# **ASSC** 16

# 2nd - 6th July 2012

The Brighton Dome & Corn Exchange **Brighton, UK** 

# Conference Handbook



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# University of Sussex Sackler Centre for Consciousness Science



#### Welcome to Brighton

And welcome to **the 16<sup>th</sup> Annual Meeting of the Association for the Scientific Study of Consciousness**, hosted by the Sackler Centre for Consciousness Science at the University of Sussex.

The annual ASSC meetings have long been a prominent forum for the dissemination, discussion, and advancement of empirical and conceptual studies of consciousness. Now in its 16<sup>th</sup> year, the science of consciousness while still young, is no longer new. In fact it seems to be growing up rather quickly. This growing maturity is reflected both by an effective reaching out to other more established disciplines, and by an increasing delivery on its own core questions concerning the nature, biological basis, and functions of consciousness, in health and in disease. While no-one would claim that the mystery of consciousness is yet solved, it is increasingly evident that much progress is being made and there seems every reason to be optimistic. Equally important is that developments in consciousness science are now yielding clinical insights of real practical importance across a wide range of neurological and psychiatric conditions. A true test of the value of science is its ability to enhance the human condition and the study of consciousness is now contributing here as well.

The success of the ASSC meetings has always depended on the active involvement of its members. We are delighted this year to again welcome members from across the world who collectively submitted 403 abstracts, setting a new record for ASSC meetings by some distance. Deciding between talks and posters seemed especially hard this year not only because of quantity, but also because of the high standard of the large majority of these submissions. We believe the final programme showcases this standard while maintaining a happy balance between the constituent 'themes' of philosophy, psychology, and neuroscience. Where possible we have tried to mix and match these themes, so that a session of talks might discuss a particular issue from multiple perspectives.

Of course the abstract submissions are complemented by a plenary programme of keynote talks, themed symposia, tutorials, and satellite sessions. We hope you will agree that the 2012 line up is particularly exciting, characterized by outstanding variety and depth. Our first thanks must go to all speakers and presenters, whether by submission or by invitation, since without such rich content the ASSC meetings simply would not be worth having.

At ASSC16 we are continuing the tradition of involving students in all aspects of the conference. Many of the talks will be given by students, and the student committee, chaired by Adrienne Prettyman, has been very active in organizing student-led events including a social evening, mentor-lunches with senior researchers, and poster prizes. We are very grateful to members of this committee for making all this possible. Some students have also benefited from travel scholarships generously provided by the Mind-

Science Foundation and by the ASSC board. Fifteen were allocated in total, balanced across discipline, merit, and need.

We have been very lucky to have secured a wonderful venue in the heart of the Brighton, one of the most vibrant cities in the UK (and – fingers' crossed – one with the best weather too!). Taking advantage of this location, we have been eager to make ASSC16 a true citywide celebration of consciousness science, reaching out beyond the academic community to engage the wider public. Headlining this effort we have organized a major one-day consciousness 'expo' bringing consciousness science to life for the public: 'State of Mind', which we expect to attract hundreds if not thousands, will not only raise the profile of consciousness science generally but also introduce its basic ideas to broad sectors of the public, including children still in the early phases of school. David Schwartzman, of the Sackler Centre, originated the State of Mind idea and has been instrumental in making it happen and we owe him our grateful thanks. We are also grateful to the many other participants who are donating their time and expertise for the event: full details are at www.consciousnessexpo.co.uk. Other public events include an evening 'consciousness salon' where hypnosis will be discussed over a beer or two; our thanks to speaker Peter Naish for volunteering his time for this.

ASSC16 is also having fun with social media. A Facebook page has been running for a while and will continue to be updated during the meeting (<u>www.facebook.com/assc16brighton</u>). The conference will also be 'live tweeted' throughout, with Twitter feeds displayed in prominent locations in the venue. Our thanks to social network guru Dan Bor for arranging the Twitter feed. Join the conversation using #ASSC16.

Many other people deserve our gratitude for helping see ASSC16 through. We thank our local committee for their extraordinary efforts in helping organize all aspects of the meeting: Hugo Critchley, Andy Mealor, Nick Medford, Ryan Scott, Jamie Ward, David Schwartzman, and Hazelle Woodhurst. Beyond this committee we have also benefited greatly from the help of Sackler Centre members Adam Barrett, Ron Chrisley, Sarah Garfinkel, and Keisuke Suzuki for their willingness to carry out many and varied duties. For their invaluable input in selecting the programme content, we thank the other members of the ASSC16 scientific committee: Olaf Blanke, Amanda Barnier, Olivia Carter, Frederique de Vignemont, David Edelman, Katalin Farkas, Sid Kouider, and Joelle Proust. We have also depended on a very large number of student volunteers – many of whom you will likely see during the meeting (look out for the t-shirts) – and unfortunately far too many to name here. But we do need to single out Kimberly Warne, Cassie Richardson, and Ella Cooper for their particular dedication. Our thanks to you. We also thank Kate Genevieve and Aneurin Wright for their wonderful graphic design, including the ASSC16 poster and the cover of this handbook. Look out for Kate's consciousness-science art installation during the conference!

The Mind-Science Foundation (<u>www.mindscience.org</u>) generously provided \$5000 for travel scholarships, complemented by an additional \$5000 from the ASSC board. Our thanks (and those of the lucky but deserving recipients) to both.

Holding ASSC16 at the Brighton Dome and Corn Exchange involved a large financial commitment. We are extremely grateful to the senior management of the University of Sussex, in particular the Vice-Chancellor Michael Farthing and the Pro-Vice-Chancellor (Research) Robert Allison, for trusting in the vision for ASSC16 and enabling us to go ahead. We are also indebted to Andrew Comben, the Chief Executive of the Dome, for facilitating the conference and the expo; working with The Dome's Delphine Cassara and Morgan Robinson has also been a pleasure. The Dr. Mortimer and Theresa Sackler

Foundation has generously funded the activities of the Sackler Centre for Consciousness Science since 2010 and we are extremely grateful to them. Their support has been absolutely central to the development of consciousness science at Sussex and has also been essential in organizing ASSC16.

Finally, we thank Olivia Carter for her continuous and invaluable help and guidance from Australia. Closer to home, we want to emphasize our gratitude to Hazelle Woodhurst and David Schwartzman for their tireless dedication to the project over recent months. Without them there would be no meeting.

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Anil Seth Zoltan Dienes

ASSC16 co-chairs Sackler Centre for Consciousness Science University of Sussex, Brighton, UK www.sussex.ac.uk/sackler

University of Sussex Sackler Centre for Consciousness Science







#### **Committees and Executive Board**

#### **ASSC 16 Local Organizing Committee**

Co-Chairs Anil Seth - Sackler Centre for Consciousness Science, University of Sussex Zoltan Dienes - Sackler Centre for Consciousness Science, University of Sussex
Committee Hugo Critchley - Sackler Centre for Consciousness Science, University of Sussex Andy Mealor - University of Sussex
Nick Medford - Sackler Centre for Consciousness Science, University of Sussex
David Schwartzman - Sackler Centre for Consciousness Science, University of Sussex
Ryan Scott – Sackler Centre for Consciousness Science, University of Sussex
Jamie Ward - Sackler Centre for Consciousness Science, University of Sussex
Hazelle Woodhurst - Sackler Centre for Consciousness Science, University of Sussex

#### **ASSC 16 Scientific Programme Committee**

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- CommitteeAmanda Barnier Macquarie University, AustraliaOlaf Blanke Ecole Polytechnique Fédérale de Lausanne, SwitzerlandOlivia Carter University of Melbourne, AustraliaFrederique de Vignemont Jean-Nicod Institute, FranceDavid Edelman The Neurosciences Institute, USAKatalin Farkas Central European University, BudapestSid Kouider Ecole Normale Supèrieure, ParisJoelle Proust Jean-Nicod Institute, France

#### **ASSC Executive Board**

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Past- President	Ralph Adolphs - California Institute of Technology, USA
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	Paula Droege - Penn State University, USA
	Steven Laureys - Université de Liège, Belgium
	Tadashi Isa - National Institute for Physiological Sciences, Japan

#### **Past Conferences**

- ASSC 15 Chair: Tadashi Isa June 9-12, 2011 Kyoto University, Japan
- ASSC 14 Chair: Mel Goodale June 24-27, 2010 University of Toronto, Canada
- ASSC 13 Chairs: John-Dylan Haynes, Michael Pauen and Patrick Wilken June 5-8, 2009 Humboldt-Universität, Germany
- ASSC 12 Chairs: Allen Houng and Ralph Adolphs June 19 – 22, 2008 National Taiwan University, Taipei
- ASSC 11 Chairs: Stephen Macknik and Susana Martinez-Conde June 22 – 25, 2007 The Imperial Palace Hotel, Las Vegas
- ASSC 10 Chairs: Geraint Rees and Patrick Wilken June 23 – 26, 2006 St. Anne's College, Oxford
- ASSC 9 Chairs: Christof Koch and Patrick Wilken June 24 – 27, 2005 California Institute of Technology, Pasadena
- ASSC 8 Chair: Erik Myin June 25 – 28, 2004 University of Antwerp, Antwerp
- ASSC 7 Models and Mechanisms of Consciousness Chair: Stan Franklin May 30–June 2, 2003 University of Memphis, Memphis
- ASSC 6 Consciousness and Language: Reportability and Representation in Humans and Animals Chairs: Manuel García-Carpintero and Josep Macià May 31–June 3, 2002 La Caixa Foundation Science Museum, Barcelona
- ASSC 5 The Contents of Consciousness: Perception, Attention, and Phenomenology Chairs: Güven Güzeldere and Ron Mangun May 27 – 30, 2001 Duke University, Durham
- ASSC 4 The Unity of Consciousness: Binding, Integration, and Dissociation Chair: Axel Cleeremans June 29 – July 2, 2000 Université Libre de Bruxelles, Brussels

- ASSC 3 Consciousness and Self: Neural, Cognitive, and Philo sophical Issues Chair: Mel Goodale June 4 – 7, 1999 University of Western Ontario, London
- ASSC 2 Neural Correlates of Consciousness: Empirical and Conceptual Issues Chair: Thomas Metzinger June 19 – 22, 1998 Hanse Institute for Advanced Study, Bremen
- ASSC 1 What Does Implicit Cognition Tell Us About Consciousness? Chairs: William Banks and Patrick Wilken June 13 – 16, 1997 The Claremont Colleges, Claremont

#### **ASSC 16 Exhibitors**



**The MIT Press** publishes distinguished scholarly publications in the cognitive and brain sciences. New titles include: *Consciousness: Confessions of a Romantic Reductionist* by Christof Koch; *Plato's Camera: How the Physical Brain Captures a Landscape of Abstract Universals* by Paul M Churchland, and *The Cognitive Science of Science: Explanation, Discovery and Conceptual Change* by Paul Thagard.

Company representative: Phil Laughlin Senior Acquisitions Editor T: +001 (617) 252 – 1636 E: <u>laughlin@mit.edu</u> W: <u>www.mitpress.mit.edu</u> Contact details: The MIT Press 55 Hayward Street Cambridge MA 02142 USA



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Psychology and Neuroscience Oxford University Press Great Clarendon Street Oxford OX2 6DP

# Programme Overview

		Mon	Jul 2		1	Fue Jul 3	3	v	Ved Jul	4	Thu Jul 5		Fri Jul 6								
<b>09:15</b> 10:00				I T	Keynote: Tim Bayne		Keynote: Geraint Rees		e: ees	Keynote: Tania Singer	Keynote: Josef Perner		: er								
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18:30	Pre	sidenti	al addr	ess:				Ch	ristof K	stof Koch											
19:00		Victor	Lamme	2								Dro diopor dripke									
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20:00																					
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21:00			Latest Music Bar		сваг	Poor man's dinner															

#### Location key:

Old Ship Hotel	Dome theatre	Pavilion theatre
Dome social areas	Corn exchange (1)	Corn exchange (2)

## ASSC 16 Venue Map

#### Main ASSC 16 Venues

A. Entrance to ASSC 16. Brighton Dome and Corn Exchange, Church Street.

B. ASSC 16 Tutorials, Monday July 2<sup>nd</sup>. The Old Ship Hotel, 31-38 Kings Rd, Brighton BN1 1NR.

#### Social Venues

C. Consciousness Salon, Wednesday July 4<sup>th</sup>, 8pm. Latest Music Bar, 14-17 Manchester Street, Brighton, BN2 1TF.

D. Student social, Tuesday 3<sup>rd</sup> July, 8pm. Smugglers, The Loft, 10 Ship Street, Brighton, BN1 1AD.

E. The Poor Mans Dinner, Thursday July 5<sup>th</sup>, 8pm. Days Buffet, 79 East Street, Brighton, BN1 1NF.

F. ASSC 16 After Party, Friday July 6<sup>th</sup>, 8pm. The Globe, 77-78 Middle Street, Brighton, BN1 1AL.

Brighton train station (2 mins)



#### **Brighton Dome Complex**

(Main Conference Venue)



#### Wifi Login:

SSID: ASSC Password: Year2012

Continue the discussion on the ASSC forum where you'll find online commentary pages for the tutorials, symposia and keynote lectures happening over the week. Speakers and presenters are also encouraged to include any materials, background reading or other interesting references. Contribute your impressions, comments and questions beyond our time constraints and make a living archive of our yearly meeting! <u>http://theasscforum.blogspot.co.uk/</u>

And remember also to interact via the ASSC16 Facebook page (<u>www.facebook.com.assc16brighton/</u>) and Twitter #ASSC16.

# **Detailed Programme**

#### MONDAY, JULY 2, 2012

Time	Торіс	Presenter	Location	Page
09:30	Tutorial Workshops		Old Ship	
	T1 Towards a Comprehensive Theory of Subjectivity and Selfhood: Philosophy, Cognitive Science, Neurology, and Neuroimaging	Olaf Blanke & Thomas Metzinger		37
	T2 Sensory Substitution	Jamie Ward & Thomas Wright		37
	T3 A Primer on Experimental Hypnosis Research	Devin Terhune		38
	T4 Self-Knowledge: Philosophy meets Cognitive Science	Axel Cleeremans, Morten Overgaard, Bert Timmermans & Ryan Scott		39
12:30	Lunch			
13:30	Tutorial Workshops		Old Ship	
	T5 The Science of Magic: Turning magic into Science	Gustav Kuhn & Ronald Rensink		41
	T6 Meditation and Consciousness: Two ways Meditation can Contribute to Consciousness Science	Susan Blackmore		41
	T7 Neurosurgery and its Role in the Study of Consciousness	James Laban, Harutomo Hasegawa & Keyoumars Ashkan		42
	T8 The Phenomenology, Neurobiology, and Neurocognitive Basis of Depersonalization	Heather Berlin & Nick Medford		42
17:15	Opening Remarks and James Prize Lecture		Dome	
18:30	Presidential Address		Dome	
	You have conscious sensations without knowing it	Victor Lamme		110
19:30	Welcome Reception		Dome Foyer Bar	

Time	Торіс	Presenter	Location	Page
0915	Keynote Lecture		Dome	
	The Unity Of Consciousness	Tim Bayne		54
10:30	Coffee Break			
11:00	Symposium 1: Consciousness Fading	Chair: Andreas Engel		
	Block Of Intracortical Communication By Propofol-Induced Neural Hypersynchrony	Gernot Supp		157
	Is Propofol-Induced Loss Of Consciousness A Sleep-Like State?	Melanie Boly		57
	The Neural Dynamics of Loss and Recovery of Consciousness under General Anesthesia	Emery Brown		60
13:00	Lunch			
	Concurrent Session 1			
14:00	CS 1.1 Metacognition and Higher Order Consciousness		Dome	
	How To Determine If Knowledge Is Unconscious.	Zoltan Dienes		73
	ERP Correlates Of Consciousness Depend On The Measurement: Decisional Confidence Vs. Visual Experience.	Manuel Rausch		138
	Knowing If They Know: A Novel Bias- Free Method For Incentivising Accurate Metacognitive Reports.	Ryan Scott		148
	How Can We Know When We Know We Know? Towards Measuring Metacognition.	Adam Barrett		53
	Titchener's "Introspectionism" Contra Contemporary Introspective Approaches In Scientific Psychology.	Christain Beenfeldt		54
	There Is No Introspective Attention.	Kevin Reuter		139

Time	Торіс	Presenter	Location	Page
14:00	CS 1.2 Altered States		Corn Exchange	
	Immersion Consciousness.	Carolyn Jennings		98
	Is Asymbolia The Only "Genuine" Case Of Dissociation Between The Affective And Sensory Dimensions Of Pain?	Adam Shriver		152
	Communicating With The Unconscious: The Development Of A Brain-Computer Interface For The Vegetative And Minimally Conscious States.	Damian Cruse		67
	Thalamic Generator For Propofol- Induced Alpha-Rhythm: A Simultaneous EEG-fMRI Study.	Ithabi Gantner		84
	Cognitive Capacity But Not Sedation Level Predicts Neural Signatures Of Conscious Processing.	Jacobo Sitt		154
	The Neural Correlates Of Psychedelic Consciousness As Determined By fMRI and MEG Studies With Psilocybin.	Robin Carhart-Harris		61
14:00	CS 1.3 Unity and the Unconscious		Pavilion	
	Visual Sensory Memory Contains Phenomenal Rather Than Unconscious Representations.	Annelinde Vandenbroucke		166
	Behavioural Priming: It's All In The Mind, But Whose Mind?	Axel Cleeremans		65
	Objective Markers Of Detection Process During A Choice Blindness Task.	Philip Pärnaments		131
	Adaptation To Unconscious Conflicts In Unconscious Contexts.	Heiko Reuss		139
	Do Split-Brain Subjects Have Unified Consciousness?	Ting-An Lin		115
	Access And The Unity Of Consciousness.	Michael Klincewicz		104

Time	Торіс	Presenter	Location	Page
	Concurrent Session 2			
16:30	CS 2.1 Implicit Learning and		Dome	
	The 'Sublink' Effect: Inducing An Attentional Blink From Subliminal Stimuli.	Sid Kouider		107
	The Evolution Of Masked Priming Effects Using The Incremental Priming Technique.	Eva Van den Bussche		164
	Subliminal Sequence Learning In Peripheral Vision.	Anne Atas		49
	Cultural Differences In Implicit Sequence Learning.	Qiufang Fu		81
	Retro-Attention: Triggering Conscious Perception After The Stimulus Is Gone.	Claire Sergent		150
	Stimulus Size Has Opposite Impacts On The Speed Of Unconscious Processing And The Timing Of Conscious Perception.	Ryota Kanai		100
16:30	CS 2.2 Prediction Expectation, and Consciousness		Corn Exchange	
	Predictive Coding In The Visual Cortex.	Lars Muckli		125
	Pre-Stimulus Activity Predicts Awareness In Visual Extinction.	Maren Urner		163
	An Interoceptive Predictive Coding Model Of Conscious Presence	Anil Seth		150
	Can We Tell What We Said When We Hear Ourselves Saying Something Else?	Andreas Lind		116
	Making Predictive Coding More Predictive, More Enactive.	Ron Chrisley		65
	The Anticipation/Fulfilment Model Of Vision Connects Phenomenology And Cognitive Neuroscience.	Michael Madary		119

Time	Торіс	Presenter	Location	Page
16:30	CS 2.3 Time Perception and Attention		Pavilion	
	Attention and The Passing Of Time.	lan Phillips		135
	Time Consciousness and Object	Jan Almäng		46
	Unconscious Attention.	Bence Nanay		126
	A Unified Neuroanatomical Model Of Time Perception.	Sundeep Teki		160
	The Role Of Action-Effect Prediction In Intentional Binding And Sensory Attenuation.	Gethin Hughes		95
	Quantitative Evaluation Of Conscious And Nonconscious Temporal Integration.	Nathan Faivre		76
20:00	ASSC Social		Smugglers,	

The Loft

#### WEDNESDAY, JULY 4, 2012

Time	Торіс	Presenter	Location	Page
09:15	Keynote Lecture		Dome	
	Decoding Consciousness	Geraint Rees		139
10:30	Coffee Break			
	Concurrent Session 3			
11:00	CS 3.1 Theories and Models		Dome	
	Integration Theories of Consciousness and the Unity of the Self- A Proposal for Mutual Exchange Between Research Programs.	Robert Van Gulick		165
	How to Build a Robot that Feels.	Kevin O'Regan		128
	Stability as a Hallmark of the Neural Dynamics Underlying Conscious Sensory Perception.	Aaron Schurger		148
	Consciousness as an Answer to Pervasive Intentionality.	Paul Verschure		167
	A Multi-Access Model of Conscious Awareness.	Michael Cohen		65
	Is Consciousness Graded, Dichotomous, or Both?	Bert Windey		171
11:00	CS 3.2 Neural Correlates and Mechanisms		Corn Exchange	
	Decoding the Contents of Conscious Perception.	Moti Salti		143
	Perceptual Learning Incepted by Decoded fMRI Neurofeedback without Stimulus Presentation.	Kazuhisa Shibata		151
	The Time Course and Spatial Distribution of Consciousness-Dependent Activity in the Brain.	Roger Koenig-Robert		105
	Confuse Your Illusion: Feedback to Early Visual Cortex Contributes to Perceptual Completion.	Martijn Wokke		170

#### WEDNESDAY, JULY 4, 2012

Time	Торіс	Presenter	Location	Page
	Perceptual Closure in Grapheme-Colour Synaesthesia.	Tessa Van Leeuwen		165
	Looking Without Seeing: A Direct Oculomotor Correlate of Unconscious Visual Processing.	Marcus Rothkirch		141
11:00	CS 3.3 Self, Agency and Hypnosis		Pavilion	
	Increased fMRI Resting State Network Functional Connectivity in Hypnotic State.	Athena Demertzi		70
	Using Suggestion to Gain Control Over Increasingly Automatic Processes.	Michael Lifshitz		115
	Placebo-Suggestion Modulates Conflict Adaptation in the Stroop Task.	Pedro De Saldanha da Gama		68
	Zombies, Ouija, and the Ideomotor Effect: When Implicit Cognition Turns Explicit.	Helene Gaucho		85
	Authorship of Thoughts in Thought Insertion.	Max Seeger		149
	Disturbances of Agency in Schizophrenia.	Georgina Torbet		162
13:00	Lunch (and ASSC mentor lunch)			
14:00	Poster Session 1		Corn Exchange	22
16:00	Coffee Break			
16:30	Poster browsing session		Corn Exchange	
18:00	Special Lecture		Dome	
	Studying the Murine Mind using Large Scale Observatories	Christof Koch		105

#### THURSDAY, JULY 5, 2012

Time	Торіс	Presenter	Location	Page
09:15	Keynote Lecture		Dome	
	Social Emotions From The Lens Of Social Neuroscience: Modulation, Development And Plasticity	Tania Singer		153
10:30	Coffee Break			
11:00	Symposium 2: Bringing the In-Depth Body to the Surface: Interoception, Awareness and Prediction	Chair: Manos Tsakiris	Dome	
	Visceral Afferent Signaling, Interoceptive Awareness And Predictive Coding: Impact On Emotional Processes	Hugo Critchley		66
	Interoception And The Problem Of Consciousness	Jim Hopkins		94
	Just A Heartbeat Away From One's Body: Interoceptive Sensitivity And Malleability Of Self-Representations	Manos Tsakiris		163
13:00	Lunch			
14:00	Symposium 3: Perceptual Consciousness and Cognitive Access	Chair: Ned Block	Dome	
	The Fundamental Methodological Problem of Consciousness Research	Ned Block		57
	Kinds of Access and Phenomenality	Jérôme Sackur		142
	Making Perceptual Consciousness Accessible	Ilja Gabriël Sligte		154
	Indeterminate Perceptual Consciousness and Cognitive Access	James Stazicker		156
16:00	Coffee Break			
16:30	Poster Session 2		Corn Exchange	29
19:00	Pre-Dinner Drinks (dinner guests only)		Foyer Bar	
20:00	Conference Dinner		Foyer Bar	

#### FRIDAY, JULY 6, 2012

Time	Торіс	Presenter	Location	Page
09:15	Keynote Lecture		Dome	
	Infants' Sensitivity to Others' Belief: Unconscious Theory of Mind?	Josef Perner		134
10:30	Coffee Break			
	Concurrent Session 4			
11:00	CS 4.1 Stability and Neural Mechanisms		Dome	
	Effects of Transcranial Magnetic Stimulation on Conscious Awareness and Perception.	Chris Allen		45
	GABA Concentrations Predict Individual Differenced in Bistable Perception.	Anouk Van Loon		165
	EEG Correlates of Stable and Unstable Object Representations are Similar Across Stimulus Categories.	Jürgen Kornmeier		106
	Visual Rivalry in the Fly Brain Reveals a Dissociation Between Salience and Time.	Bruno Van Swinderen		166
	Binocular Rivalry Requires Attention.	Jan Brascamp		59
	Object-Based Attention Without Awareness.	Liam Norman		128
11:00	CS 4.2 Embodied Consciousness		Corn Exchange	
	In-Depth Body and its Non-Topographic Representation.	Helena De Preester		68
	Is Proprioception a Form of Perception?	Lana Kuhle		108
	Mineness, Minimal Self, and Self-Related Processing.	Timothy Lane		111
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	Analyzing Phenomenal Concepts Relying on Mental Files.	Albert Newen		127
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	Attention, Phenomenology, and the Semantics of Questions.	Philipp Koralus		106
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	Smelling Phenomenal: Rethinking the Distinction between Access and Phenomenal Consciousness.	Benjamin Young		173
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	Vestibular and Multisensory Foundations of Self-Location and Self-Other Distinction	Christophe Lopez		117
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# **Tutorials**

## **MONDAY, JULY 2, 2012**

MORNING TUTORIALS- 09:30-12:30

# T1- Towards a Comprehensive Theory of Subjectivity and Selfhood: Philosophy, Cognitive Science, Neurology, and Neuroimaging.

