(Un)Consciousness
A Functional Perspective
The Jerusalem Conference on
Conscious and Unconscious Processes
August 25-27, Jerusalem, Israel
Funded by The Jerusalem Brain Community

Organising Committee

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The Jerusalem Brain Community

The Jerusalem Brain Community (JBC) is an organization of researchers, from all disciplines of brain science, at the Hebrew University of Jerusalem. The JBC supports, fosters and promotes all related brain research, from the traditional, neuroscience, to new and innovative areas, such as, cognitive behavioral science, by our faculty and their students. In order to encourage interdisciplinary research, the JBC organizes international conferences, lectures and workshops.

The JBC’s goal, is to support young scholars in the pursuit of expanding, their research, exposure and experiences. To encourage and enhance the scientific careers of young researchers, the JBC offers, scholarships to international and local students. The JBC affords students opportunities to engage in cutting edge research with top researchers in their field, as well as, organize and participate in conferences.

The JBC was founded through the generous support of the Edmond J. Safra Philanthropic Foundation.
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<td>8:45-9:30</td>
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| 9:30-11:00  | **Sid Kouider** - Developing a Reflective Mind: Consciousness, Predictive Coding and Metacognition in the Infant Brain  
**Axel Cleeremans** - The Reach of the Unconscious                                                                                       | **David Soto** - Nonconscious Working Memory                                                                                      |
| 11:00-11:30 | **Coffee Break**                                                                                               |                                                                             |                                                                             |
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| 13:00-15:00 | **Lunch**                                                                                                      |                                                                             |                                                                             |
| 15:00-16:30 | **Keith Payne** - Conscious of What? Relationships Between Implicit Bias and Conscious Experiences  
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| 16:30-18:00 | **Poster Session**                                                                                             |                                                                             |                                                                             |
Developing a Reflective Mind: Consciousness, Predictive Coding and Metacognition in the Infant Brain

**Sid Kouider** Ecole Normale Supérieure - Paris

My talk will focus on whether and how infants 1) experience perceptual consciousness, 2) rely on bayesian inference during perception, and 3) rely on metacognitive sensitivity to track their own behaviors. I will first describe how one can test for perceptual consciousness in infants by relying on neural signatures of consciousness validated in adult populations. Our studies confirm the presence of these neural signatures in 5 to 15 month-old infants, but also show that such mechanisms are much slower than in adults, and accelerate throughout development. Regarding predictive coding, we combined EEG recordings with a cross-modal cueing paradigm and show that, consistent with Bayesian accounts of perception, neural responses for unexpected events are increased in 12 month-olds. However, in infants, this effect of prediction error was observed only during late processing stages and involves the same neural signature as found for perceptual consciousness. Early neural components, by contrast, revealed an amplification for predicted rather than surprising events, suggesting that selective attention enhances perceptual processing for expected events. These results demonstrate that the neural mechanisms underlying the use of predictive signals are already functional in infancy, but follow different dynamics depending on whether expected events are confirmed or instead surprising. Furthermore, they reveal a privileged link between prediction error and consciousness in infants. Regarding metacognition, we demonstrate that infants reflect upon their own (simple) decisions to evaluate their accuracy and adapt subsequent behaviour. We show that after performing a binary choice, 12 and 18-month old infants display appropriate decision confidence by persisting more following correct as compared to incorrect decisions, even though nothing in the external world provides information about their accuracy. Furthermore, we found that an electrophysiological marker of error detection, the Error-Related Negativity, is elicited when 12 month-old infants make an incorrect decision. Hence, although explicit forms of metacognition might mature later during childhood, the mechanisms responsible for metacognitive sensitivity are already functional during the first year of life. I will conclude on perspectives for learning and education.

The Reach of the Unconscious

**Axel Cleeremans** Université Libre de Bruxelles

A great conceptual pendulum oscillates, with a period of about 30 or 40 years, over our understanding of the relationships between conscious and unconscious information processing. Its path delineates the contours of the unconscious mind as well as its contents: Sometimes smart and defining the very fabric of the mind, the unconscious is at other times relegated to taking care of little more than our bodily functions. At this point in time, the pendulum finds itself hovering rather steadily on the side of those who think so many functions are served by the unconscious that they even question the very role that consciousness plays in shaping the human mind.

