

ERC « Consciousbrain » Kickoff Workshop

Organised by Claire Sergent on Friday June 16th, Paris

Interactions between consciousness and other domains of cognition

decision-making, prediction, creativity, mind-wandering, emotions...

ABSTRACTS

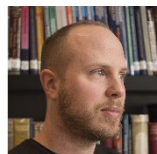


Claire Sergent

Integrative Neuroscience and Cognition Center (INCC), UPC/CNRS, Paris

Introduction

Research on consciousness over the past fifty years seems to outline a distinction between two general processing modes in the wakeful brain, which interact and complement each other: an automatic mode which follows well-established pathways and allows fast and efficient, but stereotyped, computations, and another, less efficient but more flexible mode which departs from the former by the possibility to explore functional routes beyond the most strongly connected pathways. The former seems to be characterized by an absence of conscious access, while the latter seems to be associated with a reportable subjective experience. More recent studies have also started investigating the different ways in which this conscious processing mode can be deployed, notably depending on the current task context or current goals of the individual. While other domains of cognition are often investigated independently of the question of awareness, it seems to be the right time to start exploring how these different modes of processing interact with cognition in general. How does conscious processing impact our decisions? How does it impact predictive coding? What aspects of decision-making are non-conscious? Are there both conscious and non-conscious components in creativity? How does awareness of the external world interact with mind-wandering? How does it impact multisensory integration, time perception, emotions? Can there be unconscious emotions? The objective of this workshop is to bring together experts on consciousness and experts in other domains of cognition to initiate discussions on these interactions.



Valentin Wyart

Département d'études cognitives, Inserm/ENS/PSL University, Paris

Cognitive noise in human learning and decision-making: origin, impact, function

Making sense of uncertain environments, a cognitive process modeled across domains as statistical inference, constitutes a difficult yet ubiquitous challenge for human intelligence. Recent research has identified the limited computational precision of human inferences as a surprisingly large contributor to the variability of perceptual and reward-guided decisions made under uncertainty. In this talk, I will review the theoretical and experimental evidence obtained by my group which, taken together, provides key insights into the origin, impact and function of this cognitive noise for human learning and decision-making. Moving beyond the classical description of internal noise as a performance-limiting constraint for cognitive systems, I will present unpublished findings from recurrent neural networks and large datasets of human participants that delineate the adaptation and the emergent benefits of cognitive noise in response to specific forms of uncertainty.



Frédérique de Vignemont

Institut Jean Nicod, CNRS/ENS/EHESS, Paris

Protective agency: when do we need consciousness?

Pain and fear are often explained in purely motivational terms: we need to have such experiences because they make us act so that we protect ourselves. But do we really need to consciously experience the threat for us to start doing something about it? Why unconscious nociception does not suffice for instance? Animals for whom it is still controversial whether they feel pain still survive. Furthermore, Ledoux has recently argued in favour of the existence of an unconscious defensive circuit that triggers defensive responses. But if all can be done independently of pain or fear, why do we still experience it?



Florent Meyniel

NeuroSpin, CEA/Paris-Saclay University, Gif-sur-Yvette

Confidence during learning: Function, representation, introspection

Natural environments are both stochastic and dynamic. These two aspects should promote opposite components in learning, namely stability, to maintain estimates in the face of stochastic noise, and flexibility, to quickly adapt estimates when the environment changes. In theory, the balance between these two antagonistic features of learning should be regulated by the confidence that accompanies the current estimate. I will show that human learning is confidence-weighted as prescribed by normative theory. I will also review recent work on the neural representations of this confidence, and show that human subjects can introspect and report this confidence level.



Daniel Pressnitzer

Laboratoire des Systèmes Perceptifs, ENS/PSL/CNRS, Paris

Auditory perception, memory, and individual differences

Whether we engage in lively conversation with a friend, instantly recognize a piece of music we last heard years ago, or react in an appropriate manner to the sound of breaking glass, we tend to believe that our sense of hearing effortlessly and truthfully registers the physical events making up the acoustic world. However, nothing could be further from the truth. It has been recognized since at least Helmholtz that sensory information is by nature fragmentary, so determining the exact cause of the waveforms at the ears is an ill-posed problem. Therefore, perception must combine current evidence with prior knowledge to infer acoustic events from sensory information. In this talk, I will review evidence touching upon auditory memory and “unconscious inference” in hearing. A logical but perhaps surprising prediction of such a framework is that there should exist large and often unnoticed individual differences in the conscious perception of sounds. In the spirit of light entertainment, I will illustrate this claim using various auditory illusions.



