation last?". Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences. vol. 358 (1432), pp. 735–744, 2003, doi: 10.1098/rstb.2002.1222.

43. S. Tazerart et al., "A spike-timing-dependent plasticity rule for dendritic spines." Nat Commun vol. 11, pp. 4276, 2020, https://doi.org/10.1038/ s41467-020-17861-7.

44. R. A. Thomas et al., "Entanglement between distant macroscopic mechanical and spin systems." Nat. Phys., 2020, https://doi.org/10.1038/ s41567-020-1031-5.

45. J. Yin et al., "Satellite-based entanglement distribution over 1200 kilometers" [Online] Science: vol. 356, issue 6343, pp. 1140-1144, doi:10.1126/science.aan3211, 2017. [retrieved: March, 2021].

46. C. Marletto, D. M. Coles, T. Farrow, and V. Vedral, "Entanglement between living bacteria and quantized light witnessed by Rabi splitting." Journal of Physics Communications, vol. 2(10). [Online] Available from: http://iopscience.iop.org/article/10.1088/2399-6528/aae224/ meta. [retrieved: March, 2021].

47. M. Sillanpää and S. Hong, "Spooky quantum entanglement goes big in new experiments." [Online] Science News 25 April 2018. Available from: https:// www.sciencenews.org/article/spooky-quantum-entanglement-goes-big-new-experiments. [retrieved: March, 2021].

Igor Val Danilov
Sandra Mihailova
igor_val.danilov@acci.center
Academic Center for Coherent Intelligence
Rīga Stradiņš University (Latvia)