Here I will suggest that the pendulum has swung a little too far, and illustrate the argument with recent experimental findings that document how challenging it may be to arrive at a satisfactory conception of the relationships between conscious and unconscious information processing. I will focus on three recent studies — one dedicated to perceptual awareness and the other two dedicated to social cognition. All are suggestive that the specific methods we use, as well as the manner in which we interpret the data, are of profound importance with respect to the conclusions we draw about the power of the unconscious.

A few general principles emerge from this skeptical analysis. First, the unconscious is probably overrated today. Second, there is a pervasive and continuing confusion between information processing without awareness and information processing without attention. I suggest that considering how learning and plasticity mechanisms modify conscious contents can reduce this confusion.
Demystifying Conscious Awareness
Leon Deouell Hebrew University
The quest for the neural correlates of consciousness (NCC) has been suggested as a strategy to understand the neurobiological foundation of consciousness while avoiding the ‘hard problem’ or the ‘explanatory gap. However, it was recently suggested by several groups that the empirical search for the NCC confounds the ‘NCC proper’, ‘pure NCC’ or constitutive NCC, which is the actual goal, with processes which are mere prerequisites or consequences of being consciously aware. Furthermore, it was suggested that with careful attention to methodological details, it will be possible to use cognitive neuroscience to distill the NCC proper, devoid of the required prerequisites and consequences. This view is echoing widely in recent literature (Blake et al., 2014; Dehaene et al., 2014; Li et al., 2014; Mashour and Alkire, 2013; Panagiotaropoulos et al., 2014; Pitts et al., 2014; Rey et al., 2014, for just a few examples), becoming sometimes a benchmark for new research (Bachmann, 2013; Macerollo and Quattrocchi, 2014; Miller, 2014). I challenge this claim, and suggest that any result that seems like NCC proper, once carefully examined, will turn out to be (or could be regarded as) either a prerequisite or a consequence. Further, I suggest that if anything such as an NCC proper exists, it can only be recognized on a priori, theoretical grounds, rather than on empirical arguments. Finally, I will argue that charting the full picture of the prerequisites and consequences associated with conscious awareness, and their complexity, is a satisfying goal for a cognitive neuroscience of conscious awareness.

Integrating Semantic Information: The Role of Conscious Awareness
Liad Mudrick Tel-Aviv University
Conscious experiences inherently involve integration; we perceive a barking dog, rather than the sight of a dog and the sound of a bark. But is such integration unique to conscious experiences, or can it also be unconsciously performed? Recent empirical work supports the latter. This is in sharp contrast with the widely held assumption that consciousness is necessary for information integration – especially one that involves the combination of sensory signals from different modalities, or the combination of semantic information related to high-level concepts. In this talk, I will present different types of semantic integration, performed with and without awareness; based on this work I will suggest that consciousness does not serve as an immediate necessary condition for sensory and semantic integration. Rather, it may operate as an enabling factor that establishes mechanisms for future unconscious integration of sensory and semantic information.
Conscious of What?
Relationships between Implicit Bias and Conscious Experiences

Keith Payne  University of North Carolina

Implicit biases are often assumed to be attitudes that people hold but are unaware of. This claim is based mainly on a lack of correspondence between implicit measures and self-reports. Recent research, however, shows that people can accurately report their implicit attitudes, given the right conditions. Are implicit biases conscious after all? I will examine this question from the perspective of metacognitive theories of priming and constructionist theories of emotion. I present evidence that people have some awareness of automatically activated affective reactions which are measured by implicit tests. However, the conscious experience of these states depends on how people interpret their affective responses. The same implicit bias can be experienced as intended or involuntary, one's personal belief or non-personal stereotypes, as fear or as sympathy for group members. This research suggests moving beyond the conscious-unconscious distinction to uncover the processes that lead to different phenomenal experiences of implicit bias.