**Olaf Blanke,** Laboratory of Cognitive Neuroscience, Swiss Federal Institute of Technology, Switzerland **Thomas Metzinger,** Johanes Gutenberg University, Mainz, Germany

Subjectivity is at the heart of current theories of consciousness, in neuroscience as well as in philosophy of mind: What is a conscious self? What are the earliest origins of the first-person perspective, and what exactly makes phenomenal experience a subjective phenomenon? In the past, many different aspects of self-consciousness have been categorized and these aspects have been continuously refined and expanded, including many different sensory, emotional or cognitive layers. This has led to an excess of definitions, in the absence of a widely accepted model of self-consciousness that is based on empirical neurobiological data.

Recent theories converge on the relevance of bodily self-consciousness, i.e., the non-conceptual representation and processing of body-related information (multisensory and sensorimotor), leading to the activation of a phenomenal self-model (PSM). This tutorial introduces concepts and latest experimental findings from philosophy of mind and cognitive neuroscience on bodily self-consciousness and, in the first section, proposes conceptual foundations for a minimal notion of phenomenal selfhood (MPS): self-location, first-person perspective, and selfidentification. We will then present neurological data concerning the breakdown of bodily self-consciousness and their neuroanatomical mechanisms. Next we will discuss the experimental manipulation of bodily selfconsciousness using video and virtual reality technology combined with neuroimaging data (fMRI, EEG). In the third part of the tutorial we will return to philosophy of mind and target the concept of a "first-person perspective" (1PP).

The course is aimed at participants with an interdisciplinary interest, from philosophy to psychology and cognitive science, as well as neurology and cognitive neuroscience.

#### **Tutorial Outline:**

Part 1: Philosophy of Mind

Conceptual foundations for a minimal notion of phenomenal selfhood (MPS): self-location, first-person perspective, and self-identification.

Part 2: Cognitive Neurology – Illusory own body perceptions

We will then present neurological data concerning the breakdown of bodily self-consciousness and their neuroanatomical mechanisms.

## Part 3: Cognitive Science and Neuroimaging

Experimental manipulation of bodily self-consciousness using video and virtual reality technology combined with neuroimaging (fMRI, EEG).

Part 4: Here we will return to philosophy of mind and target the concept of a "first-person perspective" by integrating the different theoretical concepts and empirical findings.

#### T2- Sensory substitution

Jamie Ward, University of Sussex, UK Thomas Wright, University of Sussex, UK

Sensory substitution devices convert information relating to one sensory signal into another signal: typically visual information is converted into touch or sound. This has practical consequences (e.g. for the blind) as well as raising deep scientific and philosophical questions (e.g. relating to neural plasticity, and the relationship between visual information and visual conscious experience).

In the first part of the tutorial, different devices will be considered starting from the seminal work of Bach-y-Rita to the present day (e.g. attempts to create a magnetic sense). There will be an opportunity to interact with some of these devices.

In the second part of the tutorial, evidence from psychology and neuroscience will be presented concerning performance-based and brain-based measures of the functioning of these devices. The third part of the tutorial focuses on the phenomenological reports of users of these devices and theoretical attempts to account for them (e.g. sensory-motor theories of visual experience).

#### **T3- A Primer on Experimental Hypnosis Research**

#### Devin Terhune, University of Oxford, UK

The study of hypnosis can provide valuable information regarding the nature of consciousness.

Investigating responses to hypnotic suggestions in highly suggestible individuals can yield numerous insights into agency, cognitive control, and conscious awareness. Hypnosis can also be used in an instrumental manner to systematically induce, disrupt, or otherwise alter a host of processes related to consciousness. In turn, hypnosis can aid us in investigating different phenomena that are otherwise difficult to experimentally manipulate in a laboratory setting. The central aim of this tutorial is to give a broad introduction to experimental hypnosis research.

First, I will first provide a brief history of hypnosis and introduce the instruments and procedures used by hypnosis researchers. I will devote considerable time to the measurement of hypnotic suggestibility and discuss the developmental and genetic determinants of hypnotic suggestibility and assess evidence for its cognitive and personality correlates. Next, I will describe and weigh the evidence for different theories of hypnosis and review research bearing on the cognitive and neural basis of hypnotic responding.

Finally, I will conclude by outlining the use of hypnosis as an experimental technique for studying consciousness and describe how it can be utilized to investigate different research questions.

#### **Tutorial Outline:**

The tutorial will be divided into two sections interrupted by a short break. The first part will provide a broad introduction to hypnosis with a focus on the measurement of hypnotic suggestibility and its correlates and determinants as well as research designs used in the field. The second part of the tutorial will cover recent findings regarding the neurocognitive mechanisms underlying a hypnotic induction, response to hypnotic suggestions and different theories of hypnosis. I will conclude this part by describing the instrumental use of hypnosis for the study of consciousness. I describe these two parts in turn.

## Part I

This part of the tutorial will provide an introduction to hypnosis, the measurement of hypnotic suggestibility, its correlates and different experimental research designs used in hypnosis. Following a brief outline, I will begin the course by tracking the origins of hypnosis research in the 18th and 19th century followed by an overview of important developments in the 20th century. Next, I will describe and dispel different myths regarding hypnosis; some examples are: spontaneous posthypnotic amnesia, hypnotic recovery of memories, and complete loss of control during hypnosis. I will introduce a brief lexicon of different words pertaining to hypnosis, mentioning what is meant by hypnosis, an induction, a suggestion, and so on. Then I will devote considerable time to the measurement of hypnotic suggestibility; I will introduce the most commonly used instruments, provide a taxonomy of different types of suggestions, and discuss the distribution of hypnotic suggestibility.

Next, I will turn to the response characteristics of individuals who are highly suggestible with a focus on involuntariness and verisimilitude during hypnotic responses. Following these topics, I will describe the current state of the evidence regarding the developmental and genetic determinants of hypnotic suggestibility. I will then describe research investigating potential cognitive (e.g., suggestibility) and personality (e.g., absorption) correlates of hypnotic suggestibility. I will conclude this part of the tutorial by describing different research designs used in experimental hypnosis research such as the real-simulator and surreptitious observer designs and illustrate how they can be used.

## Part II

This part of the tutorial will focus on different theories of hypnosis, the available evidence regarding its neurocognitive mechanisms, and the use of hypnosis as an experimental technique for studying other phenomena.

I will begin by providing a broad overview of the assumptions of sociocognitive and dissociation theories of hypnosis. I will devote considerable time to the major theories of hypnosis as well as more recent cognitive and neurophysiological models of hypnosis. Next, I will outline the current evidence regarding the neurocognitive mechanisms underlying response to a hypnotic induction and to particular hypnotic suggestions.

The final part of the tutorial will cover the experimental application of hypnosis. First, I will outline the assumptions and guiding principles of instrumental hypnosis research with a focus on the strengths and limitations of using hypnosis as an experimental method. I will conclude the tutorial with a detailed description of the utilization of hypnosis for the study of consciousness. I will outline how hypnosis can be used in this manner and provide examples taken from hypnosis research on agency, awareness, attention and perception.

Finally, I will conclude by considering with the attendees how hypnosis could be used to address different research questions.

#### T4- Self-Knowledge: Philosophy meets Cognitive Science

Axel Cleeremans, Universite Libre de Bruxelles, Belgium Morten Overgaard, Cognitive Neuroscience Research Unit (CNRU), Denmark Bert Timmermans, Neuroimaging Group, University Hospital of Cologne, Germany Ryan Scott, University of Sussex, UK

The study of consciousness, and in particular the study of the differences between conscious and unconscious information processing presents unique challenges for it requires that one combines subjective ("first-person") and objective ("third-person") data. In this tutorial, we will survey recent developments in the measurement of awareness and discuss their theoretical implications. Over the past few years, many new methods to assess the extent to which a person is aware of some state of affairs have been proposed. Interestingly, these novel proposals range from methods that have a strong focus on phenomenology, such as the PAS scale introduced by Overgaard and colleagues, to methods that have a strong metacognitive focus, such as confidence judgements or post-decision wagering. In parallel, Signal Detection Theory has also been the object of intense scrutiny, with strong debate about the relationships between Type I and Type II performance in discrimination tasks, and the introduction of novel indices of awareness such as meta-d'. A further development worth discussing in this light is the increasing use of what one could call sub-personal measures of performance, such as eye movements or EMG measures, as well as the introduction of methods focused on identifying the source of the knowledge involved in decisions.

Many recent studies have used several such measures on every trial, thus raising the possibility of comparing them in within-subjects design and of tracking their respective dynamics over time or over different experimental conditions. The main goal of the tutorial is to introduce the audience to the large repertoire of such new measures, to discuss best practices in the use of such methods (e.g., what are the best conditions under which d' measures should be collected?), and to reflect upon the theoretical implications of the patterns of associations and dissociations revealed by the combination of such methods. The tutorial will be illustrated with recent experimental data.

A syllabus that includes the slides as well as recent articles relevant to the discussion will be provided to participants. Ample opportunities will be provided to participants for discussion, in particular so as to make it possible to examine together specific problems popping up in participants' own research.

#### **Tutorial Outline:**

The tutorial is structured in three parts, described below:

#### Part I

Introduction. [Cleeremans & Overgaard, 50m]: In the first part of the tutorial, we will essentially offer an introduction to the challenge of measuring consciousness. Some of this material will be historical, retracing, for instance, the relevant debates as they took place in the subliminal perception or in the implicit learning literature, and overviewing general but central concepts such as subjective vs. objective methods, the relative sensitivity of different measures of a conscious state, the use of verbal reports, confidence judgments, or betting in assessing the extent to which a subject is aware of a of a particular state of affairs, methods such as signal detection or the process dissociation procedure as they can be deployed both in purely behavioural studies or in imaging experiments. Methodological issues such as the question of bias or the pervasive confound between awareness and performance will be introduced through examples involving different paradigms ranging from perception to memory and learning.

The first part of the tutorial will delineate pending challenges, including the following:

- Can the same methods be deployed in different paradigms (e.g. perception vs. memory paradigms) or should some reporting methods be preferred in certain context?
- How are different measures best combined? Do different ways of administering a d' task always yield the same result? Does it matter whether a subjective judgment is produced before or after an objective measure?
- Are there differences between dichotomous and graded measures of some content?
- What are the relationships between measures of sensitivity, awareness, and metacognition? What are the respective dynamics of such measures? What are the patterns of associations and dissociations between them?

At the end of this first part of the tutorial, a short discussion followed by a break will be organized with the goal of collecting specific questions that participants would like to see answered. This will also be supported by interactions with the participants in the weeks that precede the meeting, so that the presenters know which issues will be most relevant to the participants.

## Part II

Sensitivity, awareness, and metacognitive judgments. [80m]: The second part of the tutorial will be dedicated to specific illustrative examples taken from very recent and ongoing research. We envision presentations of about 20m each.

Overgaard will survey subjective methods, asking what constitutes "subjective methods" and how one should in practice make use of them. These questions will be illustrated by a detailed review and analysis of findings using one specific approach to subjective reporting: The Perceptual Awareness Scale (PAS). A number of experiments will be described and discussed with a specific focus on exact methodologies. Furthermore, the implications of the experiments will be discussed actively with the tutorial participants. For instance, some experiments suggest that findings of blindsight and even subliminal perception may at least to some degree rely on confounding factors from inaccurate reporting methods. The talk intends to introduce methods for subjective reporting for a scientific audience without prior experience with their use.

Timmermans will survey subjective measures, specifically asking whether they all subtend the same form of metacognition. According to Sandberg et al., 2010, the best method consists of simply asking participants about the clarity of their visual experience Cleeremans, Overgaard, Timmermans & Scott 3 (as in the Perceptual Awareness Scale, PAS). This method outperforms confidence ratings (in response accuracy), and post-decision wagering, presumably because the latter may depend more on participants' answers, and on the information they consider relevant to that answer (judgment knowledge), and are therefore less exhaustive. PAS, as with confidence ratings as they were originally conceived (pertaining to stimulus clarity instead of response accuracy), has the advantage that it is unrelated to this judgment knowledge. However, in designs where one is specifically interested in whether people know on what knowledge they base their answer (like for instance, letter string classification in an Artificial Grammar Learning task), the question is not about what people believe to have perceived (hence PAS cannot be applied), but about what knowledge they consciously think they possess. Here, the target task becomes relevant, and therefore CR (with respect to response accuracy) and PDW (preferably in a no-loss variant, see Dienes & Seth, 2010) are the subjective measures of choice. The following questions ensue: To what degree can both be compared, to what degree is metacognition in the context of knowing-what-you-saw comparable to metacognition in the context of knowing-what-you-know.

Scott will address the following issues: Judgment vs. Structural knowledge, including coverage of recent methods to assess the basis for participants' decisions. Confidence vs. Attribution judgments – Based on Scott & Dienes (2008) and on more recent work, the issue of unexpected dissociations between confidence and attribution judgments (such participants reporting zero confidence while simultaneously reporting that they exploited a systematic strategy or rule) will be addressed. Type I vs. Type II decisions, including recently developed novel indices and the relationships between Type I and Type II decisions. Relative familiarity and recalibration. Participants' recalibrate their confidence thresholds in an intelligent way when given bogus information about their accuracy – showing that they do in fact have conscious access to more information than is typically expressed in their confidence ratings. Relative familiarity can be also used as a potential basis for confidence, which provides a tangible example of how SDT can in principle apply to both first order and metacognitive judgments.

Finally, Cleeremans will report on recent experimental work dedicated to exploring the factors that influence visibility as assessed by means of d'. When investigating unconscious influences in subliminal priming experiments, many have argued that primes are invisible because subsequent d' ("d prime") task suggest that people are not able to discriminate between the different primes. However, some problems with this technique have been overlooked. Using different versions of the d' task, a recent study shows that target presentation, attention on prime stimuli and timing of the response are factors that lead to over- or underestimation of the measured d'. This suggests that the standard d' task is not a straightforward objective measure of prime visibility and that one has to consider these factors when developing a d' task in further subliminal perception research.

#### Part III

Theoretical implications & general discussion. [50m]: The third part of the tutorial will be dedicated to the theoretical implications of the methods and findings presented in Part II of the tutorial as well as providing an opportunity for ample interaction with the participants.

## MONDAY, JULY 2, 2012

#### AFTERNOON TUTORIALS- 13:30-16:30

#### T5- The Science of Magic: Turning magic into Science!

Gustav Kuhn, Brunel University, UK Ronald Rensink, University of British Columbia, Canada

Over the centuries, magicians have developed extensive knowledge about how to manipulate our conscious experience; knowledge that has been largely ignored by science. However, in recent years, steps have been taken towards utilizing this knowledge to further our understanding of human cognition and consciousness. In previous ASSC symposium and tutorial, the case was made for a close collaboration between magicians and scientists. In this tutorial we will go further and show how such collaboration can serve as the foundation for a science of magic, and present an explicit framework. Illustrations are given in broad terms about how this science might work in practice, including a description of the kinds of contributions that would be considered valuable.

In the second section, we will examine how a science of magic can provide us with new tools and perspectives from which to investigate the nature of perception, cognition, and human experience. We will explore the things that can we learn from the perceptual and cognitive effects that magicians have developed? How can we use magic as a tool to investigate psychological processes? How can magical effects be used to investigate belief systems? What can the experiential states generated by observing magic effects tell us about human experience? What can we learn from the magician's expertise in motor control? We will conclude that there are numerous areas in which magic is not merely a sufficient, but a necessary way of investigation.

#### **Tutorial Outline:**

Warm up: Magic Demonstration (10 min) The science of Magic Framework (30 min) Possible contributions to the science of magic (30 min) Discussion (15 min)Break (15 minutes) Warm up: Magic Demonstration (5min) Contributions from a Science of Magic (60 min) Discussion (15 minutes)

#### T6- Meditation and Consciousness: Two Ways Meditation can Contribute to Consciousness Science

Susan Blackmore, University of Plymouth, UK

There are two ways in which formal meditation may contribute to consciousness studies.

First, there is research exploring how physiology and brain function change, both in the short term during meditation and in the long term after years of practice. Studies of stress levels and relaxation generally do not support popular claims, but dramatically slowed breathing is often found. PET, fMRI and other methods reveal increased overall coherence, and more specific effects are found especially on attentional systems. All these types of study face serious methodological challenges, especially in finding appropriate control groups and conditions, but some of these have been overcome with recent advances. When well conducted these studies may contribute to our understanding of the neural correlates of altered states of consciousness, and especially the correlates of changes in attention.

Second, meditation may (or may not!) be considered useful as a method for training more accurate introspection into consciousness. Traditional Zen koans (paradoxical questions used in meditation) often tackle questions familiar to consciousness researchers such as 'Who is meditating?' or 'When is this?'. Using meditation in this way confronts all the problems of first-person inquiry, especially that of independent corroboration. We shall discuss whether (as I believe) the results may legitimately inspire new theories of consciousness or refute existing theories and assumptions.

This tutorial will include short lectures covering the major empirical findings of meditation research, interspersed with brief meditation sessions that will help us better understand the methods and effects entailed in that research.

## **Tutorial Outline:**

0.00 Introduction. Two ways meditation research can contribute to consciousness studies. 0.10 Meditation exercise 1: Ten minutes calming the mind.

- 0.25 Physiology of meditation: breathing, arousal, blood O2, CO2 etc. levels, significance for claims of relaxation and stress reduction. Brain function changes, PET, fMRI, problems and implications. Meditation as training attention.
- 1.00 Meditation exercise 2: Ten minutes watching the breath, with timing exercise
- 1.15 Discussion
- 1.30 break (optional practicing mindfulness during the break)
- 1.50 Meditation as disciplined introspection. A possible contribution of first-person practice?
- 2.15 Meditation exercise 3: Brief koan practice and discussion
- 2.30 Implications for current theories of consciousness
- 2.50 Final discussion

#### T7- Neurosurgery and its Role in the Study of Consciousness

James Laban, St. George's Hospital, UK Harutomo Hasegawa, King's College Hospital, UK Keyoumars Ashkan King's College Hospital, UK

Clinical neurosurgery has historically played an important role in the development of neuroscience and the science of consciousness. This tutorial is an introduction to the scope of contemporary neurosurgical practice, modern neurosurgical techniques and their relevance to consciousness research in the 21st century.

#### **Tutorial Outline:**

- 1. Introduction
- 2. Historical aspects
- 3. Overview of neurosurgical conditions related to the study of consciousness
  - a. Head injury
  - b. Brain tumours
  - c. Stroke
  - d. Functional
  - e. Epilepsy
- 4. Surgical techniques
  - a. Assessment of impaired states of consciousness
  - b. Awake craniotomy
  - c. Functional Deep Brain Stimulation
- d. Epilepsy surgery
- 5. Open discussion
- 6. Summary

## T8- The Phenomenology, Neurobiology, and Neurocognitive Basis of Depersonalization

Heather Berlin, Mount Sinai School of Medicine, New York, USA Nick Medford, Sackler Centre for Consciousness Science & Brighton and Sussex Medical School, UK

We will explore the phenomenology, neurobiology, and neurocognitive basis of depersonalization. According to psychoanalytic theory, dissociation is a defence mechanism that keeps unwanted, anxiety-provoking thoughts and impulses from entering consciousness. Dissociation is a psychological state where certain thoughts, emotions, sensations, or memories are separated from the rest of the psyche. The DSM-IV-TR defines dissociation as "a disruption in the usually integrated functions of consciousness, memory, identity or perception", and specifies five dissociative disorders, one of which is depersonalization disorder (DPD). DPD is characterized by persistent or recurring feelings of detachment or disconnection from one's own mental processes, emotions, and/or body resulting from a distorted self-perception. Frequently, depersonalization is accompanied by derealization, a sense that one's external surroundings are unfamiliar or that the world is 'unreal'. However, people experiencing depersonalization and derealization retain full reality testing surrounding their perceptually altered experiences, i.e. they are not delusional.

Across psychiatric disorders, depersonalization symptoms are common, yet how these disturbances of selfexperience interact with other aspects of mental state, such as post-traumatic, affective, or psychotic symptoms, is little studied. We will discuss studies from psychology, psychiatry, and cognitive neuroscience that are beginning to elucidate the neural basis of depersonalization. While primary DPD will be our main focus, we will also discuss the relevance of recent research findings in DPD with reference to literature on both healthy and pathological mental states, in particular the potential importance of depersonalization symptoms in the genesis of psychotic disorders such as schizophrenia.