Virginie van Wassenhove

NeuroSpin, CEA/Paris-Saclay University, Gif-sur-Yvette

Making sense of time (in the brain)

How the brain tells time is fundamental for the individuation, the coincidence, the integration and the ordering of events but also for the feeling that time passes, that things exist for a while (duration) or that we can, at will, mentally travel to our vanished past and our not yet existing future. An epistemological difficulty stands in the way of understanding the status of “time” in neurosciences: temporalities emerge from the perspective of the brain (the generator, actuator, and observer) not from the external observer (the experimenters). Yet how neural circuits code, use, and represent time is largely debated. I will discuss some consequences of incorporating the time dimension in multisensory perception (representational abstraction) and the consciousness of time itself (e.g. cognitive maps).



Thomas Andrillon

Institut du Cerveau et de la Moelle (ICM), CNRS/INSERM/Sorbonne U, Paris

Sleep-like activity in wakefulness and fluctuations of the stream of consciousness

Sleep and wakefulness are not mutually exclusive, all-or-nothing phenomena. Rather, both during sleep and wakefulness, regional brain activity can contrast with the global state of an individual. For example, individuals getting tired can show a pattern of brain activity reminiscent of sleep, here referred as sleep-like slow waves, while still behaviorally and physiologically awake. These sleep-like slow waves have been paired, in animals, with periods of neuronal silencing, which could explain their association with lapses of attention. These slow waves have also been associated with changes in subjective experience as they predict instances of mind wandering or even mind blanking. Here I will present a set of new studies that sought to better characterize these slow waves in wakefulness and their link with fluctuations of consciousness during the day.



Alizée Lopez-Persem

Institut du Cerveau et de la Moelle (ICM), CNRS/INSERM/Sorbonne U, Paris
<https://sites.google.com/view/alizeelopezpersem/>,

The Brain Valuation System: from decision-making to creativity

What drives us to search for creative ideas and why does it feel good to find one? Creativity is an impressive cognitive ability that makes humans a notable species. However, the cognitive and neural mechanisms of creativity are still poorly understood. Formally, it is defined as the ability to produce an object/idea that is both original and adequate to the context. Therefore, creativity should involve an evaluative process of adequacy and originality, interacting with a generative process that generates candidate ideas. Today, a unitary modeling approach is still lacking in the field of creative cognition, and the evaluative process has been poorly explored. In this talk, I aim to shed light on the role of valuation in creativity by presenting findings from three studies. Firstly, I will introduce the Brain Valuation System, which encompasses four properties demonstrated through intra-EEG recordings in humans. In particular, this system automatically assigns subjective value to various types of items. Subsequently, I will present behavioral evidence supporting the involvement of valuation in the creative process. Finally, I will unveil preliminary results from neuroimaging studies (fMRI) that demonstrate the engagement of the Brain Valuation System in creativity. Altogether, these results emphasize the role of preferences in creativity. By investigating the intricate interplay between valuation and creative ideation, we aim to enhance our comprehension of the cognitive processes underlying human creativity.

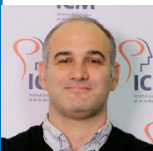


Jérôme Sackur

Laboratoire de sciences cognitives et psycholinguistique (LSCP), CNRS/ENS/EHESS/PSL, Paris

New directions in the study of the stream of consciousness

Studying consciousness at a "meso" time scale (10 ~ 30 seconds) poses difficult theoretical and empirical challenges. First I will present some evidence for the significance of this particular duration concerning the continuous flow of conscious experience. Then, I will present two avenues of exploration, one still promising, the other an interesting failure.



Jacobo Sitt

Institut du Cerveau et de la Moelle (ICM), CNRS/INSERM/Sorbonne U, Paris

Brain patterns dynamics characterizing states and contents of consciousness

Consciousness is central to subjective human experience and a key pillar of human society. It traverses our healthy daily experiences but also defines most of neuropsychiatric diseases. Uncovering the neural mechanisms that allow subjective experience is a major challenge of neuroscience. This topic becomes critically important in the clinics when it comes to disorders of consciousness patients (DOC).

Recently, my team and others have demonstrated the existence of dynamically recurrent brain patterns that characterize the state of consciousness. Using human and non-human primate fMRI data, we have shown that brain dynamics is predominated by brain patterns characterized by long-range functional communication and anti-correlation between areas in conscious subjects. In contrast, the predominant brain patterns in unconscious subjects are associated with sparse and low inter-areal communication.

Today, I will briefly show two new exciting results demonstrating that the described brain patterns not only define the state of consciousness but even more they also determine the dynamics of the contents of consciousness. In the first study, we analysed fMRI during movie watching and rest. Our analyses revealed that certain brain connectivity states were predominantly manifested in the movie condition, while others were mainly present in the non-movie conditions. Furthermore, we hypothesized that functional connectivity dynamics would be similar across participants during movie watching when brain activity is driven by the same narrative. As expected, we found a higher synchronization across participants during movie watching compared to resting state and scrambled movie conditions.

In the second study, we went beyond this correlation and assessed the functional role of these brain states in forming conscious experiences by altering the capacity to process external information. Participants underwent simultaneous fMRI and EEG recordings while performing an auditory detection task, with stimuli presented either at the detection threshold, sub-threshold, or supra-threshold in a randomized fashion.