Just Think:
The Challenges of Deliberative Thought

Tim Wilson  University of Virginia

One of the hallmarks of consciousness is the ability to control one’s thoughts. As far as we know, human beings are the only species who can select a topic and think about it for a prolonged period of time. This ability, however, may not be as well-developed or as easy as is sometimes thought. It may be particularly difficult for people to control their thoughts in a way that is enjoyable and improves their subjective well-being. I will discuss results showing that people find it difficult to entertain themselves with their own thoughts and do not particularly enjoy “just thinking,” especially compared to engaging in everyday external activities. “Just thinking” is more enjoyable, however, if people are given simple thinking aids that reduce the amount of mental control they need to exert.
Nonconscious Working Memory

David Soto Imperial College London

I will present data suggesting that working memory processes are not necessarily linked to conscious states. Non-conscious items (e.g. simple gratings and also complex visuospatial sequences of events) can be committed to working memory and kept online even in the presence of distracters, and later retrieved to drive behaviour. Brain substrates associated with working memory such as the prefrontal cortex appear engaged when non-conscious information has to be maintained for later use in perceptual decision making. Additional data shows that working memory cues can boost awareness of targets during continuos-flash suppression even when the cues are not consciously seen. Finally I will present data that speak about the independence of conscious awareness and other cognitive processes associated with working memory and cognitive control, namely, metacognition.


Ran Hassin Hebrew University

Recently I proposed a framework for thinking about the abilities of the human unconscious. The proposed view – Yes It Can (YIC) – is couched in evolutionary considerations, and in the capacity limitations of conscious processes. Taking these as my point of departure, I proposed that every fundamental, basic level function that can be carried out by conscious processes, can also be carried out by unconscious processes. I will present this view, as well as old, new and very new data, from various sub disciplines of the cognitive sciences. I will then discuss a few common misunderstandings of YIC, and future directions in our journey to understand consciousness and the human unconscious.
Conscious and Nonconscious Processing of Rewards and Effects on Performance

**Henk Aarts** Utrecht University

The question of how human performance can be improved through rewards is a recurrent topic of interest in psychology and neuroscience. Traditional approaches to this topic have focused mainly on consciously communicated rewards. Recently, a new, and largely neuro-cognitive inspired perspective has emerged to examine the role of conscious awareness of reward information in effective reward pursuit. This presentation discussed research employing a monetary reward presentation paradigm that allows a systematic investigation of potential similarities and differences in how consciously and nonconsciously presented rewards are processed and impact performance.

Goals and Consciousness

**Ruud Custers** University College London

Goals are commonly thought to arise through the conscious act of goal-setting. However, if one assumes that goals refer to desired states that can be mentally represented, rendering these representations more accessible (i.e., priming them) may trigger motivational processes associated with goal attainment. In the present talk I will discuss earlier work demonstrating evidence for such effects, suggesting that they are the result of primed goals triggering action preparation as well as evoking reward signals. That is, results suggest that the reward value of, or positive affect associated with, the goal representation motivates effortful instrumental behavior and sustains accessibility of the goal representation. I will present a new line of research in which Continuous Flash Suppression is used to explore whether such sustained accessibility causes goal-related information to reach conscious awareness faster and hence whether primed goals could potentially determine what we become aware of.
Ignitions and Flickers in the Dynamic of Human Perceptual Responses

Rafi Malaach Weizmann Institute

While the possibility of explaining the link between neuronal activity and conscious awareness is debated, substantial progress has been made in the search for underlying principles that may account for the diversity of conscious phenomena. Here I will discuss recent results from our research on visual perception, mainly with intra-cranial recordings in patients conducted for clinical purposes. Our results support a model of local “ignitions” of neuronal activity in high order visual areas. Examining spontaneous and voluntary blinks we demonstrate the “ballistic” nature of such ignitions—i.e. their immunity to brief gaps in the visual input. However, the sustained responses show a striking adaptation which does get interrupted by the reappearance of a conscious percept. Together these results highlight the complex dynamics associated with the neuronal events underlying a conscious percept. They particularly emphasize the importance of positive activations in such process.