## **Tutorial Outline:**

Heather Berlin: Title: Neurocognition in Depersonalization Disorder (60 min + 10 min discussion)

Nick Medford: Title: Neural Substrates of the Unreal Self: Studies in Depersonalization Disorder (60 min + 10 min discussion)

General Discussion, facilitated by presenters (40 minutes)

# Abstracts

#### Looking Into Myself

Vivien Ainley, Royal Holloway, University of London, UK Ana Tajadura-Jimenez, Royal Holloway, University of London, UK Aikaterini Fotopoulou, King's College, London, UK Manos Tsakiris, Royal Holloway, University of London, UK

## *July* 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Interoceptive sensitivity, defined as our awareness of what is happening inside our bodies, is generally measured by accuracy in a heartbeat detection task. Research has identified relationships between interoceptive sensitivity and measures such as emotional arousal, intuitive decision-making and exteroceptive processing (as in the rubber hand illusion), as well as with clinical conditions such as depression, anxiety and anorexia nervosa. Because interoceptive sensitivity has appeared to be a robust trait variable, these links have necessarily been correlational. There has been limited success in experimentally manipulating interoceptive sensitivity, in order to establish causal links. However, self-observation is known to enhance aspects of self-processing. In this study we examined whether self-observation in a mirror can improve interoceptive sensitivity. 129 participants, aged 10-74 years, performed a heartbeat detection task while looking at a black screen (the baseline) and again while looking into a mirror. Increased interoceptive sensitivity in the mirror condition was significantly predicted by the individual's interoceptive sensitivity at baseline. Thus, participants with lower baseline interoceptive sensitivity showed greater improvement in heartbeat detection when looking into a mirror. This effect was independent of the order in which the conditions were presented and changes in heart rate between conditions, as well as participants' gender, age, body mass index and habitual exercise levels. Our results suggest that mirror self-observation may be a viable way to manipulate interoceptive sensitivity. This would enable the direct testing of the effects of interoceptive sensitivity on other emotional, cognitive and exteroceptive variables, with which links have previously been established.

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#### Human Information Field: Cutting a Gordian Knot in Cognitive Science?

#### Aleksandar Aksentijevic, University of Roehampton, UK

## July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

One of the fundamental problems in consciousness research concerns bridging the gap between first- and thirdperson perspectives (e.g. Chalmers, 2003). We illustrate the problem by means of a paradox: Psychologists and cognitive scientists use objective methods to investigate subjective experiences that are ultimately responsible for creating these very methods. We propose that the two perspectives can be reconciled by acknowledging the subjective origin of objective knowledge. We introduce the notion of the Human Information Field (HIF), a subjectcentred cognitive reference system. HIF describes the totality of human perception, cognition and action from the first-person perspective and relates these to the physical and computational notion of information. The field extends away from the observer's body and has a flexible boundary. As the informational distance from the centre of the field increases, the phenomena become more difficult to relate to by virtue of being too small, large and/or complex to be assimilated. On the other side of the boundary lies the unknowable region of infra- or supra-human scale and randomness. Finally, we discuss the implications of the HIF for the scientific study of consciousness.

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Size does (not) matter! On the impact of extreme stimulus size on target visibility in metacontrast masking. Thorsten Albrecht, Georg-August-University Göttingen, Germany Uwe Mattler, Georg-August-University Göttingen, Germany

# July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

In metacontrast masking the visibility of a target stimulus can be strongly reduced by a subsequent nonoverlapping masking stimulus displayed at some critical temporal interval and in close contiguity to the target stimulus. Typically, metacontrast studies employ rather small stimuli (< 1° visual angle) rarely investigating metacontrast for stimuli of intermediate size of up to 2.6° visual angle. Here we report experiments in which we examined whether there is a maximum stimulus size for metacontrast. We presented targets with sizes ranging from 0.6° visual angle to 6.5° visual angle, which were followed by a meta-contrast mask at different stimulus onset asynchronies (SOA), and recorded objective discrimination performance as well as subjective visibility ratings. Surprisingly, we found that the absolute masking level is not affected by stimulus size: Across SOAs huge stimuli were as effectively masked as very small stimuli. However, the time course of masking differed for different stimulus sizes, and different observers were affected differently by stimulus size. These findings contribute to our understanding of individual differences in masking and may be explained by different time courses of and differential weighting of processes in a boundary contour system and a feature contour system. In addition, these results are in line with current theories of access consciousness which propose that recurrent processing is crucial for conscious perception: Although the processing of large stimuli should entail stronger feedforward activity than small stimuli, metacontrast masking seems to effectively impede recurrent processing and conscious perception.

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#### How can E become conscious of W in the domain of state machines?

## Igor Aleksander, Imperial College London, UK Helen Morton, Imperial College London and Brunel University, UK

# July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Can one formalise how an entity E, might become conscious of a world W in which E is situated? Here we specify constraints on state machines which appear to be necessary to address this question. 1. E is a neural automaton where every state variable is the output of a neuron.2. W has a vast number of state variables arranged in a 2-D manner, for analytic convenience.3. E 'sees' a 2-D window of W which is its input state. For exploration it selects one of a fixed number of actions as output. 4. The states of E are replicas (iconic learning1) of window states, and selected actions.5. To satisfy integration as necessary for consciousness, the states are enhanced by the addition of a timing message to the iconic state, and indivisible by appropriate net connectedness. 6. E requires an imaginational mode through an attentional switch that replaces the world window input by noise, providing a phenomenal and probabilistic state structure that represents and makes usable past experience. So as E has an integrated representation of itself in W which it learns by exploration, and it is capable of acting according to its experience, we submit that this defines what it is for E to become conscious of W under conditions of exploration and invariance in W. More purposeful forms of exploration and actions on W are currently being studied. [1] A fuller and more comprehensible version of this argument is found in Aleksander and Morton Aristotle's Laptop: The Discovery of our Informational Mind, World Scientific Press, 2012.

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### Effects of Transcranial Magnetic Stimulation on Conscious Awareness and Perception.

Chris Allen, Cardiff University Brain Research Imaging Centre, UK Petroc Sumner, Cardiff University Brain Research Imaging Centre, UK Richard Edden, Johns Hopkins University School of Medicine, USA John Evans, Cardiff University Brain Research Imaging Centre, UK Ben Dunkley, York University, Toronto, Canada Suresh Muthukumaraswamy, Cardiff University Brain Research Imaging Centre, UK Krish Singh, Cardiff University Brain Research Imaging Centre, UK Chris Chambers, Cardiff University Brain Research Imaging Centre, UK

# July 6<sup>th</sup>, 11:00-13:00: Concurrent Session 4.

In a series of experiments we explored the effects of two classes of transcranial magnetic stimulation (TMS) (online and off-line) upon measures of conscious detection and reportedly 'unseen' discrimination abilities. In the online experiments we replicate the classic TMS-induced blindsight effect resulting from TMS applied to early visual areas at around 100ms and show that the concurrent 'unseen' abilities are maintained and above chance when input from the superior colliculus is depleted. This indicates that retinotectal input is not a critical requirement of the residual abilities demonstrated in TMS-induced blindsight. In the off-line experiments we used repetitive TMS to reduce the cortical excitability in early visual areas. Contrary to our initial hypothesis, TMS increased conscious detection of stimuli and had no effect on 'unseen' abilities. We replicated this behavioural effect in conjunction with magnetoencephalography, finding that the TMS intervention potentiated the event-related desynchronization (ERD) in the low alpha band. Using magnetic resonance spectroscopy, we then found that this TMS technique also increased levels of gamma-aminobutyric acid (GABA) in the occipital cortex. Across subjects these changes in GABA concentration correlated with the extent of the ERD. Changes within the alpha band, such as the ERD, have been linked to the suppression of neuronal noise, as has GABA. Taken together, the off-line experiments indicate a prominent role of gating within the occipital cortex in visual consciousness.

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## **Time Consciousness and Object Constancy**

#### Jan Almäng, University of Gothenburg, Sweden

# July 3<sup>rd</sup>, 16:30-18:30: Concurrent Session 2.

Philosophers have discussed time-consciousness ever since William James introduced the concept specious present. The specious present is normally conceived of as the length of time that can be presented by a sensory modality in a single act of perception. James probably subscribed to the doctrine that the act of perception coincides in time with the time presented in the content of the act, a position which later became known (through Miller) as the Principle of Presentational Concurrence (PPC). According to PPC the perceptual act is spread out in time so that in a single point in time we will never experience the complete content of the act of perception, but merely a temporal part of it. In this talk I argue that PPC cannot account for certain features of object constancy. A by no means uncommon feature of perception is that the perceptual content can change even though we perceive no change in the object perceived. We might for example in a specious present see a property as more and more determinate. The object could initially be presented as having an indistinct colour and subsequently as red and as having a particular shade of red. Nevertheless we would perceive the object as having had the same determinate property throughout the specious present. But this is impossible on an account relying on PPC. For according to PPC, the object is initially presented as merely being coloured and this determination is not revised in accordance with later determinations in the specious present.

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### **A Puzzle Concerning Spatial Consciousness**

Adrian John Tetteh Alsmith, University of Copenhagen, Denmark

July 6<sup>th</sup>, 11:00-13:00: Concurrent Session 4.

I would like to consider the following trilemma:

- (i) A subject's perceptual experience is unified both within and between its senses according to a single perspective.
- (ii) The perspectival nature of perceptual experience ought to be conceived as the point of origin for an egocentric frame of reference.
- (iii) Multiple distinct egocentric frames of reference are employed both within and between the senses.

Individually, each of these claims has some plausibility. Collectively, they seem to present an inconsistency: perceptual experience cannot be unified according to a single perspective, if that perspective is conceived as the point of origin for an egocentric frame of reference, when there are multiple distinct egocentric frames of reference in operation within and between the senses. I will argue that the trilemma is genuine and discuss the motivations for each of the claims constituting it, in the hope of discerning which ought to be rejected.

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#### Do Synaesthetic Graphemes and Colours Bind Unconsciously?

Hazel Anderson, Sackler Centre for Consciousness Science & School of Psychology, University of Sussex, UK Ryan Scott, Sackler Centre for Consciousness Science & School of Psychology, University of Sussex, UK Zoltan Dienes, Sackler Centre for Consciousness Science & School of Psychology, University of Sussex, UK Anil Seth, Sackler Centre for Consciousness Science & Dept of Informatics, University of Sussex, UK Jamie Ward, Sackler Centre for Consciousness Science & School of Psychology, University of Sussex, UK

## July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

Grapheme-colour synaesthesia is when letter, number or symbolic inducing stimuli simultaneously evoke a concurrent colour experience. Evidence suggests that attention and conscious perception to the inducing stimulus is necessary for the full generation of the concurrent; however it is not yet known whether the inducing grapheme and colour could bind pre-consciously to aid conscious perception. To address this question, we used continuous flash suppression (CFS) to present a dynamic Mondrian pattern to one eye and a grapheme to the other, so that the grapheme remains below conscious threshold an extended time prior to 'breaking through' into consciousness. Since genuine colour is known to facilitate break-through under CFS, we reasoned that graphemes which evoke synaesthetic colour would be perceived more quickly than those eliciting synaesthetic monochrome experiences. Experiment 1 tested this hypothesis by presenting inducing graphemes in black font to determine whether those graphemes with colour concurrents would aid breakthrough. We also wondered whether graphemes presented in a synaesthetically congruent colour would break through faster than those presented in an incongruent colour. In experiment 2, coloured graphemes were presented either in their congruent or incongruent colours. Neither the colourfulness of the synaesthetic colour or the congruency of it significantly affected the length of time till it was consciously perceived. These results suggest that the grapheme and colour do

not bind pre-consciously, which would be in line with previous research demonstrating that consciously attending to a grapheme is necessary to fully trigger the synaesthetic concurrent.

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#### Neural Traces of Consciousness: Towards Molecular Genetic Dissection of Subjective Experience

Konstantin Anokhin, "Kurchatov Institute" National Research Center, Russia

## July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Consciousness and memory are tightly linked in neural mechanisms of subjective experience. We have previously shown that memory consolidation involves neuronal expression of immediate-early genes (IEGs) (Maleeva et at., 1989) that can be used to map memory assemblies in the brain (Anokhin, 1989). Behavioral induction of IEGs is triggered by subjective novelty of experience (Anokhin & Sudakov, 1993) and occurs during establishment of single-trial episodic-like memories (Anokhin et al., 1991; Ryabinin & Anokhin, 1993). At the level of neuronal activity it is associated with experience-dependent specialization of neuronal responses (Svarnik et al., 2005). In extension of this line of research I propose that imaging of behaviorally induced expression of IEGs can be used to visualize activation of IEGs during behavior by employing GFP transgenic reporter mice (Anokhin et al., 2012), methods for optical clearing of a whole mouse brain after behavioral episodes of induction of IEGs (Efimova & Anokhin, 2009) and whole brain cell-resolution optical fluorescence tomography to image experience-driven distributed functional systems tagged by IEGs expression (Morozov et al., 2010). I further suggest that linking IEGs promoters to optogenetic tools will allow to move forward from purely correlative to causal analysis of neural bases of subjective experience.

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# The Different Faces of One's Self: An fMRI Study into the Recognition of Current and Past Self-Facial Appearances

Matthew A J Apps, Royal Holloway University of London, UK Tajadura-Jimenez. A., Royal Holloway University of London, UK Turley, G., Royal Holloway University of London, UK Tsakiris, M., Royal Holloway University of London, UK

# *July* 5<sup>th</sup>, 14:00-16:00: *Poster Session* 2.

A plethora of research has investigated the neural basis of the ability to recognise one's current facial appearance in photographs or mirrors. However, one important question has not previously been examined; how are images of one's past facial appearance processed in the brain when they are also recognised as "me"? To examine this question, we used fMRI to investigate brain activity as participants viewed images of themselves, morphed with images of a personally familiar other. The images were morphs between the participants' and the familiar others' current facial appearances or their childhood appearances. The participants performed a self-other judgement on morphed pictures that contained 0%, 20%, 40%, 60%, 80% or 100% "self". We analysed the fMRI data parametrically, to examine activity that covaried with the percentage of "self" present in the stimuli. Activity in areas involved in body-ownership and memory retrieval varied with the amount of the participants' childhood face in the images, but not the amount of the participants' current facial appearance. We also found that activity in a network of face-selective, but not self-face selective areas varied with the amount of current self in the stimuli and not the amount of childhood self. We argue that a representation of one's current facial appearance is maintained and updated in networks that process all faces. In contrast, representations of one's past facial appearances are stored in memory and then are re-experienced as a part of one's own body, allowing them to be recognised as one's own.

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#### **Exogenously Controlled Attention Does Not Inevitably Engage Awareness.**

#### **Craig Arnold**, University of Durham, UK **Jamal Kinsella**, University of Durham, UK **Robert Kentridge**, University of Durham, UK

## *July* 4<sup>*th*</sup>, 14:00-16:00: Poster Session 1.

It has long been suggested that consciousness and attention are inextricably linked. Recent studies have, however, shown that attended stimuli do not necessarily enter consciousness, suggesting that attention and consciousness are mediated by distinct underlying mechanisms. Most of these studies have focused on endogenous attention

and it has been suggested that dissociation between attention and awareness may not occur when attention is controlled exogenously. We investigate this possibility in a study in which we not only collect a subjective measure of awareness but also assess subjects' ability to explicitly detect targets, be they seen or unseen, using a twoalternate forced-choice procedure. Salient, peripheral cues directed exogenous attention to one of two locations where colour primes - meta-contrast masked by target rings - were presented. On each trial the two target rings were the same colour as one another. One of the primes matched the targets in colour; the other had an incongruent colour. Participants showed evidence of selective attentional processing of the cued primes, identifying target rings' colour more quickly when the congruent colour prime was at the cued location. Crucially, participants reported having no awareness of the primes' existence and performed at chance level when making forced choice discriminations between trials with primes present and those without. The data presented here demonstrate that exogenously controlled attention can be dissociated from consciousness. This supports the view that attention and awareness are distinct processes regardless of the manner through which attention is controlled.

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#### Distilling the NCC: Do Local Gamma Band Responses in Visual Cortex Reflect Conscious Experience?

Jaan Aru, Max-Planck Institute for Brain Research & Frankfurt Institute for Advanced Studies, Germany Nikolai Axmacher, University of Bonn, Germany Anne T.A. Do Lam, University of Bonn, Germany Juergen Fell, University of Bonn, Germany Wolf Singer, Max-Planck Institute for Brain Research & Frankfurt Institute for Advanced Studies, Germany Lucia Melloni, Max-Planck Institute for Brain Research, Germany

### July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

Progress in unravelling the neural correlates of consciousness (NCC) is limited by a fundamental difficulty in one of its key methodologies, i.e., the contrastive analysis. As commonly employed, the contrastive analysis does not exclusively reveal the neural processes directly related to conscious perception but also the prerequisites for and the consequences of conscious perception. Therefore, in order to understand the neural basis of conscious perception the NCC need to be experimentally distilled from these confounding processes.

We discuss one potential strategy for eliminating (some of) the prerequisite processes confounding our search for the NCC. In particular, we designed an experimental paradigm in which conscious perception is modulated either by sensory evidence or by prior knowledge. The logic of our approach is the following: although conscious perception could be affected by these two different prerequisite processes, conscious experience and thus the NCC should be the same in both cases. To test the hypothesis that local category-specific gamma band responses (GBR) reflect the NCC, we recorded intracranial local field potentials from the visual cortex of 6 epilepsy patients. We observed that although conscious perception was enhanced both by sensory evidence and by prior knowledge, GBR were accordingly increased only by sensory evidence and not by prior knowledge. This result implies that local category-specific GBR in the human visual cortex do not reflect conscious experience.

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#### Sequence Learning, Attention & Consciousness

Dariusz Asanowicz, Jagiellonian University, Poland Vinciane Gaillard, Universite Libre de Bruxelles, Belgium Michał Wierzchoń, Jagiellonian University, Poland Axel Cleeremans, Universite Libre de Bruxelles, Belgium

## July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

There is an ongoing debate regarding the role played by attention in sequence learning. Among other problems, this debate is questioning the level of conscious access of the knowledge acquired through sequence learning as any secondary task may in fact interfere with either implicit, explicit or even motor aspects of the learning process. To assess the role of a secondary task for all these aspects of sequence learning, we need a secondary task that is both demanding and easily controllable.

The present study uses two such tasks in addition to the serial reaction time (SRT) task - the mental arithmetic (MA) and random number generation (RNG). The crucial difference with previous studies is that with this tasks we can separately manipulate the cognitive load (with the MA high and low cognitive load conditions) and the time required to control the SRT performance (depending on the RNG condition). Importantly those two manipulations (i.e. cognitive load vs. desynchronization of the SRT time characteristics) refer to two often mentioned causes of impaired sequence learning in dual-task settings.

To assess exclusive influences of both tasks on unconscious and conscious knowledge, the indirect learning phase (SRT task) is followed by direct tests. Above the main effects of cognitive load vs. desynchronization of the SRT time characteristics, we expect performance in the direct test to be more impaired under dual task conditions, when knowledge is conscious. Results will be presented at the meeting. The relation between attention, consciousness and sequence learning will be discussed.

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### Heartfelt Empathy: Interoceptive Signals Modulate Mental Own-Body Transformation

- Jane Elizabeth Aspell, Brain Mind Institute, Ecole Polytechnique Fédérale de Lausanne, Switzerland & Anglia Ruskin University, UK
- Francesco Walker, Brain Mind Institute, Ecole Polytechnique Fédérale de Lausanne, Switzerland
- Bruno Herbelin, Brain Mind Institute, Ecole Polytechnique Fédérale de Lausanne, Switzerland
- Lukas Heydrich, Brain Mind Institute, Ecole Polytechnique Fédérale de Lausanne & University Hospital, Geneva, Switzerland
- Olaf Blanke, Brain Mind Institute, Ecole Polytechnique Fédérale de Lausanne & University Hospital, Geneva, Switzerland

# July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Adopting the perspective of another person is an important aspect of social cognition and has been related to empathic ability in women. Here we investigated whether performance on a mental own-body transformation (OBT) task could be modulated by projecting heartbeat timing information onto an avatar. Subjects had to imagine adopting the position and perspective of front-facing and back-facing avatars presented on a computer screen. They indicated by button press whether the marked avatar's hand would be their own left or right hand. Subjects' heart rate was recorded and used to determine the timing of a flashing silhouette that outlined the avatar and flashed synchronously or asynchronously (separate blocks) with respect to their heartbeat. Repeated periods of 'avatar-flashing' were interleaved with OBT trials. Based on previous data using our heartbeat illusion paradigm, we predicted that synchronous flashing should render the avatar more 'self-like', making it easier for subjects to adopt its perspective and thereby enhancing performance on the task relative to the asynchronous condition. We assessed empathy with the empathy quotient questionnaire. Although no effects of synchrony were found in the group average, after splitting the subjects into low and high empathy scorers we found subjects with high empathy (but not low empathy) had faster reaction times in synchronous blocks (compared to asynchronous blocks) (p < 10.01). We conclude that viewing avatars flashing synchronously with one's own heartbeat facilitates own body transformations and perspective taking. Only high empathy scorers showed this effect suggesting they have a superior interoceptive processing ability.

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## Subliminal Sequence Learning in Peripheral Vision

Anne Atas, Université Libre de Bruxelles, Belgium Nathan Faivre, Ecole Normale Supérieure (Paris) & Caltech, USA Axel Cleeremans, Université Libre de Bruxelles, Belgium Sid Kouider, Ecole Normale Supérieure, France

## July 3<sup>rd</sup>, 16:30-18:30: Concurrent Session 2.

Can we learn complex information without awareness? During the last fifty years, this important issue in neuroscience has been extensively investigated. However, most of empirical data suggests that learning is accompanied by awareness (Shanks, 2010 for a review). This lack of evidence for unconscious learning might reflect the systematic use of visible stimuli during the learning phase. In the present study, we overcome this problem by testing whether sequence learning can take place when each stimuli within a sequence cannot be perceived consciously. We used gaze contingent crowding (Faivre & Kouider, 2011) to ensure that each visual event can be presented for a long duration while remaining invisible. Our task involved discriminating between two subliminal sequences based on a corresponding outcome: one sequence was always associated with a monetary reward and the other with a monetary punishment. Our results revealed a significant facilitation of responses times for the reward sequence in comparison with punish sequence, whereas awareness tests indicated no awareness of the sequence of stimuli. Our results thus demonstrate, for the first time, that sequence learning can take place completely unconsciously. These findings also suggest that the serial structure of unconscious information can not only be processed but also lead to long-lasting traces in the brain.