We hypothesized that participants would have higher detection rates for threshold stimuli presented during the occurrence of a high-state. As expected, we found a significant increase in detection rates only for threshold stimuli when participants were exhibiting a high-state. Our results underline the importance of these complex brain states for conscious access and conscious states. In the future, targeting these moments of high-connectivity states in DoC patients could help us detect windows of higher permeability to the external world and pave the way for individualized patient-care protocols.



Isma Zmerli

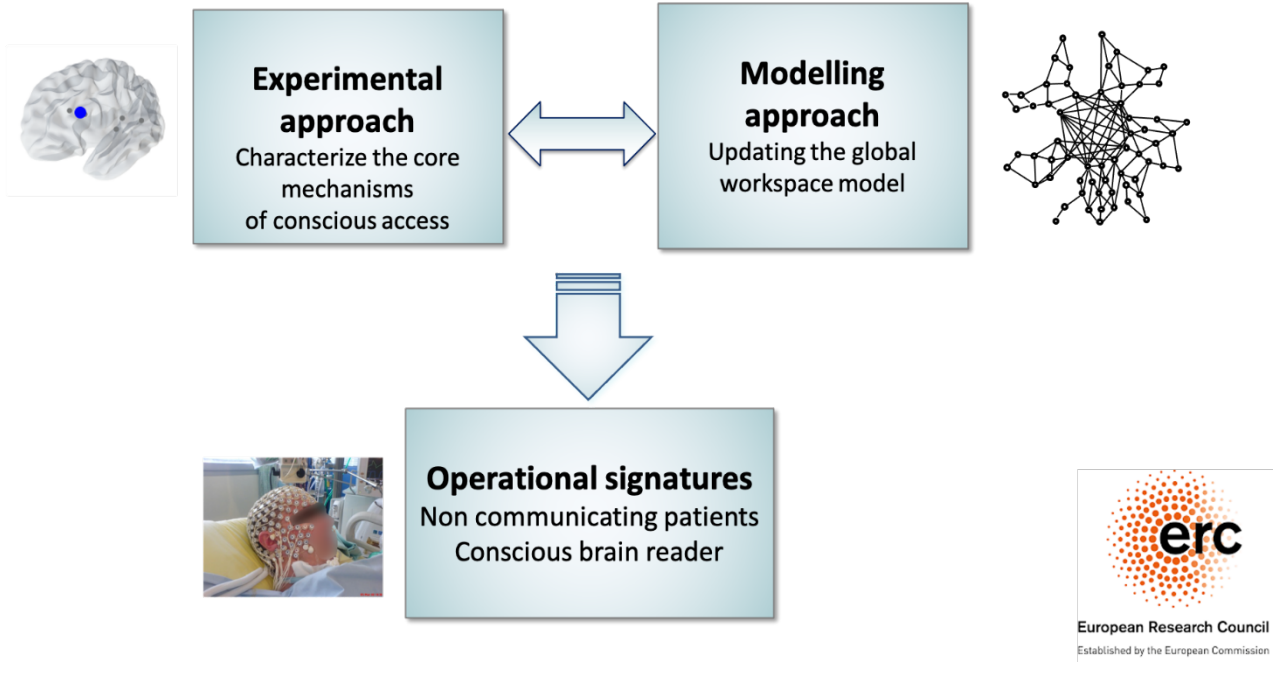
Cogmaster Student, UPCité/ENS/EHESS, Paris
<https://www.magicresearchlab.com/>

Sleights of Mind: How Magicians Exploit the Illusion of Conscious Awareness

Embark on a captivating journey with Isma Zmerli as he weaves together magic and science, illusion and perception, all under the spellbinding lens of human consciousness. In this presentation, Isma will unravel the delicate threads of cognition that magicians have been expertly manipulating for centuries, while illuminating the fascinating landscapes of our minds.

He will challenge popular misconceptions around the art of misdirection, revealing how our focused attention plays the pivotal role in the magic we perceive. Using compelling examples and innovative studies, Isma will examine how magicians subtly guide our expectations and attention to create an alternate reality on the stage.

THE CONSCIOUSBRAIN PROJECT



CONTACTS

Claire SERGENT

Professeure de Neurosciences Cognitives
Co-directrice du Cogmaster
Université Paris Cité / CNRS
Integrative Neuroscience and Cognition Center
INCC / UMR 8002
Centre Biomédical des Saints-Pères
45, rue des Saints-Pères
75006 Paris
Tel : +33 (0) 1 76 53 10 24
claire.sergent@u-paris.fr

For non scientific topics :

Diane Duboué

European Projects Manager
ERC Grant Manager
Pôle recherche
Faculté des Sciences
Université Paris Cité
Tel : +33 (0) 6 61 68 67 89
diane.duboue@u-paris.fr