Dissociating Conscious Perception and Perception for Action: The Role of Past Sensory Evidence

Dominique Lamy Tel-Aviv University

Recurrent processing is thought to play a critical role in conscious perception. However, several different mechanisms operate through recurrent processing, among them attention, expectations and past sensory experience, and are often conflated. Here, we focus on the role of past sensory experience, while controlling attention and expectations. We show that exposure to clearly visible exemplars of liminal targets as well as inter-trial awareness priming affect conscious perception, assessed using direct measures of perception, both objective (forced-choice discrimination performance) and subjective (Perceptual Awareness Scale). We show that by contrast, the same manipulations do not affect perception for action, assessed by an indirect measure of processing, response priming. We consider the implications of these findings, complemented by other findings from our lab, for current methodologies used to assess unconscious processing and thereby delineate the function of consciousness. Finally, we discuss how our findings can be accommodated by current theories of conscious perception.
Neurobiological Signatures of Natural and Trained Synaesthesia

Anil Seth University of Sussex

Synaesthesia offers a unique window into the neuro-cognitive mechanisms underlying conscious perception. Intriguingly, recent evidence suggests that extensive training can induce synesthesia-like experiences in non-synaesthetic adult volunteers. On the other hand, classical neuroimaging findings of colour-selective responses during natural (grapheme-colour) synaesthesia remain inconsistently reported. Focusing on the specific case of grapheme-colour synaesthesia, I will report a series of studies linking neural responses to phenomenology in both natural and ‘trained’ synaesthesia. For natural synaesthetes, our results show that colour-specific specific brain responses can be predicted by individual differences in synaesthetic phenomenology captured by ‘localisation’ and ‘automaticity’. For trained non-synaesthetes, we find increased cortical excitability and modality-specific perceptual processing following overtraining of grapheme-colour associations. Finally, I will highlight an overlooked property of synaesthesia, which is that synaesthetic concurrents usually lack perceptual presence; that is, they are not experienced as being part of the external world. A new theory based on counterfactual predictive processing suggests why this might be so.

Keepin’ it Raw: Consciousness as an Unselective Medium of Mental Representation

Baruch Eitam Haifa University

In this talk I will argue and present evidence for the insensitivity of visual awareness to task relevance. I will further argue that part of the so called ‘blindness’ effects arise because of the extreme sensitivity of knowledge activation (categorisation; stimulus’ interpretation) to task relevance. The functionality of keeping a ‘raw’ account of the external world, the role of ‘cognitive resources’ in the mix and some methodological implications will also be mentioned.
Unconscious impressions for conscious predictions in the brain

Moshe Bar  Bar-Ilan University

It is argued that the brain is a proactive organ, striving to know what is next. This proclivity for constant predictions creates an interesting paradox: we want to minimize uncertainty with predictions, but we also need to approach novelty and learn so that we can increase the pool of scenarios on which we are able to generate predictions in the future. These two conflicting demands imply different states of mind. There are states when we want to learn, and states when we prefer to exploit the certainty of a predictable environment; our minds sometime seek to maximize gathering of novel information, and in other times it prefers to minimize surprise. This constant tension between exploration and exploitation modes will be illustrated through a discussion of top-down and bottom-up processing, mental simulations, impression formation, and the influence of load. Implications to topics such as creativity and mood will be proposed.

Exploring the Spatiotemporal Dynamics of Functional Networks in the Human Brain Using a Multimodal Approach

Josef Parvizi  Stanford University

Combining intracranial EEG with functional imaging and direct cortical stimulation in individual human subjects make it possible to obtain simultaneous electrophysiological recordings from pre-identified nodes of functional networks in the human brain, and do so with a high anatomical precision and temporal resolution while electrically perturbing the dynamics of activity in the network to test the causal role of, and directionality of information flow within the network. This presentation will present prototype examples of how this multimodal approach can provide novel insights about spatiotemporal dynamics of functional networks in the human brain.


10. Improved Reading Measures in Adults with Dyslexia Following Transcranial Direct Current Stimulation Treatment. Inbahl Heth.


15. Habits - Outcome Gets You Started, Control Keeps You Going. Nafcha Orit and Eitam Baruch, University of Haifa, Israel.


19. Consciousness is Mandatory for Proactive Control, but Not Reactive Control: A Somatosensory Study. Yael Salzer, Alex Gotler & Avishai Henik.