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#### Attentional Modulation of Perception of Spatial Position Does Not Necessitate Visual Awareness

Ricky K. C. Au, University of Tokyo & Japan Society for Promotion of Science, Japan Fuminori Ono, University of Tokyo, Tokyo, Japan Katsumi Watanabe, University of Tokyo, Tokyo, Japan

## July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

In spatial localization, the "attentional repulsion effect" has been demonstrated that a briefly presented visual cue that draws attention leads to displacement of the perceived position of subsequent stimulus presented nearby to a direction opposite to the cue. The similar "attentional attraction effect" has also showed that localization is subject to retrospective influence of attention drawn by objects appearing afterwards. Here, we attempted the following question: does attentional modulation of spatial representation necessitate visual awareness to occur? In Experiment 1, we examined the attentional repulsion and attraction effects under near absence of visual awareness. Briefly presented positional cues were rendered invisible by immediate backward masking of stimuli that covered all possible cue locations. Observers judged the horizontal alignment of two vernier targets that were preceded or followed by the cue. In a separate session, we confirmed that observers could not reliably detect the location of the masked cue. The results revealed that the repulsion and attraction effects occurred even with the masked cues, though the effect magnitudes were smaller than those without the mask. In Experiment 2, we employed a dual-task paradigm that required observers to report the location of both the target and masked cue. The significant repulsion and attraction effects were associated with the actual cue locations, not with the reported cue locations. These results suggested that prospective and retrospective attentional modulation of spatial location does not require visual awareness to occur and the underlying process is based on unconscious attentional shift, rather than perception of the cues.

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#### Subjective Rating of Weak Tactile Stimuli is Parametrically Encoded in Event Related Potentials

**Ryszard Auksztulewicz**, Humboldt-Universität zu Berlin, Germany **Felix Blankenburg**, Freie Universität Berlin & Max Planck Institute for Human Development, Germany

## July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

Neural signatures of somatosensory awareness have often been studied in EEG responses to hardly detectable stimuli. Previous reports consistently showed that event-related potentials (ERP) measured over primary somatosensory cortex diverge for detected and missed perithreshold stimuli 80-100ms after stimulus onset. So far, however, the behavioural paradigms of these studies have conflated somatosensory awareness with binary stimulus detection.

In the current study, we investigated whether ERP components attributed to activity in the early somatosensory cortex would parametrically reflect the ratings of subjective stimulus awareness. EEG (64-channel) was recorded in participants (N=20) with perithreshold electrical stimulation applied to the left median nerve (pulse duration 0.2ms, 4 blocks of 200 trials including 20% catch trials with no stimulation). Participants indicated their ratings on a continuous scale, and stimulation intensity was readjusted in each block to a perithreshold level. EEG signals were entered into a full factorial analysis (SPM8) with two regressors, coding the physical stimulus intensity and the subjective rating respectively.

ERP has been found to parametrically predict the subjective rating of perithreshold tactile stimuli starting from approximately 120ms after stimulus onset (N140 component). This correlation was observed over the contralateral centroparietal sources, therefore likely corresponding to activity in early somatosensory cortex. Furthermore, in later EEG, the subjective rating of stimuli correlated with the amplitude of a broadly distributed P300 component. Our results suggest that already early neural activity in somatosensory cortices reflect subjective quality of tactile perception.

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### Crossmodal Change Blindness between Vision, Touch, and Audition: The Influence of the Task

Malika Auvray, Laboratoire d'Informatique pour la Mécanique et les Sciences de l'Ingénieur (LIMSI), France Alberto Gallace, Universita' degli Studi di Milano Bicocca, Italy Charles Spence, Oxford University, UK.

# July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

Change detection studies have revealed a striking failure by people to detect changes between two consecutively presented scenes, when they are separated by a distractor that masks the transients typically associated with change. This failure, known as 'change blindness', has been reported within vision, audition, and touch. We report a series of experiments investigating this phenomenon crossmodally. In particular, our studies revealed that

participants' performance in detecting changes in position between two tactile scenes is impaired not only when a tactile mask is introduced between the two to-be-compared displays but also when a visual mask is used instead. Interestingly, using a similar procedure, no effect of auditory masks on tactile task performance or of tactile masks on visual task performance has been reported. We have also investigated change detection performance when the two to-be-compared stimulus patterns were presented to different sensory modalities (one stimulus pattern was tactile while the other was presented visually or vice versa). The results showed that in the absence of masking, participants detected changes in position accurately, despite the fact that the two to-be-compared displays were presented in different sensory modalities. Furthermore, when a mask was presented between the two to-be-compared displays, crossmodal change blindness was elicited no matter whether the mask was visual or tactile. Finally, additional experiments revealed that the asymmetries observed between the sensory modalities are dependent on the task. These findings suggest that certain of the processes underlying the detection of changes are modality-specific whereas others are multisensory in nature.

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#### Narrowing the Explanatory Gap

Uziel Awret, Trinity DC University/ Chapman University

## July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

In "Wittgenstein's Vienna" Janic and Toulmin describe Kant's transcendental epistemology as an epistemology that determines its scope and limitations 'from the inside' so to speak. This is true for mature scientific theories in general. Godel's incompleteness theory is an example of a mature arithmetic exploring its limitations from the inside and Heisenberg's uncertainty principle is an example of a mature classical mechanics doing something similar. Will a mature enough theory of cognition discover its limitations from the 'inside' or will these limitations will be imposed on it from the 'outside', by philosophers for example? This paper will propose a way in which physical theories of cognition can determine their own limitations from the inside by exchanging philosophical ineffability with scientific intractability and by conceiving of physically possible mechanisms that can transform relational ultimates, or bits, into self-relational ones. (I will use bits and ultimates interchangeably because the Bekenstein bound is independent of physical realization.)

Using computational and biomimetic arguments, and also recent evidence from condensed matter physics, I will claim that mammalian brains are ideally suited for producing biological singularities, even harboring Closed Timelike Curves (Lloyd, Aaronson.) The question here is not whether all this seems too strange but whether it is strange enough. Next I will discuss the philosophical advantages of this position and the differences between it, dual aspect theories of consciousness, and Russelian experiential monism.

I believe that scientific approaches to the explanatory gap must first tackle the information confinement problem. Transmutation begins with a good crucible.

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#### In Quest for Neural Correlates of Face Recognition

Vadim Axelrod, Tel Aviv University, Israel Galit Yovel, Tel Aviv University, Israel

*July* 4<sup>th</sup>, 14:00-16:00: *Poster Session* 1.

One of the most fascinating properties of human's visual system is its fast and effortless face recognition abilities. The Fusiform Face Area [FFA], the largest face-selective region, is considered by many to be a key region for face recognition. Surprisingly, only few studies demonstrated its direct involvement in this process. Alternatively, the Anterior Temporal Lobe [ATL] and the recently discovered face-selective region in the ventral ATL were suggested to play important role in face recognition. Unfortunately, severe MRI susceptibility artifacts especially in the face-selective ATL area precluded systematic exploration of this area. In the current high-resolution fMRI study we explored identity decoding of familiar faces. We presented 8 different images of two famous people (the prime-minister and the president of Israel). Importantly, we used an optimized scanning technique, which permitted us for the first time to localize the ATL face-selective region in most of the subjects. We applied ROI-based as well as searchlight multivariate pattern analysis (MVPA) to examine face identity decoding in face-selective and non-face selective region in the ATL, but not in the face-selective ATL area. This result provides support to the idea that face-recognition is a multi-stage process, which might be achieved by both face-selective and non-face selective cortex.

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## HOT Becomes HOO: A Modification of the Higher-Order Thought Theory of Consciousness

James Bachmann, University of Alberta, Canada

# *July* 4<sup>th</sup>, 14:00-16:00: *Poster Session* 1.

According to David Rosenthal's higher-order thought theory of consciousness, a lower-order mental state is phenomenally conscious when it is accompanied by a suitable higher-order thought. At the same time, it seems the lower-order mental state is also altered in light of the concepts contained in the nonconscious higher-order thought. I argue that this creates a problem in that due to this alteration, it cannot be the lower-order mental state of which we are conscious. I examine this problem on both the theoretical and neuronal level and put forth a modification to the higher-order thought theory according to which it is not the lower-order mental state of which we are conscious, but rather a new mental state that is a combination of the lower-order mental state and the concepts contained in the higher-order thought. I call this modified approach the higher-order output (HOO) theory of consciousness.

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#### Mental Causation and Mental Property Realism.

#### Andrew Bailey, University of Guelph, Canada

## July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

A key, somewhat unexamined, theme in the debate on mental causation is the question of property realism. We want mental properties to be real and to be causal, but -- prima facie surprisingly -- there are tensions between these desiderata. The more full-blooded one's realism about higher-level properties, including mental properties, the greater the force of exclusion-type considerations suggesting that they are epiphenomenal. On the other hand, properties are often individuated by the contributions they make to the causal powers of the objects that instantiate them, so there's an apparent risk that epiphenomenalism slides into eliminativism. This presentation will lay out and make clear these issues, and present a taxonomy of the options available so that their relative attractiveness can be more easily assessed.

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# Losing Your Left Side of the World by Dozing Off: Auditory Spatial Neglect-Like Effects in Drowsy Normal Participants

Corinne Bareham, MRC - Cognition and Brain Sciences Unit, Cambridge, UK

# *July* 5<sup>th</sup>, 14:00-16:00: *Poster Session* 2.

Normal participants performed an auditory spatial localisation task while falling asleep. 16 out of the 30 participants made more left-tone than right-tone errors, demonstrating a rightward bias in spatial attention. EEG correlates of theta-alpha ratios from 129 electrodes were PCA reduced and the first principal component used as an objective measure of physiological drowsiness (drowsiness index). Regression analyses indicated that the history of theta-alpha ratios – specifically the average from the four trials preceding the auditory stimulus - provided the best predictor of performance on the task. A nonparametric analysis indicated that left-tone errors are preceded by significantly higher drowsiness indices than right-tone errors (p = 0.029). This significant difference between left and right tones was not evident for correct trials on the task, or for error trials performed during a "full wakefulness" baseline task. In addition, when participants' data were split into wakeful and drowsy quartiles based on this drowsiness index, a significantly greater frequency of left versus right tone errors were found in the drowsy trials;  $X^2(1) = 5.88$ , p = 0.0153. These results indicate that during periods of reduced alertness induced by sleep onset, participants are more likely to make left-tone errors - indicative of a rightward spatial bias similar to that of clinical neglect; a stroke-related condition whereby patients fail to attend to stimuli on one side of the body or environment not due to a deficit in sensation. The findings support those of previous studies of spatial attention using indirect measures of alertness.

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#### The MVGC Toolbox: A New Approach to Computing Multivariate Granger Causality

**Lionel Barnett**, Sackler Centre for Consciousness Science & Dept of Informatics, University of Sussex, UK **Anil K Seth**, Sackler Centre for Consciousness Science & Dept of Informatics, University of Sussex, UK

# July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Wiener-Granger causality is a statistical notion of causality applicable to time series data, whereby cause precedes, and helps predict, effect. It is defined in both time and frequency domains, and allows for the conditioning out of

common causal influences. Originally developed in the context of econometric theory, it has since achieved broad application in the neurosciences. It also forms the basis for *causal density*, a metric reflecting the balance between globally integrated versus segregated dynamics in a neural system, which has been proposed as a measure of conscious level. Prediction in the Granger causality formalism is based on VAR (Vector AutoRegressive) modelling and the standard approach to computing Granger causality thus involves estimation of regression coefficients. The MVGC Matlab toolbox, intended as a successor to Seth's widely-used GCCA toolbox, takes a more flexible and powerful approach, based on multiple equivalent representations of a VAR model by (i) regression coefficients, (ii) the autocovariance sequence and (iii) the cross-spectral power density of the underlying process. It features a variety of algorithms for moving between these representations, enabling selection of the most suitable algorithms with regard to computational efficiency and numerical accuracy. In particular, it facilitates fast and accurate estimation of the computationally awkward case of conditional Granger causality in the frequency domain. Like GCCA it features routines for statistical significance testing, model order selection, etc., and also for the computation of causal density. Here we explain the theoretical basis, computational techniques and application to empirical Granger-causal inference of the MVGC toolbox.

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#### How Can We Know When We Know We Know? Towards Measuring Metacognition

Adam B Barrett, Sackler Centre for Consciousness Science & Dept of Informatics, University of Sussex, UK Anil K Seth, Sackler Centre for Consciousness Science & Dept of Informatics, University of Sussex, UK

# July 3<sup>rd</sup>, 14:00-16:00: Concurrent Session 1.

A major goal in consciousness science is to discriminate between unconscious and conscious processes. Behaviourally, conscious cognition can be inferred by measuring metacognition, (i.e. knowledge of accuracy of perception, or knowledge of knowing). Metacognition is however difficult to assess consistently. Under popular signal detection theory models for stimulus classification tasks, measures such as confidence-accuracy correlation, and type II d', are highly sensitive to response biases in both the type I (classification) and type II (metacognitive) tasks. Maniscalco and Lau (2011; Cons. Cogn.) recently addressed this issue via a new measure: meta-d'. This is the type I d' that would have led to the observed type II data had the subject used all the type I information. Trivially, meta-d'=d' irrespective of response bias when type I and II decisions are based on the same Gaussian signal. However, its behaviour under more general and empirically plausible scenarios is unknown. Here, we describe a rigorous set of analytical and simulation results, leveraging new analytical formulae for meta-d'. We systematically analyse scenarios in which metacognitive judgments utilize enhanced or degraded versions of the type I signal, and when decision criteria are jittered. Analytically, meta-d' values typically reflect the underlying model well, and are stable under changes in decision criteria; however, in extreme cases meta-d' becomes unstable. Simulations of experiments indicate that data must meet certain criteria for meta-d' to be numerically accurate and stable. Our results provide support for meta-d' as a useful, stable measure of metacognition, and new rigorous methodology for its application.

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#### Repetition and Semantic Relevance Reinforcement in the Formation of Declarative Memory

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# July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

Learning can be reinforced by means of two kinds of strategy: repetition and semantic relevance of the stimulus. In the second case, memory formation can occur with a single presentation. In Cognitive Neurobiology, these strategies correspond respectively to the induction of long-term potentiation by means of temporal summation of stimuli, and spatial summation induced by the matching of bottom-up (sensory) and top-down (attentional/motivational) stimulation. We executed two series of cognitive experiments to test the advantages of each strategy. A population of 157 undergraduate students was presented to linguistic stimuli of two kinds: unrepeated sentences containing information relevant or not to their context, and repeated sentences with irrelevant information. The relevance or irrelevance of the sentences was defined by means of pilot experiments with colleagues of the students. After a brief, sequential presentation of the sentences using a screen projector in the classroom, the students were asked to respond to a written questionnaire containing one question about each sentence. The results (proportion of correct answers) indicate that both strategies are efficacious; the semantic strategy is more efficient in cases when the content of a sentence is highly relevant to the subjects in context. This result suggests that conscious appraisal of semantic content can increase the efficiency of learning and memory formation.

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## The Unity of Consciousness

#### Tim Bayne, University of Oxford, UK

July 3<sup>rd</sup>, 09:15-10:30: Keynote Lecture.

Some theorists maintain that consciousness is necessarily unified; others maintain that although consciousness is typically unified, the unity of consciousness can break down on occasions; and still others argues that the apparent unity of consciousness is an illusion, and that consciousness is typically disunified. This talk provides an overview of the debate between these three approaches to consciousness. I distinguish different forms that the unity of consciousness can take, and I provide some tentative reasons for thinking that there is a sense in which consciousness is necessarily unified. I conclude with a discussion of how debates about the unity of consciousness might inform the development and evaluation of theories of consciousness.

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#### Titchener's "Introspectionism" contra Contemporary Introspective Approaches in Scientific Psychology

#### Christian Beenfeldt, University of Copenhagen, Denmark

## July 3<sup>rd</sup>, 14:00-16:00: Concurrent Session 1.

Arguably, the "introspectionist" psychologist Edward B. Titchener was the father of systematic, laboratory-based psychology in America (Boring 1927 and 1950). His scientific work was focused directly on discovering the underlying structure of consciousness, the very subjectivity that natural scientists have traditionally been eager to eschew (Green 2010). It is often claimed that attempts in scientific psychology to studying the mental directly, via introspection, invariably lead to some form of introspectionism—i.e. to some kindred version of the system and characteristic approach to experimental psychology famously developed by Titchener.

In this talk, it is argued that one should not be mislead by surface similarities between contemporary introspection-oriented approaches in psychology, e.g. Descriptive Experience Sampling (Heavey and Hurlburt 2008), and Titchenerian psychology (e.g. Titchener 1902). It should, rather, be recognized that the fundamental theoretical commitments of the latter approach (1) differ profoundly from contemporary assumption and (2) can be shown to have been determinative for its conception of both the aims and the investigative resources of scientific psychology as such. Further, it will be maintained that "introspectionism", by contemporary lights, was a largely anti-introspective research program. The core investigative methodology of Titchenerian psychology was "analysis". This approach, it will be argued, was a largely speculative and highly theory-laden research methodology—not, by any means, an intended way of obtaining unbiased self-reflective reports.

Contemporary defenders of introspection in experimental psychology will thus find themselves best served by fundamentally distinguishing their approach from that of introspectionism, with respect to both the means and the aim of psychological enquiry. This clarification should help keep the contemporary debate in consciousness studies about the nature and scientific viability of introspection focused on the right target.

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#### Representations of Unseen Targets during the Attentional Blink are Durable

**Fredrik Bergström**, Umeå center for Functional Brain Imaging & Umeå University, Sweden **Johan Eriksson**, Umeå center for Functional Brain Imaging & Umeå University, Sweden

## July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

Conscious processing is generally seen as required for flexible and willful actions, as well as for tasks that require durable information maintenance. Here we present research that questions the assumption that only consciously presented information is durable. Using the attentional blink phenomenon, we rendered otherwise relatively clearly perceived letters unconscious. Critically, we systematically manipulated the delay between stimulus presentation and response, for the purpose of estimating the durability of unconscious representations. Using the intervals of 5, 10, and 15 seconds between stimulus presentation and a four-alternative forced-choice task we found that behavioral performance was above chance-level for items not seen during all time intervals. There was an interaction effect between behavioral performance for items unseen was constant over time, within the time window investigated. The result suggests that unconsciously presented information is durable for at least 15 seconds, and that conscious and unconscious maintenance processes might recruit different mechanisms.

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## Side Effects of Being Blue: Influence of Sad Mood on Visual Statistical Learning

Julie Bertels, Université Libre de Bruxelles & Fonds de la Recherche Scientifique – FNRS, Belgium Catherine Demoulin, Université Libre de Bruxelles, Belgium Ana Franco, Université Libre de Bruxelles & Fonds National de la Recherche, Luxembourg Arnaud Destrebecgz, Université Libre de Bruxelles, Belgium

# July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

It is well established that mood influences many cognitive processes, such as learning and executive functions. Although statistical learning is assumed to be part of our daily life, as mood does, the influence of mood on statistical learning has never been investigated before. In the present study, a sad vs. neutral mood was induced to the participants through the listening of stories while they were exposed to a stream of visual shapes made up of the repeated presentation of four triplets, namely sequences of three shapes presented in a fixed order. Given that the inter-stimulus interval was constant within and across triplets, the only cues available for triplet segmentation were the transitional probabilities between shapes. Both direct and indirect measures of learning revealed that participants learned the statistical regularities between shapes. Interestingly, although they performed similarly in the sad and neutral mood conditions, sad participants were more confident in their responses. Moreover, the combined analysis of objective and subjective measures of consciousness revealed that while "neutral" participants' performance relied on both explicit and implicit knowledge of the regularities, sad participants' performance most probably relied exclusively on extensive explicit knowledge.

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## **Consciousness as Common Information**

Nils Bertschinger, Max-Planck Institute for Mathematic in the Sciences, Germany Eckehard Olbrich, Max-Planck Institute for Mathematic in the Sciences, Germany Johannes Rauh, Max-Planck Institute for Mathematic in the Sciences, Germany

## July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Consciousness is at the basis of our subjective experience and has been studied from many different perspectives. Nevertheless, a general theory, especially with respect to its functional role, is still lacking. Most theories stress that consciousness gives rise to a unified experience i.e. requires the integration of information coming from different modalities. In [1] and following articles information-theoretic measures were used to quantify this integration. Here, we propose a more specific hypothesis that not just integration but actually the establishment of {common information} is the hallmark of consciousness. Our notion of common information is derived from the game-theoretic concept of common knowledge. There, some event \$E\$ is commonly known among a group of agents, if not only every agent know \$E\$, but also knows that everyone knows it, knows that everyone knows and so on. Common knowledge has been shown to be necessary for coordinated and synchronized actions. Starting from this hypothesis, we derive information-theoretic quantities which capture shared and eventually common information. Compared to the previously considered measures for integration, e.g. mutual and multi-information, which quantifies all statistical dependencies between different brain areas, shared information is a stronger requirement and takes only information which is available to all areas into account. Finally, we discuss possible implications for conscious processing and derive experimentally testable predictions.

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#### Neural Correlates of Associative Working Memory and Long-Term Memory

Sarah Beul, Radboud University Nijmegen, the Netherlands Heiko C. Bergmann, Radboud University Nijmegen, the Netherlands Mark Rijpkema, Radboud University Nijmegen, the Netherlands Guillén Fernández, Radboud University Nijmegen, the Netherlands Roy P.C. Kessels, Radboud University Nijmegen, the Netherlands

## July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

Consciousness and working memory (WM) are intricately related, and WM tasks are a common tool to study consciousness. Recently, an increasing number of neuroimaging and lesion studies have shown hippocampal contribution to WM processing. However, this hippocampal involvement could reflect incidental long-term memory (LTM) encoding or relate to spatial processing. To disentangle WM processing and LTM formation, we administered a four-pair delayed-match-to-sample associative WM task in an fMRI study. Subsequently, an unexpected recognition-memory (LTM) task was administered. Brain activity during retrieval was analyzed based on WM and LTM performance, which allowed us to isolate activity predicting WM success in the absence of successful LTM formation. We performed whole-brain analyses ( $\alpha$ =.001, contiguous voxels>50) of retrieval-related brain activity of 19 participants. During successful WM processing without LTM encoding, increased activation was

found in orbito-frontal cortex, cingulate gyrus, precuneus and temporal areas. Even using a lower threshold, no hippocampal activation became apparent in the WM contrast. Incidental LTM formation was accompanied by increased activation in parahippocampal gyrus, superior temporal pole and temporal areas. Concluding, no hippocampal contribution to pure WM processing could be detected. Our results therefore do not provide additional evidence for the hypothesis that hippocampus is involved in associative WM processing. In light of this finding, results of previous studies have to be interpreted cautiously with respect to their informative value about non-spatial associative WM processing. These results can inform more accurate models of the neural correlates of WM, which are necessary to further elucidate the connection between WM and consciousness.

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#### **Neural Signatures of the Perceived Audiovisual Synchrony**

Marek Binder, Jagiellonian University, Poland

## July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

Creating multimodal representations from the available sensory input is an important aspect of the putative neural mechanism of consciousness. Here neural correlates of this process were studied using EEG and simultaneity judgment task with audiovisual stimuli in which subjects report whether pairs of stimuli are either "synchronous" or "asynchronous".

Thirty one volunteers participated in two experiments. In the Experiment 1 the stimuli were pairs of 10ms whitenoise bursts and flashes. The values of stimulus onset asynchrony were based on the individual estimates of simultaneity thresholds - the intervals between audio and visual stimulus for which there is an equal probability of "simultaneous" or "non-simultaneous" response. On presenting each pair subjects pressed one of two buttons to indicate their synchrony. In the Experiment 2 the setup was identical, except subjects indicated if audio-visual pair began simultaneously.

EEG was recorded from 10-20 system 32 scalp sites with Ag-AgCl active electrodes (BioSemi Active-Two). Datasets were analyzed using BrainVision Analyzer. Neural correlates of synchrony judgments were studied by comparing ERPs in trials that were judged as either simultaneous or non-simultaneous.

In both experiments at about 200ms after the second stimulus onset a stronger ERP wave positivity for trials judged as non-simultaneous was observed in parieto-central sites.

The results demonstrate that subjective perceptions of temporal relations between multimodal stimuli with identical physical parameters are reflected in localized ERP differences. Given their localization in the posterior parietal regions, these differences may be viewed as correlates of conscious perception of temporal integration vs. separation of audiovisual stimuli.

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## Turning on the Light to See How the Darkness Looks

Susan Blackmore, University of Plymouth, UK

July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

William James described introspection as like "trying to turn up the gas quickly enough to see how the darkness looks". The modern equivalent is trying to open the fridge door fast enough. I suggest that this curious property of introspection is why some common assumptions we make about consciousness are false.

Inquiring into one's own conscious experience "now" produces different answers from inquiring into the immediate past. I have explored this extensively using Zen meditation. "Now" consciousness seems to be unified with one self experiencing a stream of consciousness. This implies a fundamental difference between the contents of the conscious stream and the brain's unconscious processing. This difference underpins the hunt for the NCCs.

By contrast, looking back into the immediate past reveals no unified conscious stream, but multiple backwards threads of different lengths, continuing without reference to each other or to a unified self. From this perspective there is no hard problem and no magic difference.

I suggest that the apparent difference between conscious and unconscious events is an illusion created by introspection into the present moment. Most of the time we are not doing this but whenever we do the mystery appears. Looking into those times when we are not deluded is like turning on the light to see how the darkness looks.

Introspection of this kind is not science, but I submit that it can help us better examine the many assumptions on which our science of consciousness is currently based.

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#### The Fundamental Methodological Problem of Consciousness Research

Ned Block, New York University, USA

July 5<sup>th</sup>, 14:00-16:00: Symposium 3.

Theories of consciousness are ultimately based on what we and other people report (or better: think) about their conscious states in various experimental paradigms. Some approaches—mine for example—claim that on the basis of such evidence we can conclude that consciousness is richer than cognitive access and in particular there are experimental setups where inevitably reports and other cognitive processes will not reflect all of the specific details of conscious experience. But how can we know about the unaccessed conscious detail when being unaccessed would seem to preclude such knowledge? A similar problem arises in knowing about the conscious experience of unattended stimuli, since reporting requires attention to the stimuli or to memory traces of them, and attention is known to alter conscious experience. This talk proposes a solution to this problem.

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#### Is Propofol-Induced Loss Of Consciousness A Sleep-Like State?

Melanie Boly, University of Liege, Belgium

July 3<sup>rd</sup>, 11:00-13:00: Symposium 1.

Mechanisms of propofol-induced fading of consciousness, as well as the relationship between propofol anesthesia and sleep remains poorly understood. We will review recent neuroimaging studies investigating neural correlates of loss of consciousness during propofol sedation and non-REM sleep. We will then highlight some commonalities as well as observed differences in terms of spontaneous EEG, or functional and effective connectivity (using highdensity EEG, functional MRI or TMS-EEG) between propofol and non-REM sleep. Finally, we will discuss the implications of these results for neural correlates of consciousness and for their use as clinical tools to detect awareness during anesthesia, and in other altered consciousness states.

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#### Consciousness and the Prefrontal Parietal Network: Insights from Attention, Working Memory and Chunking

Daniel Bor, University of Sussex, UK Anil K. Seth, University of Sussex, UK

# July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

Empirical research is converging on the view that the prefrontal parietal network (PPN) is closely associated with consciousness. Theoretical work has primarily sought to explain how informational properties of this cortical network could account for phenomenal properties of consciousness. However, less focus has been given to psychological features. The PPN has independently been heavily linked with various cognitive processes, such as attention. We describe how this literature is under-appreciated in consciousness science, in part due to an increasingly entrenched assumption of a strong dissociation between attention and consciousness. We argue instead that, although objects can under certain circumstances be attended to in the absence of conscious access, attention as a content selection and boosting mechanism is an important and necessary aspect of consciousness. Like attention, working memory and executive control involve the interlinking of multiple mental objects and have also been closely associated with the PPN. We propose that this set of cognitive functions, in concert with attention, constitute core psychological components of consciousness. One related process, chunking, has been shown to activate PPN particularly robustly, even compared with other cognitively demanding tasks, such as working memory or mental arithmetic. It is therefore possible that chunking, as a tool to detect useful patterns within an integrated set of intensely processed (attended) information, has a central role to play in consciousness. Synthesizing these lines of evidence, we suggest that a key evolutionary purpose of consciousness may be to provide innovative solutions to complex or novel problems.

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# Is There A Vestibular-Somatosensory Interaction? Evidence From Brain-Damaged Patients And Healthy Participants

## Gabriella Bottini, University of Pavia, Italy

# July 6<sup>th</sup>, 14:00-16:00: Symposium 4.

Signals from the vestibular system make a crucial contribution to everyday behaviours. No primary vestibular cortex has been identified; rather several multimodal areas integrate vestibular, visual and somatosensory signals. Functional imaging results revealed a clear anatomical overlap of vestibular and somatosensory projections in a number of parietal areas. Moreover, clinical evidence suggests a direct functional link between these sensory systems: a temporary remission of tactile imperception has been observed after left cold caloric vestibular stimulation in right and left brain-damaged patients. Further, psychophysical studies showed that vestibular stimulation improves detection of touch but, intriguingly, it also dramatically increases the threshold for detecting pain. These results lead to the suggestion that specific cross-modal perceptual interactions occur between vestibular and somatosensory systems. Successful interaction with the environment involves constant adjustment and updating of multisensory inputs. The vestibular system seems to play a crucial role in influencing processing within other individual sensory channels.

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## On Being in Two Minds: Panpsychism, Brain Bisection & the Mind-Mind Problem

#### Simon Bowes, University of Sussex, UK

# July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

It has been argued (e.g. by Galen Strawson) that panpsychism is the position to take on the place of consciousness in nature due to the inconceivability of eliminativism or emergentism; we don't have to explain how consciousness arose, or arises, as it has always been there. One problem for this argument is the composition problem – it's hard to see how the 'small minded' particles that we are composed of can be combined to make one big one. I argue that this problem is not a real problem that it seems like one because of an overly 'selfish' conception of subjecthood, but that the result of deproblematising composition, which is achieved by reference to so-called 'split-brain' subjects, actually allows us to see how emergentism might be the best explanation after all. An understanding of how and what can compose to make subjects like us points to Aaron Sloman's notion of 'virtual machines.' This allows us to cut through the problem of the relationship between the psychological and physical levels of explanation: the physical describes the composition of the parts that make up 'mental machines', which can be said to possess something like 'qualia' by virtue of developing a perspective on its sensory input; the psychological describes the on-going function of those parts in the machine they exist to be a part of.

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## The Attentional Blink and All-or-None Perception

Howard Bowman, University of Kent, UK Haynes, S, University of Kent, UK Chennu, S, University of Cambridge, UK Craston, P, University of Kent, UK Wyble, B, University of Syracuse, USA

# July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

Our paper focuses on a neural network model that helps further our understanding of visual consciousness. We combined two important hypotheses on the impairment of conscious visual perception in the attentional blink paradigm and propose a biologically plausible extension to a prominent neural network model (eST2) that can account for both. The attentional blink results when subjects view a rapid serial visual presentation incorporating a masked second target (T2) 200-500ms after the first target (T1). Most often, subjects are not consciously aware of T2's identity, hence the name attentional blink. However the T2 does produce semantic Event Related Potentials (ERPs) and can function as a prime in a subsequent task. The first hypothesis (Sergent and Dehaene, 2004) relates to conscious perception during the attentional blink being more all-or-none, as measured by subjective visibility. The second hypothesis we make use of is Vogel and Luck's (2002) delayed working memory consolidation. This follows from EEG experiments that showed delayed onset of the P3 ERP (a marker of working memory update) for an unmasked T2 compared with T1. Our model explains both these results with a pattern of activation that is strength-sensitive during its first phase, but becomes more all-or-none during its later phase. In the case of the first target, the blaster in the eST2 model (Wyble et al, 2009) fires early, attentionally enhancing the strength-sensitive phase. But for the second target during the attentional blink, the blaster is delayed by some 150ms and fires during the more all-or-none phase of activation.

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A Psychophysiological Investigation into the Electrodermal Components Underlying the Rubber-hand illusion in those who Report Out-of-Body Experiences and Kindred Hallucinations of the Body and 'Self'.

Jason J Braithwaite, University of Birmingham, UK Emma Broglia, University of Birmingham, UK

# July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

An out-of-body experience (OBE) can be defined as "an experience in which a person perceives the world from a location outside their physical body". Previously, research has indicated that these experiences reflect a temporary breakdown in typically stable egocentric body-based processing and multi-sensory integration (Blanke et al., 2005). The consequence of this is a disintegration of the bodily 'self' in space. In addition to OBEs, kindred hallucinations like "sensed-presence experiences" (SPE) - are also very common in non-clinical samples. Both are thought to reflect temporary disorders in body processing. Here we present preliminary findings from the first investigation of electrodermal activity from hallucinating OBEers and those who report SPEs (relative to controls) during the induction of a rubber-arm illusion. This task has been shown to be a useful and reliable measure of embodiment and multi-sensory integration. We present evidence for a new psychophysiological component of the electrodermal response underlying the induction of the rubber-hand illusion – that appears to occur principally with the existence and strength of the illusion. Specifically, we show that a DC shift emerges and precedes the report of the rubber-arm illusion in those that experience the illusion and that this component is stronger for those who report stronger illusions and those who are prone to body-based hallucinations (OBEs / SPEs). This component is severely attenuated or absent in those who do not report the illusion. In addition, there was some evidence that electrodermal responses to a threat to the rubber-arm were heightened for those reporting OBE experiences.

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#### **Binocular Rivalry Requires Attention**

Jan Brascamp, Utrecht University, the Netherlands Randolph Blake, Vanderbilt University, USA & Seoul National University, Republic of Korea

# July 6<sup>th</sup>, 11:00-13:00: Concurrent Session 4.

Binocular rivalry occurs when the two eyes view different stimuli – rather than melding into a stabile percept, the two dissimilar images compete for dominance, the result being fluctuations in perception over time. Although binocular rivalry has been widely studied, fundamental questions about this intriguing phenomenon remain unanswered. Here we address one such question: can the alternating periods of dominance characterizing rivalry proceed without attention? To measure cycles of rivalry during inattention we could not utilize perceptual reports, because observers perforce were paying no attention to the rival stimuli. Instead, we asked observers to report perception immediately before withdrawing attention from rivalry and then again, a few seconds later upon returning attention to rivalry. Because binocular rivalry's alternation cycle exhibits some regularity, a strong statistical association normally exists between dominance at one moment and dominance a few seconds later. This same association should also occur between two moments straddling a period of inattention if, but only if, rivalry continued during that period. Instead, this association completely disappeared, with the effect of inattention exactly mimicking the effect of physical removal of the rival images. Buttressed by further control experiments, this finding shows that the cyclic alternations that define binocular rivalry require attention.

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# The Consciousness Quotient Inventory (CQI): Introducing Consciousness Experience as a Research Variable in Psychological Assessment

**Ovidu Brazdau**, Consciousness Quotient Institute, USA **Petru-Madalin** Constantinescu, University of Bucharest, Romania

# *July* 5<sup>th</sup>, 14:00-16:00: *Poster Session* 2.

Although the consciousness research has widely developed in the past decades, it is quite difficult to create/establish a psychological assessment of conscious experience, especially in studying consciousness as a research variable (Baars, 1997). The Consciousness Quotient Inventory - CQI (Brazdau, 2008) represents an innovative contribution in this field, that attempts to objectively quantify the subjective experience of being conscious, using self-reports. CQI is the first inventory that takes consciousness through rigorous psychological assessment methodology in relation with various important personality measures (CPI, EPI, NEO PI-R, and MSCEIT). The dimensions of the conscious experience that compose Consciousness Quotient (CQ) are physical, emotional, mental (cognitive), spiritual, social-relational and self-consciousness. This study (N=140) further establishes the psychometric properties of CQI and analyzes the factorial structure of the CQI.

#### **Extended Consciousness?**

#### Andrew Brook, Carleton University, Canada

July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Advocates of the extended mind hypothesis can both oppose (Clark) and accept (Noe) what we might call the extended consciousness hypothesis, the hypothesis that consciousness extends beyond brain and skin. Interestingly, none of the arguments that are effect for and against the extended mind hypothesis work very well when applied to the question of whether consciousness extends in the same way. The considerations relevant to finding a principled boundary (or boundaries) for consciousness are different from those relevant to finding in a principled boundary (or boundaries) for the mind. If we identify consciousness with what I call the global conscious representation or what Bayne (2010) calls the unified phenomenal field, there is no basis for holding that any part of such a representation or field extends beyond the brain. We conclude by examining some arguments by Noe and others against this view.

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#### The Neural Dynamics of Loss and Recovery of Consciousness under General Anesthesia

#### Emery Brown, Harvard Medical School, USA

## July 3<sup>rd</sup>, 11:00-13:00: Symposium 1.

General anesthesia is a drug-induced, reversible condition comprised of five behavioral states: unconsciousness, amnesia (loss of memory), analgesia (loss of pain sensation), akinesia (immobility), and hemodynamic stability with control of the stress response. The mechanisms by which anesthetic drugs induce the state of general anesthesia are considered one of the biggest mysteries of modern medicine. We have been using three experimental paradigms to study general anesthesia-induced loss of consciousness in humans: combined fMRI/EEG recordings, high-density EEG recordings and intracranial recordings. These studies are allowing us to establish precise neurophysiological, neuroanatomical and behavioral correlates of unconsciousness under general anesthesia. Combined with our mathematical modeling work on how anesthetics act on neural circuits to produce the state of general anesthesia we are able to offer specific hypotheses as to how changes in level of activity in specific circuits lead to the unconscious state. We will discuss the relation between our findings and two other important altered states of arousal: sleep and coma. Our findings suggest that the state of general anesthesia is not as mysterious as currently believed.

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#### Automation Technology and Sense of Control: A Window on Human Agency

Berberian Bruno, ONERA, France Jean-Christophe Sarrazin, ONERA, France Patrick Haggard, University College London, UK

July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Previous studies have shown that the perceived times of voluntary actions and their effects are perceived as shifted towards each other, so that the interval between action and outcome seems shortened. This has been referred to as 'intentional binding' (IB). However, the generality of this effect remains unclear. Here we demonstrate that Intentional Binding also occurs in complex control situations. The scenario chosen for our experiment involves piloting an aircraft in crowded airspace. The subject has to maintain separation from surrounding traffic. When another aircraft approaches too close, the navigation system signals a conflict to the pilot. In manual mode, the pilot takes action to resolve the conflict, and then receives feedback on the screen that the conflict has been resolved. In automatic mode, the pilot simply receives a visual signal that the autopilot has commanded action, and again receives conflict resolution feedback on the screen. Two factors are manipulated: (1) Levels of Automation, (2) Effective time between command delivery and conflict resolution. After each conflict, subjects estimated the time between their action (Command delivery) and its effect (the visual Conflict resolution signal). In addition, we asked participants to report their feelings of authorship at the end of each block of trials. Our results first indicated a strong relation between measures of IB and different levels of system automation. Second, measures of IB were related to explicit agency judgement in this applied setting. We discuss the implications for the underlying mechanisms, and for sense of agency in automated environments.

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# To What Extent are the Cognitive Mechanisms Leading to Good Performance Related to the Generation of Subjective Experience?

## Florence Campana, Laboratoire de Neurosciences Cognitives, France Catherine Tallon-Baudry, Laboratoire de Neurosciences Cognitives, France

# *July* 4<sup>th</sup>, 14:00-16:00: *Poster Session* 1.

Understanding the link between cognition and subjective experience could help better defining the nature of consciousness. The cognitive mechanisms leading to good performance and those mechanisms generating subjective experience could be closely related, or they could be independent of one another. The first hypothesis predicts a robust link between subjective experience and objective performance, whereas the last one predicts dissociation between them. To experimentally distinguish between these possibilities, we conducted two behavioral experiments using visual stimuli, in which subjects had to perform, at each trial, both a subjective task and an objective task. To make sure that the subjective and objective tasks tapped onto exactly the same level of visual representation, we presented subjects with textured stimuli in which a single low-level feature (orientation) could vary, thereby defining a shape. Subjects had to report whether they had the feeling a shape was embedded in the texture or not (subjective experience) and to discriminate the orientation of the shape (objective performance). By varying parametrically a texture parameter (line length), we determined whether objective and subjective measures co-vary or not. In both experiments, we observed a significant dissociation between the evolution of subjective experience and objective performance. More precisely, in both experiments, subjective experience improved more with the manipulated texture parameter than objective performance. Our result therefore suggests that the subjective feeling of presence can be dissociated from an objective cognitive processing, even when both are based on strictly identical physical information. In this experiment, subjective experience therefore appears distinct from efficient information processing.

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# It Feels like It's Me: Interpersonal Multisensory Stimulation Enhances Somatosensory Mapping of Shared Tactile Stimuli

Flavia Cardini, Royal Holloway, University of London, UK Ana Tajadura-Jiménez, Royal Holloway, University of London, UK Andrea Serino, Centro studi e ricerche in Neuroscienze Cognitive, University of Bologna, Italy Manos Tsakiris, Royal Holloway, University of London, UK

# *July* 5<sup>th</sup>, 14:00-16:00: *Poster Session 2*.

We constantly feel, see and move our body, and have no doubt that it is our own, distinct from the body of other people. At the same time, understanding other people's feelings in social interactions depends on the ability to map onto one's own body the observed experiences on the bodies of others. It has been shown that the more similar others are perceived to be to our self, the stronger this mapping is. While previous studies have focused on existing similarities or differences between self and other, we ask whether the experimental change of the self-other boundaries can lead to changes in somatosensory processing. It has been shown that the perception of tactile stimuli on the face is enhanced if participants concurrently observe a face being touched. This Visual Remapping of Touch (VRT) is significantly stronger when viewing one's own face as compared to that of another individual. We used the enfacement illusion that relies on synchronous interpersonal multisensory stimulation (IMS) to manipulate self-other boundaries. Following synchronous, but not asynchronous IMS, the self-related enhancement of the VRT effect was extended to the other individual. These findings suggest that shared multisensory experiences represent one key way in which the boundaries and perceived similarity between self and others can be overcome, as evidenced by changes in somatosensory processing of shared tactile stimuli.

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## The Neural Correlates of Psychedelic Consciousness as Determined by fMRI and MEG Studies with Psilocybin

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## July 3<sup>rd</sup>, 14:00-16:00: Concurrent Session 1.

Psychedelic drugs produce profound changes in consciousness. People often describe their experiences with psychedelics to be among the most profound of their whole lives. Here we administered the classic psychedelic psilocybin (magic mushrooms) intravenously to two groups of 15 healthy subjects in two placebo-controlled resting state fMRI studies that were designed to image the transition from normal waking consciousness to the

psychedelic state. Subjects reported a rapid onset of effects after injection, with peak effects occurring after 3-4 minutes and consisting of altered space and time perception, vivified imagination, disturbed ego-boundaries and visions of animated patterns and complex imagery. Despite reports of profound changes in consciousness, we found only decreases in brain activity after psilocybin and this was maximal in important 'connector hubs', e.g. the thalamus, medial prefrontal cortex (mPFC) and posterior cingulate cortex (PCC). The magnitude of the decreases was positively correlated with self-ratings of 'intense' drug effects. Measures of functional connectivity revealed increased thalamocortical coupling after psilocybin, decreased mPFC to PCC coupling and increased coupling between the default mode network (DMN) and task-positive network (TPN). The increases in DMN-TPN coupling correlated positively with the intensity of the subjective effects. We speculate that the decreases in connector hub activity after psilocybin permit unconstrained system-dynamics and so an unconstrained style of cognition. We also interpret the decreases in mPFC-PCC and increases in DMN-TPN coupling after psilocybin as further evidence of disorganized system dynamics - potentially related to disturbed ego-boundaries.

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# A Case Study – Assessing the Narrative Pattern Analysis of Primary Process Language and Body Boundary Imagery in Discourse of Religious-Mystical and Psychotic Experiences

Laura A. Cariola, Lancaster University, UK

## July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Computer-assisted content analysis has identified that the narrative pattern of linguistic variables associated to regressive states, i.e., primary process language and body boundary imagery, follows a fifth polynomial degree curve that reflects Underhill's (1911) five-stages of development in Christian mysticism. This study investigated the narrative pattern of primary process language and body boundary imagery in the discourses of mystical and psychotic altered states of consciousness (ASC). The mystical discourse was based on Saint Teresa of Avila's (1567) mystical writing in "The Way of Perfection" and the psychotic discourse is Daniel Paul Schreber's (1903) autobiographical writing "Memoirs of My Nervous Illness". The results showed that neither the religious-mystical text nor the psychotic text confirmed Underhill's five-stage hypothesis. The narrative patterns of primary process language and body boundary imagery are discussed in relation to contemporary psychoanalytic theories and psychological theories.

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#### The Generalizing Effect of Attention in Unconscious Perceptual Learning

#### David Carmel, New York University, USA Marisa Carrasco, New York University, USA

# July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

Perceptual learning (PL) is the improved performance of perceptual tasks that results from practice. Visual PL is highly specific to trained stimulus features and locations, and thus considered a manifestation of neural plasticity in early visual regions. Attention facilitates PL, but PL can occur even when observers are unaware of "trained" stimuli. We therefore asked whether manipulating spatial attention to stimuli observers remain unaware of would affect PL of those stimuli.

First, we measured performance on a texture discrimination task used commonly in PL studies. Discrimination targets (embedded in the texture) appeared at various locations. In seven subsequent training sessions similar textures were presented monocularly and suppressed from awareness by continuous flash suppression, in which monocular stimuli are rendered invisible by high-contrast, dynamic displays presented to the other eye. Observers performed an attentional task on stimuli presented to the dominant eye, while texture discrimination targets were presented at one attended and one unattended location in the suppressed eye. Texture discrimination was assessed again in the final session. We expected PL – improved texture discrimination performance – to be greatest at locations that were attended during training.

Surprisingly, performance for texture targets improved significantly at both attended and unattended locations. Control experiments ruled out the possibility that the improvement was due to either the repeated testing or to training on the dominant eye's task. As observers were unaware of the texture stimuli during training, this finding indicates that attention can facilitate PL without awareness, and furthermore, can generalize it to untrained locations.

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#### Influence of Familiar Music on Cognitive Processes in Comatose Patients

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# *July* 5<sup>th</sup>, 14:00-16:00: *Poster Session* 2.

Music can be a highly familiar and emotional stimulus that conveys beneficial effects on cognitive processes both in normal and brain-damaged participants.

The aim of our study was to evaluate the effect of music exposure on cognitive processes and perceptual awareness. We recorded electroencephalogram (EEG) in comatose patients and control participants while presenting several sequences of different first names, one of them being the patient's/participant's own first name. These sequences were preceded by either familiar music chosen by close relatives of the patients or the participants themselves or music noise.

Our results replicated the previously reported P300 component related to one's own first name in both control participants and some patients in altered states of consciousness. More importantly, in patients with a P300 evoked by the first name, the presentation of familiar music before the sequence of names increased the similarity of the evoked P300 component to that observed in the control participants. Indeed, the P300 had a greater amplitude and shorter latency after the music than after the noise.

Our results will be discussed in link with the previously proposed hypothesis suggesting that music induces positive emotional states, which are correlated with increased arousal. The observed heterogeneity of results among patients can be, at least partially, explained by the patients' varying etiologies. Finally, we discuss the potential interest of developing such a protocol to estimate the perceptual awareness of patients

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#### Strengthen Or Weaken? Mirror Therapy for Phantom Limb

Chieh-Ling Cheng, National Yang Ming University, Taiwan Allen Y. Houng, National Yang Ming University, Taiwan

# *July* 5<sup>th</sup>, 14:00-16:00: *Poster Session 2*.

From the externalism, body schema which governs the function of body is shaped by the involvement with habits and projects. Body image, which is the mental picture one has of oneself, is independent from body schema. The phenomenon of phantom limb is because of body schema. In the mirror therapy designed by V. S. Ramachandran, not only phantom limb pain but also phantom limb vanished. However, theoretically the body schema of phantom limb should be strengthened out of synchronic movement with the reflection of the intact limb in the mirror. Based on this point, it is unreasonable that the phantom limb shrank. Here is my hypothesis. For people with phantom limb, there are motor commands sent from the motor cortex without the corresponding sensory feedback. The failure of sensory-motor matching in the parietal lobe leads to the occurrence of pain, which makes up the deficiency of sensory feedback. However, the consistent representation of pain in the somatosensory cortex delays the adaption to new circumstances. Under the application of mirror therapy, sensory feedback is regained. Pain is then unnecessary and thus relieved. After treatment for a period of time, the sensory cortex of the phantom limb, without representation of pain, starts to shrink. It then leads to the shrinking of phantom limb. If this hypothesis is true, then body image and body schema are not independent from each other as we think. There can be some interaction between them.

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### Spectral, Coherence and Network Analysis of Resting State EEG in Disorders of Consciousness

Srivas Chennu, University of Cambridge, UK Eleonore Peres, University of Cambridge, UK Tristan Bekinschtein, MRC Cognition and Brain Sciences Unit, Cambridge, UK

# *July* 5<sup>th</sup>, 14:00-16:00: *Poster Session* 2.

Functional neuroimaging has recently been applied to further our understanding of disorders of consciousness (DoC). Active paradigms that test for 'thought actions' in response to command have been proposed for uncovering covert awareness in behaviourally unresponsive patients. However, such tests are unlikely to be useful for a majority of patients with inconsistent, intermediate levels of awareness. Taking a complementary approach,

we analysed passive resting state electroencephalographic (EEG) data from DoC patients. By comparing patterns of variability in spectral power, coherence and network complexity, we identified characteristic patterns that differentiated groups of patients from each other and from healthy controls. In comparison to controls, DoC patients showed statistically significant power increases in the delta frequency band of the EEG, coupled with decreases in the alpha/beta bands. Alongside, there was a comparative reduction in long-range cortical synchrony, in particular between frontal and parietal regions. Interestingly however, many patients showed highly synchronous activity in neighbouring cortical regions. These characteristics were reflected in the large-scale properties of the brain graphs estimated from these interactions: relatively disconnected regions of highly coherent activity. These findings highlight the functional disintegration following severe brain injury, and corroborate similar findings from resting state functional magnetic resonance imaging (fMRI). Such measures can be used to assess a much larger number of DoC patients, and complement the use of active paradigms. However, they will require a detailed understanding of the patterns and sources of inter-subject variability at the cohort level before they can be applied to inform diagnoses of individual patients.

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#### Transient Auditory Signal Shifts Perceived Offset Position of A Moving Visual Object

Sung-en Chien, University of Tokyo, Japan Fuminori Ono, University of Tokyo, Japan Katsumi Watanabe, University of Tokyo, Japan

## July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

Information received from different sensory modalities influences human perception profoundly. For example, changes in the auditory flutter rate induced changes in the apparent flicker rate of a flashing light (Shipley, 1964). In the present study, we investigated that whether auditory information would affect the perceived offset position of a moving object. In Experiment 1, a visual object moved across the screen and disappeared abruptly. A transient auditory signal was presented at differential timings relative to the moment where the object disappeared abruptly. The result showed that if the auditory signal was presented before abruptly offset, the final perceived position was shifted backward, implying that the perceived offset position could be affected by transient auditory information. In Experiment 2, we presented the transient auditory signal to either the left or right ear. The results showed that the perceived offset shifted backward more largely when the auditory signal was presented to the same side as the visual field where the moving object originated. In Experiment 3, we found that the perceived timing of the auditory signal was not affected by the spatial proximity between the auditory and visual signals. These results suggest that the perceived offset position was shifted more largely by the transient auditory signal with high spatial proximity.

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#### What Is The Way To Solve The Mystery Of The Theory Of Mind?

Hui-Ming Chin, National Yang-Ming University, Taiwan Allen Y. Houng, National Yang-Ming University, Taiwan

## July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

Theory of mind (ToM) is the ability that allows organisms to interpret and predict others' behaviors, and this makes organisms having an idea that they understand other's mind. Two prominent approaches used to explain the ToM are the theory-theory and the simulation theory. In recent debates, mirror neuron systems seem to provide neurological evidences to support the simulation theory. But there are still lots of experiments disagree on the mirror neuron theory.

I think it is misleading to say that we can understand other's mind. I deny the idea that we can really understand others mind, but can we only attribute mental states to others. I suggest a third way to explain the attributing function of ToM is related to theories of *the self*. According to Antonio Damasio, an organism uses its emotion mechanism to value the information from the world. The selected information will participate in the integrating process of information. After the integration, relevant information will constitute the self. Meanwhile, other information will be treated as non-self, and its meaning will be referred to the external world. (Feinberg, 2001) In my opinion, one can integrate the information she perceived from other's behavior and forms a putative mental state according to her own experiences and memory. But this mental state is not concerned as a part of the self, and hence will it be attributes to others. I will also analyze the cases of autism to support my theory.

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#### Making Predictive Coding More Predictive, More Enactive

Ron Chrisley, Sackler Centre for Consciousness Science & Dept of Informatics, University of Sussex, UK

# July 3<sup>rd</sup>, 16:30-18:30: Concurrent Session 2.

Predictive coding (PC) architectures (e.g., Dayan, Hinton, Neal, & Zemel, 1995; Rao & Ballard, 1999) have been recently proposed to explain various aspects of consciousness, including those involved in binocular rivalry (Hohwy, Roepstorff & Friston, 2008), and presence ("the subjective sense of reality of the world and of the self within the world") (Seth, Suzuki & Critchley, 2011). It is argued that the potential of PC explanations of consciousness has been obscured by overemphasis of a number of features that are typically held to be essential to the PC approach, but which in fact are not central, and may be detrimental, to PC explanations of consciousness. For example: 1) the components of PC architectures that do the work of explaining consciousness can be de-coupled from hypotheses concerning (e.g. Bayesian) optimality; 2) the structure of the models employed by PC architectures is typically not predictive in any direct sense, being instead a representation of the causes of sensory input (Hohwy, Roepstorff & Friston, 2008); 3) these models are typically disconnected from action, accruing the familiar limitations of disembodied accounts (with (Seth, Suzuki & Critchley, 2011) being a notable exception); 4) the winner-take-all promotion of a model to be the content of consciousness can be eliminated, thus enabling PC architectures to accommodate anti-realist or at least more critically realist views of consciousness (Dennett 1991). A more general architecture, Enactive EBA (following (Chrisley & Pathermore, 2007)), is proposed to preserve the strengths of PC architectures, while avoiding the above limitations and suggesting new hypotheses and experiments to test them.

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#### Behavioural Priming: It's All In The Mind, But Whose Mind?

Axel Cleeremans, Université Libre de Bruxelles, Belgium Stéphane Doyen, Université Libre de Bruxelles, Bussels Cora-Lise Pichon, Université Libre de Bruxelles, Belgium Olivier Klein, Université Libre de Bruxelles, Belgium

## July 3<sup>rd</sup>, 14:00-16:00: Concurrent Session 1.

The perspective that behavior is often driven by unconscious determinants has become widespread in social psychology. Bargh, Chen, and Burrows' (1996) famous study, in which participants unwittingly exposed to the stereotype of age walked slower when exiting the laboratory, was instrumental in defining this perspective. Here, we present two experiments aimed at replicating the original study. Despite the use of automated timing methods and a larger sample, our first experiment failed to show priming. Our second experiment was aimed at manipulating the beliefs of the experimenters: Half were led to think that participants would walk slower when primed congruently, and the other half was led to expect the opposite. Strikingly, we obtained a walking speed effect, but only when experimenters believed participants would indeed walk slower. This suggests that both priming and experimenters' expectations are instrumental in explaining the walking speed effect. Further, debriefing was suggestive of awareness of the primes. We consider these findings in light of current theories of consciousness and conclude that unconscious behavioral priming, while real, involves mechanisms different from those typically assumed to cause the effect.

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#### A Multi-Access Model of Conscious Awareness

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July 4<sup>th</sup>, 11:00-13:00: Concurrent Session 3.

Are the mechanisms of cognitive access (i.e. attention, working memory) sufficient for the richness of conscious experience? Many researchers claim the answer to this question is "No," citing the fact that participants can only attend to roughly 4 items at a time, but are often conscious of more than just a handful of objects. Thus, it is claimed, phenomenology overflows access.

Here, we challenge this conclusion by presenting a variety of new empirical findings that demonstrate that "access" is a more dynamic, versatile process than previously thought. These findings alter the landscape of the debate and provide numerous avenues for addressing this controversy with testable predictions. Specifically, we focus on two points: First, several recent findings demonstrate that attention is a multi-faceted process consisting of a variety of resource pools and subsystems that can operate across numerous scales and dimensions. Attention is not simply the product of a single, unified source (Chun, 2011). Second, advances in computational modeling have allowed for a mathematical description of information loss in the visual periphery (Freeman and Simoncelli,

2011). Such models have allowed for the creation of depictions of natural scenes that clearly visualize how little we perceive in the periphery, and how oblivious we are to this fact.

Together, these findings not only allow for a richer account of conscious access, they demonstrate the ways future scientific research can be directed towards addressing these fundamental issues in consciousness studies. Discussing such issues in the context of potential experiments also highlights the difference between falsifiable and unfalsifiable theories of consciousness.

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#### Visceral Afferent Signaling, Interoceptive Awareness and Predictive Coding: Impact on Emotional Processes

Hugo Critchley, Sackler Centre for Consciousness Science & Brighton and Sussex Medical School, UK

# July 5<sup>th</sup>, 11:00-13:00: Symposium 2.

The experience of emotions as subjective feeling states arguably reflects the cognitive appraisal of information about changes in bodily state in conjunction with the inferences about the causes of those changes, consistent with a predictive coding framework. Moreover, individual differences in physiological responsivity influence the experience of emotions and people can be categorized according to their accuracy in judging physiological processes including heartbeats. Studies of good and bad 'heartbeat detectors' confirm a relationship between enhanced interoceptive ability and intensity of emotional experiences. Mechanistically, central signalling of cardiovascular arousal occurs via the activation of baroreceptors at cardiac systole that signals the occurrence and amplitude of individual heartbeats. We have shown this interoceptive stream differentially influences automatic processing and intentional evaluation of emotional stimuli including facial expressions. Nevertheless, cognitive and physiological dimensions of interoception can be dissociated experimentally, endorsing a model of interoceptive predictive coding which we have recently developed.

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#### Interoceptive Sensitivity and Trait Anxiety Have Dissociable Effects on Perception and Metacognition

Hugo D. Critchley, Sackler Centre for Consciousness Science, & Brighton and Sussex Medical School, UK Anil K. Seth, Sackler Centre for Consciousness Science & Dept of Informatics, University of Sussex, UK Adam B. Barrett, Sackler Centre for Consciousness Science & Dept of Informatics, University of Sussex, UK Sarah N. Garfinkel, Sackler Centre for Consciousness Science & Brighton and Sussex Medical School, UK

# *July* 5<sup>th</sup>, 14:00-16:00: *Poster Session* 2.

#### Background

We tested how perceptual performance and awareness of performance accuracy (metacognition) are influenced by bodily signals (interoception), awareness of bodily signals (interoceptive sensitivity) and trait anxiety: Interoceptive effects on perception are testable at rest by timing stimuli before, or during, individual heartbeats when timing and strength of each contraction is signalled centrally by a burst of activity from baroreceptor afferents. Interoceptive sensitivity describes individual differences in awareness of internal bodily changes, typically tested using heartbeat detection tasks. Anxiety is linked to enhanced focus on bodily sensations, but not necessarily to increased interoceptive sensitivity.

#### Methods

Face stimuli were presented at the border of visual perception using an attentional blink paradigm. Timelocking the experiment to each participant's heart trace enabled stimuli to be initiated before or during individual heartbeats. Performance (perceptual accuracy) was assessed at each trial using a force-choice test. ROC analyses of confidence ratings for each performance decision quantified how well confidence predicted accuracy; indexing metacognition.

#### Results

Heartbeat timing modulated performance, particularly in participants with greater interoceptive sensitivity (r=.492, p=.027). Interoceptive sensitivity inversely correlated with metacognition (r=-.527, p=.03). Trait anxiety did not affect performance, but predicted increased metacognition (r=.671, p<.001) and the extent to which heartbeat timing influenced metacognition (r=-.661, p=.005).

### Conclusions

Interoceptive signals affect periliminal perceptual breakthrough. The capacity for awareness of interceptive signals reflects the strength of this channel yet is dissociable from metacognitive processes more closely coupled to anxiety. Our findings highlight discrete aspects of awareness, self-representation and self-monitoring including direct and interpretive aspects of interoception.

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# Communicating With the Unconscious: The Development of a Brain-Computer Interface for the Vegetative and Minimally Conscious States

Damian Cruse, University of Western Ontario, Canada Srivas Chennu, University of Cambridge, UK Marco Fattizzo, Maastricht University, the Netherlands Adrian M. Owen, of Western Ontario, Canada

# July 3<sup>rd</sup>, 14:00-16:00: Concurrent Session 1.

The vegetative and minimally conscious states (VS; MCS) are characterised by an inability to consistently demonstrate awareness with overt behaviours. In a recent study, Cruse et al. (2011) demonstrated that 19% of vegetative state patients were able to alter their cognitive states – as indexed by appropriate EEG responses – in response to motor imagery commands, thereby demonstrating a level of awareness which would not be evident with behavioural tests alone. Monti et al. (2010) have also shown that one VS patient was able to answer yes/no questions using fMRI-detected brain responses. Together, these studies provide a proof-of-concept for the use of EEG as a brain-computer interface (BCI) that can provide a cheap and portable means for some VS/MCS patients to regularly communicate with the outside world – something that is entirely impractical with fMRI alone. The current research describes the development of the EEG motor imagery approach for use as a bedside communication tool with VS/MCS patients. First, methods developed for the real-time translation of EEG signals into communicative outputs will be described. Second, the results of a variety of different forms of motor imagery task – adapted from those employed by Cruse et al. (2011) – will be described, which allow for the optimization of the neural signal to be detected in each patient. Finally, data from a number of VS and MCS patients will be presented which show an ability to detect covert awareness with only minimal EEG equipment and simple BCI methods.

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#### Conscious Perception Immunizes Task-Selection against Unconscious, External Control: A Case of 'Freed Will'?

**Greg Davis,** University of Cambridge, UK **Anita Zhou,** University of Cambridge, UK

# July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Subjectively, our choices seem to be under 'free', conscious control. However, demonstrations that choices can be predicted and controlled by unconscious processes are widely held to contradict this impression, lending support to radical 'illusionist' views on which subjective 'freedom' does not reflect any objective autonomy. Here, we describe experiments that we believe may help to integrate these two perspectives. In common with previous work, we find that high-level decisions regarding task selection can be influenced by unconsciously-perceived stimuli. However, we also note a substantial mediating effect of conscious perception in such tasks - an effect that suggests the mind-brain's choices retain a far greater degree of independence from external stimuli than previous work has supposed. We integrate our results into an alternative 'realist' view of free choices on which subjective freedom reflects, imperfectly, independence of choices from non-strategic influences. Some of this independence appears to reflect an active process associated with conscious perception.

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#### Is The Sense Of Self Innate?

Jorge de Almeida Gonçalves, Instituto de Filosofia de Linguagem, Universidade Nova de Lisbo

# *July* 5<sup>th</sup>, 14:00-16:00: *Poster Session* 2.

Is the sense of self innate? Currently several authors give a positive answer to this question. Shaun Gallagher, one of them, argues that the senses of self and others are embodied and present from birth. According to him there is a minimal sense of the self, a body schema, and a proprioceptive awareness already present in the nervous system of a newborn. On this account the child did not depend on cognitive learning or language to acquire at least the basic feeling that he is a self distinguished from others and from environment. Empirical evidence supporting this theory includes the experiments of child imitation. If a few hour old baby can imitate the movements of an adult then there is a differentiation between self and other. However other experiments were performed which challenge there is true imitation in early stages of life. There are alternative explanations for the apparent imitation in babies. Reflecting on both kinds of evidence I argue that there is no innate feeling of self. What I think is innate is the ability to relate to other human beings but this does not mean there is a sense of self. This sense of self only develops in the interaction between the child and the others that mirror her actions. In this sense you can say that the self is a potentially in the body such as speech is in the tongue.

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#### **Does Working Memory Load Influence Consciousness?**

Esther De Loof, Ghent University, Belgium Wim Fias, Ghent University, Belgium Van Opstal, Ghent University, Belgium

# *July* 4<sup>th</sup>, 14:00-16:00: *Poster Session* 1.

Both theories on consciousness and working memory (WM) detail the involvement of frontoparietal connections. First, frontoparietal connections are thought to trigger consciousness by igniting the global neural workspace. Second, a frontoparietal network is hypothesized to underlie WM processing. Given the similar mechanisms and neural underpinning of consciousness and WM, we hypothesize that the level of consciousness interacts with WM load. When a WM load activates the frontoparietal network, this activity could either make the mechanism for igniting consciousness more sensitive or limit the frontoparietal capacity available for establishing consciousness. We probed consciousness through priming (main task), while varying WM load in a secondary task. In the main task, participants judged a target number to be smaller/larger than five. The target number was primed by a congruent/incongruent prime number. To manipulate the conscious perception of the primes, the stimulus onset asynchrony between prime and target was varied. Participants indicated their awareness of the prime number on each trial. In a secondary task, WM load was manipulated by letting participants remember zero, two or six letters (i.e., zero, low, and high load conditions). First, increasing WM load apparently limits conscious perception: the visibility threshold for prime numbers tends to rise with increasing WM load. Second, increasing WM load facilitates the congruency effect: the prime has a stronger influence on the response to the target when more letters are kept in memory. Both effects are discussed in relation to the involvement of prefrontal cortex in WM and consciousness.

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#### In-Depth Body and Its Non-Topographic Representation

## Helena De Preester, University College Ghent, Belgium

# July 6<sup>th</sup>, 11:00-13:00: Concurrent Session 4.

Converging evidence indicates that the brain represents the *in-depth* body as well as the surface, sensorimotor body. In research inspired by neurology, it has been repeatedly suggested that it is from this in-depth body that emotional awareness and the self originate (Craig, 2002; Damasio, 1994, 1999, 2003, 2011).

What it precisely means that the brain *represents* body states and that the body is the *object* on which awareness of the body depends, often remains underdeveloped. The notion of 'representation' fits nicely with the topographic organization of the primary somatosensory cortex or with topographic maps that define the location of a sensory stimulus within the environment, but this fit is under pressure when it comes to the internal milieu and the visceral section of the body. In contrast to the signals of the surface body, signals from the viscera or the internal milieu most often do not result into a localization of the stimulus (e.g. a toxic chemical molecule) or into a topographic representation of the body.

The topographic dimension of the body and thus the body's object-like nature are still dominating in thinking about the body and embodiment, whereas there is much less attention for what it means that bodily systems are not topographically represented and thus further removed from the idea of the body as an object. We focus on a description of this non-topographic bodily dimension and point to some consequences for the study of consciousness.

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#### Placebo-Suggestion Modulates Conflict Adaptation in the Stroop Task

Pedro Alexandre Magalhães de Saldanha da Gama, Université Libre de Bruxelles, Belgium Hichem Slama, Université Libre de Bruxelles, Belgium Emilie Adrienne Yvonne Caspar, Université Libre de Bruxelles, Belgium Wim Gevers, Université Libre de Bruxelles, Belgium Axel Cleeremans, Université Libre de Bruxelles, Belgium

# July 4<sup>th</sup>, 11:00-13:00: Concurrent Session 3.

Expectation manipulations such as suggestion, placebo and post-hypnotic suggestion have been shown to bias several cognitive processes (pain, visual awareness and emotions). Here we demonstrate that a mixed placebo-suggestion is able to create expectations that have a profound impact on conflict adaptation assessed by objective measures. Two groups were exposed to a placebo-suggestion to induce either positive or negative expectations about the properties of a sham "brain wave" machine while performing a Stroop task. The experimental design associated a placebo (the equipment and procedure) to a suggestion (verbal and written persuasive information).

The machine was described as either enhancing (positive group) or impairing (negative group) participants' ability to perceive colors. In the baseline condition, participants completed the Stroop task without the equipment. We found a double interaction between Stroop conditions, suggestion and group. Planned comparisons indicated that the suggestion only influenced accuracy in the incongruent conditions. Participants committed fewer errors compared to baseline when under the positive suggestion but more errors when under the negative suggestion. Furthermore, participants' intra-individual variability was influenced by suggestion and group. This study thus demonstrates that expectations induced by a placebo-suggestion can modulate cognitive conflict.

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### **Through The Inverting Glass**

Jan Degenaar, University of Groningen, the Netherlands & University of Antwerp, Belgium

# July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

Experience with inverting glasses reveals key factors in spatial vision. Drawing on my experience with wearing left/right inverting glasses, I show how a sensorimotor analysis helps to characterize visual experience. From a first-person perspective, we normally cannot differentiate between the factors working together in experience. Inverting glasses provide a partial remedy, for they help to disentangle what is usually tied together. This yields valuable insights in the basis of visual experience. Previous studies have raised the question whether visual experience may turn back to normal after adaptation to inverting glasses. While some reports seem to suggest it does (e.g. Taylor 1962; Kohler 1964), others give indications that it does not (e.g. Stratton 1897). I argue that a more fine-grained sensorimotor analysis can resolve the issue. The crucial fact is that inverting glasses introduce a conflict at the very heart of spatial vision. Although the glasses change the relation between eye movements and the distal stimuli, they leave unaltered how head movements change the direction of visual field. It would be inadequate to describe the resulting experience as a case in which visual images are inverted. At first, judgments of visual direction grounded in head movements differ from judgments grounded in eye movements. During adaptation, this difference disappears. One may learn to see without conflict where objects are located (this took me 123 hours of practice). But while a normal visual grasp of the world is re-acquired, sensorimotor differences remain that are relevant to describe the phenomenal character of experience.

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## Global Breakdown in Resting State Networks fMRI Connectivity in Patients with Disorders of Consciousness

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# July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Patients with disorders of consciousness (DOC: brain death, coma, vegetative/unresponsive, minimally conscious state) show reduced resting state fMRI connectivity in a default mode network as a function of the level of consciousness. Here, we aimed to assess resting state fMRI connectivity in multiple cerebral networks. We further aimed to correlate clinical "pain" scales scores (i.e., Nociception Coma Scale, NCS3) with the functional integrity of the pain-related salience network because the issue of pain in DOC is of particular ethical interest. 300 fMRI resting state scans were obtained in 28 patients (11 minimally conscious, 12 "vegetative"/unresponsive, coma) and 22 controls. Seven seed regions were used to identify functional connectivity in the default mode, left and right frontoparietal, salience, sensorimotor, auditory, and visual networks. For salience network, a regression analysis was performed with patients' NCS total score. A group-level correlation between resting state functional connectivity and the level of consciousness was identified for all studied networks. Additionally, patients' NCS scores showed a positive correlation with functional connectivity in the salience network's anterior cingulate cortex (ACC). We observed group-level functional connectivity decreases in both primary (visual, auditory) and higher-order associative networks (default mode, right and left fronto-parietal, salience, sensorimotor) possibly accounting for patients diminished consciousness capacities. The observed positive correlation between the NCS

scores and ACC salience network activity reflects nociception-related processes in these patients measured in the absence of an external stimulus. Our results emphasize the clinical importance of multiple fMRI resting state networks to consciousness.

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#### Increased fMRI Resting State Network Functional Connectivity in Hypnotic State

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# July 4<sup>th</sup>, 11:00-13:00: Concurrent Session 3.

Hypnosis is "a procedure during which a health professional or researcher suggests that a patient or subject experiences changes in sensations, perceptions, thoughts, or behavior". We here employed fMRI to better characterize hypnosis-related functional connectivity changes in multiple large-scale "resting state" cerebral networks. 12 subjects were scanned under i. normal eyes-closed wakefulness, ii. During mental imagery of pleasant autobiographical memories (i.e., control condition), and iii. During hypnotic state (i.e., reviving pleasant autobiographical memories). Seven seed regions were used to identify functional connectivity in the default mode, left and right frontoparietal, salience, sensorimotor, auditory, and visual networks. Behavioral data concerning partial amnesia, modification in body and time sense were collected at the end of each fMRI session.Results: Behaviorally, more subjects under hypnosis reported partial amnesia and a modified sense of body and time. Compared to the control condition, we identified increased within-network functional connectivity for the default mode, left and right frontoparietal, salience, sensorimotor, and auditory networks; an enhanced cross-modal interaction between auditory and visual cortices was further observed. The visual network only showed decreases in functional connectivity in both within and between-network areas (i.e., hippocampus). Hypnosis-related increases in functional connectivity in the default mode, left and right frontoparietal, salience, sensorimotor, and auditory networks, potentially reflect lack of inhibitory cortico-cortical mechanisms. Hypnosis-related decreases in visual network functional connectivity and increases in cross-modal interaction between auditory and visual networks are hypothesized to reflect revivification of hypnotic suggestions and not merely cognitively guided memory retrieval.

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#### Surface-Based Constraints on Spreading Suppression: Evidence from Preview Search

Kevin Dent, University of Essex, UK W. Humphreys, University of Oxford, UK Xun He, University of Birmingham, UK Jason J. Braithwaite, University of Birmingham, UK

July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

In preview search when an observer ignores an early appearing set of distractors, there can subsequently be impeded awareness of new targets that share the colour of this preview. This "negative carry-over effect" has been attributed to an active inhibitory process targeted against the old items and inadvertently their features. Here we extend negative carry-over effects to the case of stereoscopically defined surfaces of coplanar elements without common features. In Experiment 1 observers previewed distractors in one surface (1000 ms), before being presented with the target and new distractors divided over the old and a new surface either above or below the old one. Participants were slower and less efficient to detect targets in the old surface. In Experiment 2 in both the first and second display the items were divided over two planes in the proportion 66 / 33% such that no new planes appeared following the preview, and there was no majority of items in any one plane in the final combined display. The results showed that participants were slower to detect the target when it occurred in the old majority. Experiment 3 held constant the 2D properties of the stimuli while varying the presence of binocular depth cues. The carry-over effect only occurred in the presence of binocular depth cues, ruling out any account of the results in terms of 2D cues. The results suggest well formed surfaces in addition to simple features may provide a medium for the spreading of suppression in search.

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#### Intentional Binding Is Driven By the Mere Presence of an Action and Not By Motor Prediction

Andrea Desantis, Université Paris Descartes & Institut Jean Nicod, Ecole des Hautes Etudes en Sciences Sociales & Ecole Normale Supérieure, France.

Gethin Hughes, Université Paris Descartes, France Florian Waszak, Université Paris Descartes, France

# July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Intentional binding refers to the fact that when a voluntary action produces a sensory outcome, action and outcome are perceived as being closer together in time. This phenomenon is often been attributed to motor predictive mechanisms such that when action prediction is consistent with changes in our environment, our temporal perception of these effects is altered. However, previous studies failed to unequivocally attribute intentional binding to these mechanisms, since the contrasts that have been used to demonstrate binding covered two processes: temporal control and motor identity prediction. In the present study we aimed to isolate the respective role of each of these processes in the emergence of intentional binding of action-effects. The results we obtained show that the binding of action-effects is not based on motor identity prediction but rather on temporal control, suggesting that this phenomenon is not linked to motor predictive processes. Our findings question also the role of intentional binding in the emergence of the sense of agency. Intentional binding has often been interpreted as related to self-agency, since it may help individuals determine whether a sensory event was caused by them or not. This interpretation is partially due to the fact that binding has reliably been observed in cases in which one is the agent of an action, thus when internal efferent information is provided by motor processes to predict the action sensory consequences. We suggest that binding is more related to the perception of causality rather than to the experience of self-agency.

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## **Comparing Conscious and Unconscious Conflict Adaptation**

Kobe Desender, Ghent University, Ghent, Belgium Elke Van Lierde, Vrije Universiteit Brussel, Belgium Eva Van den Bussche, Vrije Universiteit Brussel, Belgium

# July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

According to prominent theories of consciousness, cognitive control is a set of strategic operations exclusively associated with consciousness. In the research line on conflict adaptation, this is expressed in the assumption that subjects adapt their behavior on the current trial, only when they consciously experienced a conflict situation on the previous trial. Conflict trials which are never consciously perceived are thought not be able to trigger this adaptation process. Although a large number of studies confirmed this prediction, van Gaal, Lamme and Ridderinkhof (2010) recently challenged this consensus by showing conflict adaptation following masked incongruent trials. This effect was much smaller following unconscious compared to conscious incongruent trials. However, stimulus-onset asynchrony (SOA), was not matched between these two conditions, which in itself can modulate priming effects. In the current study, SOA was matched, and we compared the effect of conscious versus unconscious response conflict. As expected, priming effects on the current trial were sharply reduced in the unconscious, compared to the conscious condition. Looking at the influence of previous trials, we observed conflict adaptation following conflict trials in both the conscious and the unconscious condition. Interestingly, this effect was comparable in magnitude and significance in both conditions. Thus, despite markedly smaller congruency effects observed for the unconscious condition, the adaptation effect was highly similar after a conscious and an unconscious conflict trial. This finding contradicts theories of consciousness claiming that only conscious primes can evoke conflict adaptation.

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#### Event-Related Potentials of Eye Movements at Perceptual Transitions during a Moving Bistable Stimulus.

#### **Christ Devia**, Universidad de Chile, Chile. **Pedro Maldonado**, Universidad de Chile, Chile.

#### July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

A useful paradigm to studied perception and consciousness includes multistable stimuli, where the physical properties of the stimuli remain constant but the subjects' perception alternates frequently. Generally, these studies require to request the subjects' reports by an overt motor action -typically by a button press (BP)- each time there is a perceptual switch. Neural correlates of these perceptual changes can be studied through ERP waveform which is time-locked to the BP. However, there is a variable period of time between the subjects' perceptual transition and their subsequent motor action. Also, the ERP component due to the motor action can mask the ERP perceptual signals. In this work, we utilized a moving plaid stimulus that can be perceived as two
individual gratings moving sideways, or as a single plaid moving upwards. Instead of voluntary motor response, we utilized the direction of movement of the eye to determine which of the two perceptions was occurring. We measured ERPs waveforms time-locked to subjects' eye movements and compare them to ERPs obtained using BP as reports for the perceptual alternation. Preliminary results show a small, late ERP component, time-locked to eye movement transitions, restricted to parietal areas. This signal is comparable in amplitude to the ERP signal to BP in the same electrode. As expected, motor action ERPs are spread bilaterally over temporal, parietal and occipital areas, with higher amplitude on the right hemisphere. We demonstrate that unconscious eye movements can be used to study conscious perception in bistable stimuli.

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## **Does Abstraction Make The Mind Blind To Detecting Changes?**

Lee de-Wit, University of Leuven. Belgium Ervin Poljac, University of Leuven, Belgium Johan Wagemans, University of Leuven, Belgium

## July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

In recent work we (Poljac, de-Wit & Wagemans, 2012, Cognition) have reported that people perceive less color change to the dots making up a point-light biological figure, when that figure is presented in a meaningful upright configuration. We argued that this finding reflects a general reduction in the conscious accessibility of the 'parts' of a stimulus when they can be abstracted into a meaningful 'whole'. In the current work we seek to extend this parts-wholes framework in two experiments. The first looks at whether other stimulus properties (such as orientation) become less accessible when integrated into a meaningful upright walker. In the second we adapt standard 'change blindness' paradigms to ask whether the detection of changes takes longer when a scene has a meaningful gist or interpretation.

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## Perhaps There Is No Time like the Present

Alan Diamond, Sackler Centre for Consciousness Science & Dept of Informatics, University of Sussex, UK Owen Holland, Sackler Centre for Consciousness Science & Dept of Informatics, University of Sussex, UK

# July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

In consciousness research there many apparent anomalies concerning the relationship between subjective time and objective time. Underlying much of the discussion is the idea, often implicit rather than explicit, that the conscious brain should have a representation of the current state. In this talk we will challenge this idea by looking at a complex robotic system currently under development in which the performance of a generic task – planning and executing a movement – requires several representations of state at various times, none of which is contemporaneous with the actual state at the time. We will argue that if representing the present is not required for this type of task, then the mechanism for this representation is unlikely to have evolved in natural systems in which the performance of such tasks is of critical importance, and we will also argue that the representations of past and future states that are required for the task provide ample material to support the apparent temporal anomalies of consciousness. However, we will also show that providing a representation of the present is relatively easy in principle – it simply involves the use of a forward model of the robot and the environment to predict the state at (T1 + T2), where T1 is the time taken to load the data at T0 into the forward model, and T2 is the time taken to roll the model forward to (T1 + T2). We will also discuss why such a mechanism for representing the predicted present might account for those found in consciousness.

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### Tye on Acquaintance and the Knowledge Argument

Esa Diaz-Leon, University of Manitoba, Canada

# July 6<sup>th</sup>, 11:00-13:00: Concurrent Session 4.

In his recent book, "Consciousness Revisited" (2009), Michael Tye has argued that when we are acquainted with an object O in experience, we can know that object without knowing any truth of the form 'O is F', that is, we can gain knowledge by acquaintance of that object. Why should we believe that being conscious of an object yields knowledge by acquaintance of that thing? Tye argues that it is simply incoherent to suppose that one might be genuinely conscious of, say, a particular shade of red and yet not know it at all. He uses this conception of knowledge by acquaintance to provide a new solution to the Mary puzzle. In particular, he argues that when Mary

is released, she learns something new because she is acquainted with the phenomenal character of red and thereby she gains new knowledge of that phenomenal character of red. And given that knowledge by acquaintance is something over and above propositional knowledge, this can explain why Mary learns something new when she is released, even if it is true that she knew all *facts* about the experience of seeing red before her release.

In response, I will argue that Tye's new solution to the puzzle, based on the notion of knowledge by acquaintance, is flawed. In particular, I will argue that this new solution is committed to the dubious claim that in being acquainted with a specific shade of red, say red, we are in a position to know that *type* of phenomenal state. This claim is problematic because we could have an experience of red (of the sort that provides acquaintance with red) and yet not be in a position to form a *recognitional* concept for that type of phenomenal state. But then, it seems that we are not in a position to *know* that phenomenal property (because, for example, we might not be able to remember it or recognize it in future experiences), and therefore we cannot be said to gain knowledge of the *phenomenal character* of the experience of red. Therefore, Tye's new solution to the Mary puzzle cannot work.

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## How to Determine If Knowledge Is Unconscious

Zoltan Dienes, Sackler Centre for Consciousness Science & School of Psychology, University of Sussex, UK

## July 3<sup>rd</sup>, 14:00-16:00: Concurrent Session 1.

A central part of consciousness research is determining when a mental state is conscious or unconscious. Asserting a mental state is unconscious often depends on asserting a null hypothesis. For example, in subliminal perception research, the "objective threshold" occurs when people cannot discriminate a feature of the presented stimulus. That is, declaring the knowledge unconscious has conventionally relied on getting a non-significant result in discrimination and then asserting the null hypothesis. According to the zero-correlation criterion of unconscious knowledge, knowledge is unconscious (below a "subjective threshold") when there is no relation between confidence and accuracy. Once again a null hypothesis needs to be asserted. However, a non-significant result does not in itself justify asserting a null hypothesis. I show a general technique, using Bayes Factors, by which one can infer whether there is evidence for conscious knowledge, evidence for unconscious knowledge, or whether the data are just insensitive. P\_values cannot make this three-way distinction. Bayes Factors can do so in a more flexible way than power calculations can. Bayes Factor can be used in situations where power simply cannot be computed, and they extract more information from the data. I illustrate the use of Bayes Factors with several subjective and objective methods for detecting the conscious status of knowledge, and indicate both appropriate and inappropriate usage. I illustrate using free on-line software which anyone will be able to use after the talk.

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## Assessing Evidence for Animal Consciousness: The Question of Episodic Memory

### Paula Droege, Pennslyvania State University, USA

# July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

A squirrel bustles down the tree into the pachysandra to retrieve an acorn and then scurries back up to sit atop a knot in the bark while it shaves the shell and eats the nut meat. What is it like to be a squirrel? Is there any way to tell unless one is that very squirrel? Many people believe that the essentially private nature of consciousness closes off the possibility that science as an objective, third-person form of investigation could tell us anything about the subjective, first-person experience of an animal. Curiously, the same people who are adamant that consciousness is essentially subjective and inaccessible to third-person explanation are the most vociferous in their defense of animal consciousness simply on the basis of observed behavior. A brief foray into a current controversy about the memory capacity of scrub jays suggests the limits of behavioral evidence for animal consciousness. Various forms of behavior can indicate consciousness, but more is needed to attribute specific content to the animal's consciousness. A temporal representation theory of consciousness provides a promising solution. If we learn more detail about exactly how an animal represents its world – specifically, how it represents the present as well as the past – then we gain a better sense of what it's like to be that animal. While no description is fully adequate, temporal representation offers a way to bridge the explanatory gap between animal and human consciousness.

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Implicit Sequence Learning In Dyslexia: A Within-Sequence Comparison of First- And Higher-Order Information

Wenchong Du, University of Strathclyde, UK Steve Kelly, University of Strathclyde, UK

# July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

The present study examines implicit sequence learning in adult dyslexics with a focus on comparing sequence transitions with different statistical complexities. Learning of a 12-item deterministic sequence was assessed in 12 dyslexic and 12 non-dyslexic university students. Both groups showed equivalent standard reaction time decrements when the sequence was unexpectedly changed suggesting learning of the sequence took place. However, a novel measurement comparing transitions of differing complexity within the learning sequence indicated that dyslexic participants were impaired only for higher-order but not first-order sequence learning. No difference was found in the explicit awareness contribution between two groups. This result suggests that statistical complexity of the sequence may account for intact and impaired learning performance in dyslexia. Furthermore, the impairment on higher-order learning in dyslexia was only found when the new measurement was used, but not with the classic measurement, suggesting that the higher-order learning deficit in dyslexia is subtle and requires specific analyses to demonstrate such impairment.

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# What Consciousness Explains In Causal Learning by Reasoning: Sketch of Mentalistic Metatheory, Theory, and Experiment

### Donelson E. Dulany, University of Illinois, USA Richard A. Carlson, Pennsylvania State University, USA

## July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

Understanding consciousness calls not only for explanation of consciousness but also for what consciousness explains. What should be the place of consciousness in theories of phenomena that have been the focus of research in psychology—from perception and categorization, through learning and memory, to decision and reasoning? (1) In this mentalistic metatheory, consciousness is a sequence of states carrying symbolic propositional or subpropositional contents interrelated by nonconscious deliberative or associative-activational operations. These explicit and implicit mental episodes constitute these phenomena in psychology (Dulany, 1997, 2004, 2011). The metatheory is more analytic than representing consciousness as a space or system. (2) In an illustrative theory of propositional learning, deliberative mental episodes revise causal beliefs, drawing on degree of belief that a piece of evidence implies an effect, as well as degree of belief that the evidence implies the true cause uniquely (Dulany, 1979; Carlson & Dulany, 1988). In contrast to common associative theories, causal learning is reasoning, from solution of murder mysteries to hypothesis testing in science. (3) From theory to model, degrees of belief were mapped directly to variables and mental operations were mapped directly to the function within linear difference equations. (4) Reports of these conscious states were represented within a physicalistic, not phenomenological, data language, then on the Duhem-Quine thesis and network logic the mapping of reports to conscious states was competitively supported along with the theory. What consciousness explains, by carrying symbolic representations, also conveys its adaptive significance—thus contributing to the explanation of consciousness.

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#### Displaying Subliminal Words and Pictures with LCD Screens: Technical Considerations and Empirical Results

Doris Eckstein, University of Bern, Switzerland Janek Lobmaier, University of Bern, Switzerland

## July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

The technological change from cathode ray tube (CRT) monitors to liquid crystal displays (CLD) created a dilemma for many research groups in the field of subliminal priming, because CRT monitors are much better suited for precise and well-controlled on- and offsetting of fast stimulus displays than LCDs. Therefore, many laboratories resolved to keep their old CRT monitors exclusively for subliminal priming experiments. However, it is possible to realize subliminal displays with LCDs, provided some precautionary measures are taken. I will first discuss the display dynamics of LCDs and present recommendations for subliminal presentation. Then, I will present data of semantic word priming and emotional face experiments we collected using laptop computers, in which prime visibility was assessed using forced-choice tests. The data indicate that subliminal priming effects observed with LCD displays are comparable to effects assessed with CRT displays.

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### Distance Vision, the Octopus, and the Royal Road to Consciousness

David B. Edelman, The Neurosciences Institute, USA & The Scripps Research Institute, USA

# *July* 5<sup>th</sup>, 14:00-16:00: *Poster Session* 2.

I have suggested previously that distance vision—the ability to resolve objects at great distances—was a key evolutionary innovation that precipitated the appearance of consciousness. The main rationale for this argument is the idea that seeing objects from afar 'buys time,' which allows for both monitoring of salience (e.g., predators, prey) and making predictions long before any action is necessary. Monitoring a dynamic visual scene and making useful predictions are necessarily predicated on an ongoing linkage between [visual] perception and memory. It has been argued elsewhere that primary consciousness arises from precisely this linkage. Allowing that singlecompartment eyes with focusing lenses are a requirement for distance vision, one could plausibly argue that animals equipped with such eyes experience conscious states. The octopus eye has been cited as an example of evolutionary convergence because its design—consisting of a single vitreous compartment, a focusing lens with seven ocular muscles, and a retina—in many ways resembles that of the vertebrate eye. Moreover, the predatory capabilities of octopuses and other coleoid cephalopods, as well as their sophisticated learning and memory faculties, strongly suggest the pre-eminence of vision among these animals' various sensory systems. In light of this, I have been investigating the major attributes of octopus vision, from the various submodal properties that are most salient to the behaving animal to the electrophysiological signatures of those properties and their attendant neuroanatomical substrates. Here, I will discuss these studies and their relevance to building an argument for conscious states in octopuses.

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#### Intracranial Signatures of Conscious and Non-Conscious Detection of Auditory Regularities

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## July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

Novelty detection is a fundamental ability to quickly respond to new and potentially relevant stimuli. It can be fractionated into multiple cognitive processes. Some of them are purely automatic, whereas others involve conscious processing. In the present study, we used an original auditory novelty detection paradigm with two levels of regularities embedded, a local level, within a series of sounds and a global level, across series of sounds. This paradigm previously allowed us to dissociate neural correlates of conscious and non-conscious processing. both in healthy subjects and in DOC (Disorder of Consciousness) patients. In order to define precisely the cortical network dynamics involved in these processes, we recorded nine epileptic patients with intracranial electrodes. We analyzed event-related potentials, spectral modulations and connectivity between brain regions. We found that violations of local auditory regularity which can be processed non-consciously induced early responses, with strong modulation in the gamma band, which were mainly observed in the temporal lobe. Connectivity analysis, based on the phase of the signal, suggested that only short range connections were involved in this processing. Conversely, violations of global auditory regularities which have to be processed consciously induced late responses, with spectral modulation mostly in the beta band, distributed across brain regions. Connectivity analysis using the amplitude of the signal, suggest that this processing involves long range connections. Taken together, these results from intracranial recordings precise the electrophysiological signatures associated with conscious processing and are in agreement with the predictions of the global neuronal workspace theory.

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## Virtual Presence as a Form of Delocalized Consciousness

## Marco Roberto Elena, University and Polytechnic of Turin, Italy

## July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

The mind has the impressive ability to project itself well beyond the "here and now" without compromising the experience of unitary consciousness. Humans can therefore easily shift their Selves in other spaces (i.e. when taking a different visual perspective), or in other times (when thinking about upcoming events or recalling past situations), or even in other minds (when anticipating other's acrions). Remarkably, there is converging evidence that all these "delocalizating" abilities may rely on very similar neuronal mechanism, that see in the so-called "Default Mode Network" (DMN) their biological underpinning (Buchner & Carroll, 2006; Spreng et al, 2008; Mitchell, 2009; Molnar-Szakacs & Arzy, 2009). As far as Virtual Presence is defined as the feeling of being immersed in a virtual environment, my contention is that the ability of the mind to project itself in the simulated world also depends on the very same aforementioned system (that therefore configures itself as a general-purpose consciousness-"delocalizating" system). Neuroimaging results, indicating that prefrontal brain regions - which are indeed part of the DMN - are active when experiencing virtual presence (Baumgartner et al., 2008; Jancke et al., 2009); the widespread use of VR-based treatments with Autistic population (Bellani et al, 2011), - which has abnormalities in DMN deactivation - (Kennedy et al., 2006); and the effective use of VR-based pain therapies (Malloy & Milling 2010) - when we know that chronic pain affects DMN functions - (Baliki & al., 2008) taken together may support this speculative hypothesis.

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## The Sense of Agency over Artificial Actions Mediated By Direct Cortical Control

Nathan Evans, Ecole Polytechnique Fédérale de Lausanne, Switzerland Steven Gale, Ecole Polytechnique Fédérale de Lausanne, Switzerland Olaf Blanke, Ecole Polytechnique Fédérale de Lausanne, Switzerland & University Hospital Geneva, Switzerland

# *July* 5<sup>th</sup>, 14:00-16:00: *Poster Session* 2.

Recent work has demonstrated the malleability of the feeling that we are the causal author of our motor actions (sense of agency: SOA). Brain computer interfaces (BCIs) control external devices by decoding cortical activity, circumventing the motor system. We investigated whether conflict between predicted and actual artificial sensory consequences - mediated via a real-time BCI - modulates SOA and single-trial BCI classification performance.

Participants were first trained to move a cursor to the left or right by imagining clasping the corresponding hand (motor imagery-based BCI). The visual cursor was then moved either according to the participant's brain activity, in the opposite direction, or randomly. In the first two cases, a variable temporal delay was inserted on the BCI decoder, causing the cursor to move based on prior brain activity. After each trial, participants reported whether they felt as if they had been controlling the cursor or not. Classification performance was measured using persubject classifiers.

An interaction between delay and direction was found to manipulate SOA. For congruent trials, SOA decreased as a function of delay and increased from the baseline only at zero delay. Directional incongruence led to a strong decrease in SOA at all delays. We observed inter-subject variability in SOA judgments for random movements, suggesting that prior beliefs may influence SOA. Classification performance remained constant across conditions, indicating that perceptual-level changes to SOA were not due to task differences. We discuss the study of perceptual and motor systems in the absence of re-afferent proprioceptive feedback via BCIs.

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#### **Quantitative Evaluation of Conscious and Nonconscious Temporal Integration**

Nathan Faivre, California Institute of Technology, JUSA Christof Koch, California Institute of Technology, Pasadena & Allen Institute for Brain Science, USA.

# July 3<sup>rd</sup>, 16:30-18:30: Concurrent Session 2.

In order to make correct inferences about visual events defined across time (e.g., motion direction, synchrony, and causality), physical changes occurring within a temporal period must be integrated in a single representation. This temporal integration function (TI) is now well described when stimuli are consciously perceived. However, while the existence of a dissociation between visual processes and perceptual awareness is now indubitable, we still lack a characterization of TI for events we are not aware off. Here, relying on continuous flash suppression, we estimated quantitatively nonconscious TI. During an adaptation phase, observers were first presented monocularly with an apparent motion stimulus in the vertical or horizontal direction, while the other eye was flashed with a stream of salient patterns preventing perceptual awareness. During the following test phase, observers had to

indicate the perceived direction of an ambiguous quartet motion (i.e., consisting of a bistable pattern of vertical or horizontal direction). We assumed that a typical motion after-effect could arise only if the visual system was able to integrate the signal coming from the adaptor over its temporal period. By varying this period, we could estimate quantitatively the window of nonconscious TI, and compare it to a situation of full perceptual awareness (i.e., conscious TI, without continuous flash suppression). As TI is a fundamental cognitive function, the results we obtained are important in the context of a contrastive study of consciousness, and open new perspectives in the understanding of the links between consciousness and time.

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### **Three Threats to Free Will Discussion**

Kuo Ling Fang, National Yang Ming University, Taiwan Allen Y. Houng, National Yang Ming University, Taiwan

## July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Perhaps free will is the most difficult question in the realm of consciousness study. However there are several common hidden threats let the problem more difficult. First threat is that people confused the metaphysical notion of free will with the psychological one. This mistake shows in most of compatibilist's arguments. They twist the direction of discussion from "weather an agent is free or not" to "weather an agent think he is free or not". After the distortion, they define a free action as an action without any compulsion. The criterion of free action changed. The second threat appeared when people want to preserve the existence of free will by preserving the existence of moral responsibility. They think that the most unwilling consequence of denial free will is that we can't talk about moral responsibility as we usually do. However, we can't gain understanding about free will from those discussions. The third threat is that people just presuppose free will in their theories. We can find it in Libertarianist's arguments. Agent causation and non-causal account of free will is widely reviled because they often regard free will as intrinsic properties, or fundamental without any further explanation. Those threats to free will discussion make free will problem more difficult and perplex. If we aware of those threat, we can make more effort on the real question.

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#### What Mechanisms Could Possibly Explain the Predictive Power of Multi-Voxel fMRI Patterns?

## Ilya Farber, Institute for High Performance Computing, A\*STAR Singapore

# July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Multivariate pattern analysis is able to extract remarkably subtle signals from fMRI data. In particular, it has lead to some striking successes in inferring or predicting conscious mental states which are invisible to traditional measures of mean activity. By correlating multi-voxel patterns with behavioral responses to stimuli, researchers have been able to "read off" a subject's conscious perception of ambiguous stimuli (Kamitani & Tong 2005; Hsieh et al. 2012), detect covert intentions during the period before they are enacted (Haynes et al. 2007), predict "random" behavioral choices 7+ seconds before subjects become aware of them (Haynes 2011), and even predict subjects' aesthetic evaluation of neutral, abstract fractal artworks (Hsieh, this conference). Despite their demonstrable empirical power, surprisingly little is known about what these patterns mean at the neural level – i.e. where they come from, how they interact with more traditional mean-activity-based patterns, or how they might map on to the representational architectures of the areas in which they occur. Worse, the tentative hypotheses which accompanied the earlier studies appear to be inconsistent with the most recent findings. Thus, in the present work we 1) attempt to clarify the range of possible neural mechanisms which could underlie these patterns; 2) bring together empirical and computational arguments to winnow this range down to a few clearly distinct hypotheses; and 3) describe a planned set of experiments which are aimed specifically at distinguishing among these hypotheses. Our hope is that in teasing out the origins of multi-voxel patterns, we may ultimately learn more about the representational structure of the areas in which they occur.

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#### Bridging the Gap between the Philosophy and the Science Of Consciousness

Peter Fazekas, University of Edinburgh, UK & Hungarian Academy of Sciences, Hungary

# July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

According to the fundamental message of contemporary philosophy of mind, the phenomenal qualities of conscious experience pose a serious problem for scientific explanations -- they *resist functionalisation*, which leads to an unbridgeable *explanatory gap* between our phenomenal and scientific knowledge. This pessimistic

conclusion has fundamentally affected the attitude of scientists theorising about consciousness. Nowadays, they try to re-define conscious experience in cognitive and neural terms. This move, however -- as philosophers often point it out, -- threatens with changing the subject, and missing the original target. That is, the objection says, it is not conscious experience that scientific theories of consciousness account for, but rather something else (say cognitive access).

In this paper, my aim is to reconcile scientific approaches to consciousness with the subjectively most significant aspect of conscious experience. I present a cognitive account of phenomenal qualities, which, on the one hand, is compatible with state-of-the-art scientific evidences, and, on the other hand, is able to explain in purely scientific terms why consciousness resists functionalisation and why it gives rise to an explanatory gap. That is, the account proposed does not close the explanatory gap -- on the contrary, it acknowledges its presence and aims at providing an explanation of why it occurs.. This account could act as a plug-in for different scientific theories of consciousness, and further their reach by connecting cognitive processes to the distinguishing and philosophically most important features of conscious experience.

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#### Mirror Neurons, Canonical Neurons and the Recognition of Others as Acting Subjects

Liu Tzu Feng, National Yang-Ming University, Taiwan Allen Y. Houng, National Yang-Ming University, Taiwan

### July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

There are theories explaining how we know about others mind, and one of the most famous theories is the Simulation Theory, which has been popular in recent years by discovery of the mirror neuron system. Although the explanations of mirror neurons were strongly suggested relating to Simulation theory, there are still gaps between them. Simulation Theory was known as perspective-taking while mirror neurons are contributed to lower abilities that involve acting-subjective recognition.

The recognition of acting subjects is more original than knowing thoughts of those subjects. We should see others as subjects before we can understand others' feelings. For example, we should recognize others' eyes as eyes then we could track their expressions, and then the understanding of others' minds, which simulation theory involved, is a later issue.

Another lower-leveled recognition is canonical neurons which allow us to recognize objects. Scientists have found that these neurons will be activated while seeing a graspable object alone and executing the same grasping action. And this means the motor system is not simply involve in actions, but recognizing objects as well.

Of these two abilities of outer world recognition, I suggest that both of them are basic biological states, and in comparison to canonical neurons (we could only activate the action of how to raise the cup, not knowing the feeling of drinking water), mirror neurons only contribute to acting-subjects recognition, but not the mental inferential of others' minds.

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#### Reallocating the World. Vestibular Contribution to Distance Perception.

Elisa Raffaella Ferrè, University College London, UK Christina Fuentes, University College London, UK Patrick Haggard, University College London, UK

## July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Vestibular sensation is a truly enigmatic relative in the family of the human senses. Uniquely, it produces no conscious perceptions of its own, yet it is essential for all our interactions with the external environment. Clinical reports suggest that vestibular canal dysfunction leads to disintegration in the normal relation between personal and extrapersonal space (Blanke et al., 2004). Vestibular input occurs during head rotation to reorient towards a new part of external space. We investigated whether galvanic vestibular stimulation (GVS) interferes with a different form of spatial representation not directly coded by the canals, namely three-dimensional distance perception. Healthy supine participants judged the distance between their own body and an external object. Left anodal GVS produced misperception of distance: objects near the body were perceived as closer, and distant objects were perceived as farther away, relative to sham stimulation. In a further experiment, left anodal GVS lead to distance overestimation for farther sounds. This suggests that vestibular contributions to space perception are not merely driven by visuo-vestibular interactions, but imply a specific role of the vestibular system in supramodal space coding. The computation of object location from multiple sensory signals is fundamental for effective and direct action on the surroundings. We speculate that a vestibular-induced shift in space perception optimizes the sensitive pickup of information from personal space, and neglects the non-relevant ones located far away.

Vestibular mediation of the relation between body and environment may play a fundamental role in self-awareness.

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#### **Brain Correlates of Subjective Freedom of Choice**

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# July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

The subjective feeling of free choice, i.e., of making up one's mind about which of several possible alternative actions to take, is an important feature of human experience, though its neural basis is controversial. Experimental tasks have typically operationalized free choice by training monkeys or asking human participants to select one of a number of alternative responses, and have compared the mechanisms involved to those underlying instructed choice. Such free choice tasks have been criticized, and it remains unclear how they relate to the subjective feeling of freely choosing. Using fMRI, we replicated previous findings that free choice operationalised in this way involves activation of dorsolateral prefrontal cortex, premotor cortex, rostro-cingulate zone and bilateral inferior parietal lobule. We also devised a novel task in which participants could experience a graded sense of acting freely, by providing an external stimulus which could suggest or constrain their response to a greater or lesser extent. We asked them to make action choices and subsequently introspect about how free their choices had been from influence of this stimulus. BOLD response for conditions subjectively experienced as free identified a postcentral area previously unrelated to objectively-defined free action. Thus, brain correlates of objectively-defined free action did not match those of trials subjective experience of choosing and activity in the brain's voluntary motor areas.

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# Linking Evidence from Neurobehavioural Observation, fMRI And EEG in Patients with Disorders of Consciousness.

Paola Finoia, University of Cambridge, UK Tristan Bekinschtein, University of Cambridge, UK Evelyn Kamau, Addenbrooke's Hopsital, Cambridge, UK Judith Allanson, Addenbrooke's Hopsital, Cambridge, UK John Pickard, Addenbrooke's Hopsital, Cambridge, UK Srivas Chennu, University of Cambridge, Cambridge, UK

## July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Patients with disorders of consciousness (DOC) can be classified as minimally conscious (MC), showing inconsistent but reproducible goal-directed behaviours (e.g. response to command, verbalizations, visual pursuit), or in a vegetative state (VS), with exhibiting a sleep-wakefulness cycle but no signs of awareness (Giacino et al., 2002).

Amongst several tests assessing DOC, the JFK Coma recovery scale-revised (CRS-R) has proved to be one of the most effective (Giacino et al., 2004). However, as all methods based on observation, it relies heavily on subjective interpretation of observed behaviour and is ultimately dependent on a negative finding (no signs of awareness). As a consequence, this assessment is inherently vulnerable to a Type II error.

To address this problematic issue, recent studies have investigated the possibility of applying neuroimaging methods, such as fMRI and EEG, during DOC assessment, to reveal aspects of speech perception, emotional processing and language comprehension in some patients who behaviourally meet all of the criteria defining the vegetative state (Owen et al., 2008; Cruse et al., 2009; Bekinschtein et al., 2009). However there is often discordance between behavioural and neuroimaging tests of cognitive processes: patients classified to be MC may show no reliable activity during neuroimaging tasks (Bardin et al 2010).

Given substantial variability in the results obtained using these different techniques (behavioural, fMRI and EEG), we aimed to investigate which factors might predict patient performance, which technique (or combination thereof), might be most sensitive in detecting residual conscious awareness and which pattern of performance best classifies conscious state.

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## **Mindwandering and Distractibility**

Sophie Forster, University College London, UK Nilli Lavie, University College London, UK

## July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Attention may be distracted from its intended focus both by stimuli in the external environment and by internally generated task-unrelated thoughts during mind-wandering. However, previous attention research has focused almost exclusively on distraction by external stimuli and the extent to which mind-wandering relates to external distraction is as yet unclear. We present research using both real-world "beeper" methods and laboratory measures to examine this relationship. Intermittent and unpredictable thought probes during daily life found attention to be unintentionally directed towards task-unrelated stimuli approximately 23% of the time (although this varied as a function of the demands of the task being performed), with distraction equally likely to come from external and internal sources. Using laboratory measures, self-reported susceptibility to mind-wandering was found to negatively correlate with the magnitude of distraction by response-competing distractors, yet positively correlate with distraction from salient response-unrelated and task-irrelevant distractors. These results establish mind-wandering as a manifestation of susceptibility to task-irrelevant distraction and allow one to predict individual propensity to mind-wandering.

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#### How Prior Experience Influences Learning And Conscious Knowledge In Artificial Grammar Learning?

Ana Franco, Université Libre de Bruxelles, Belgium & Fonds National de la Recherche, Luxembourg Isaline Caudron, Université Libre de Bruxelles, Belgium

Arnaud Destrebecqz, Université Libre de Bruxelles, Belgium & Fonds National de la Recherche Scientifique, France Axel Cleeremans, Université Libre de Bruxelles, Belgium & Fonds National de la Recherche Scientifique, France

## July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

This study investigates how learning and conscious access to the acquired knowledge can be influenced by linguistic experience in implicit learning situations. We used an artificial grammar learning paradigm and controlled participants language skills. Because people with multiple language skills are known to have different language acquisition strategies and enhanced metacognitive skills than do people with single language skills, we should observe differences in learning and/or access to metaknowledge. Monolingual and bilingual adults learned an artificial language generated by a finite state grammar combined with a serial-reaction time task (Mysiak, Christiansen, & Tomblin, 2010). This method provides an on-line measure of learning and offers insights into the timecourse of grammar learning. Immediately after exposure, participants were tested on their ability to discriminate grammatical from ungrammatical sequences. Four types of sequences with nonpermissible pairs (Perruchet & Pacteau, 1990). At each trial, participants were also asked to give binary confidence judgments. Monolinguals and bilinguals' performance was compared in terms of grammar learning timecourse, accuracy on the discrimination task and the extent to which grammar knowledge was available to consciousness. The results will be presented at the conference.

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### Deconstructing the Mind/Body problem

Sam Freed, University of Sussex, UK

# July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

The talk aims to "deconstruct" the Mind/Body debate (MB) using the following distinctions: 1. the conflict between Subjectivism and Objectivism provides most of the impetus for MB. Both positions claim to be the seat of reality. 1.1. Subjectivism is the idea that Subjective experience is the basis of all reality. In the extreme case, it collapses into Solipsism. Holders of this position can be called infantile, as Solipsism is also a stage in normal mental development 1.2. Objectivism is very much in fashion. Objective knowledge is achieved using intersubjective experience, so the very idea of "objective" can be seen as a sham, it is dressed-up subjectivity. 2. The term "Things" can refer to one of three meanings: 2.1. Anything that can be discussed, anything that can take a predicate: Snow-White had seven dwarves. 2.2. In everyday speech, "things" are "medium sized dry goods" – solids much larger than an Atom, and much smaller than stars. Arguably, these are the targets of perception we evolved to deal with: The exceptions are few.2.3. A more sophisticated version of the above is "anything in space/time". This would include forces, fields, and other objects of physics .3. We commonly assume the primacy of Objects, and that Relations between these objects are secondary. An attempt to take the converse stance was made by Heidegger. The remaining issue is reformulated in terms of points-of-view, thereby "saving" both the mental and the physical dimensions.

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# The Evanescent Nature of Our Memory Canvas: Nonconscious Influences on the Construction of Memory Narratives

# Shelagh Freedman, Concordia University, Canada Jean-Roch Laurence, Concordia University, Canada

# *July* 4<sup>th</sup>, 14:00-16:00: *Poster Session* 1.

A large number of experiments have clearly demonstrated that errors of memory constitute an intricate part of the memory system. This process is multi-determined, and influenced by the implementation of mental heuristics shaped by earlier experiences of recall. Can the beliefs that people hold about their own memory functioning be related to their specific cognitive abilities and metamemory assumptions? To investigate this question, 367 participants responded to the Concordia Memory Questionnaire (CMQ) and were evaluated on the HGSHS:A to determine their hypnotizability level. The CMQ was designed to identify beliefs potentially influencing recall: beliefs in special memory processes, self-perceived mnemonic ability, beliefs in memory error and confusion, and perceived accuracy of early childhood memories. Confirming and extending previous findings, it was found that hypnotizable participants were more prone to harbour specific beliefs about the accuracy of their early memories, even though they appeared to be more aware of potential memory intrusions and distortions than low hypnotizable participants. Interestingly, these beliefs were also stronger in individuals who manifested posthypnotic amnesia, a temporary inability to recall the content of the hypnotic session. These assumptions about memory may taint the heuristic used to evaluate the historical accuracy of memories and lead to the reconsolidation of 'upgraded' versions of the past. The results emphasize the importance of better understanding the role that cognitive factors, beliefs and metamemory assumptions play in the assessment and validation of autobiographical memories and point to the nature of self-consciousness as a contextually congruent synergy of rearranged memories.

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## **Cultural Differences in Implicit Sequence Learning**

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- Junchen Shang, State Key Laboratory of Brain and Cognitive Science, Institute of Psychology, Chinese Academy of Sciences, China
- Xiaolan Fu, State Key Laboratory of Brain and Cognitive Science, Institute of Psychology, Chinese Academy of Sciences, China
- July 3<sup>rd</sup>, 16:30-18:30: Concurrent Session 2.

Easterners differ from Westerners in conscious perception and attention (e.g. Lin & Han, 2009; Nisbett, 2005). Generally, East Asians are more sensitive to the background and hence view the world consciously on a global scale, whereas Westerners are more focused on focal objects and hence view the world consciously on a local scale. However, cultural influences on unconscious process such as implicit learning are less well investigated.

The present study explored the effect of culture on implicit learning by adopting hierarchical letters in the SRT task. Each large (global) letter was constructed out of smaller (local) letters. The hierarchical letters followed two regularities, one at the global scale and one at the local scale (Tanaka et al 2008). The target regularity followed one of two second-order conditional sequences; the task-irrelevant regularity followed a first-order conditional sequence. Fifty-one Chinese and 51 British undergraduate students were randomly assigned to the global or local target group.

The results showed that British expressed a local precedence in perception while Chinese showed a tendency for global precedence, confirming the cultural difference in perception. However, more importantly, the Chinese learned the target regularity better than the British, especially when the target were global, indicating a global advantage for Chinese in implicit learning. Moreover, only Chinese participants acquired some unconscious knowledge of the irrelevant regularity - British participants did not - suggesting that the Chinese were more sensitive to contextual regularities than the British. The results show that the cultural biases shown to apply to conscious processes also apply to unconscious processes.

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## The Bilocated Mind

Tiziano Furlanetto, University of Turin, Italy Cesare Bertone, University of Turin, Italy Cristina Becchio, University of Turin, Italy

# July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

In daily life the self is typically tied to one place at a given point in time and this place coincides with the body. Selfexperience, however, is not always constrained by the body: empirical research into self-related disorders and fullbody illusions demonstrates that the spatial unity between body and self can be temporarily suspended (Ehrsson, 2007; Lenggenhager et al., 2007; Blanke & Mohr, 2005).

Where does the self localize during such experiences? Does the human mind allow for locating at more than one place at the same time? Here, we will focus on this latter question. In particular, we will consider the possibility that the self might be distributed over two spatially distinct places at the same time. Based on the concept of "minimal phenomenal selfhood" (Blanke & Metzinger, 2009), our contention is that *mental bilocation* can be broken down into different components: *self-localization* in two different places at the same time, *self-identification* with another body, and reduplication of *first-person perspective*. We will discuss three instances of mental bilocation in which the above mentioned components appear differentially present: heautoscopy, virtual presence, and perspective taking.

Incidences of bilocation are reported in many different cultures at many times. Through a neurophenomenological reduction of paranormal belief systems (Metzinger, 2009), we propose that these reports are rooted in the complex experience of being at two places at the same time, an experience which – we argue – is more frequent than commonly thought and plays an important role in the construction of the social space.

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## James, Collingwood and the Fringe Consciousness of History

## Steven Gable, Trinity Washington University, USA

## July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

In this paper I propose a theory of history combining R. G. Collingwood's understanding of historical consciousness, which involves intentional reconstruction of the past, with "fringe" consciousness, a cognitive notion introduced by William James and developed by Bruce Mangan (examples include the feeling of being right and 'tip of the tongue' experiences). In intentional historical consciousness, the mind is aware of its own efforts to understand the past. Historical *fringe* consciousness involves the unintentional awareness of an indistinct human past.

Historical dislocation results in the *non-contextuality* of an artifact, evoking vague yet powerful echoes of a bygone age, reminiscent of Proust's *Remembrance of Things Past*. Grounded in obsolescence, historical fringe consciousness saturates the margins of cultural expression. Both cognitive and historical artifacts possess a penumbra, a web of fuzzy connections that endows them with meaning.

As the mind encounters culturally defunct artifacts, helplessly grappling with their isolation, it attempts to reconstruct their past web of meaning. Although the artifacts remain intentional objects they become severed from their original enveloping context. Cognitive phenomena such as 'change blindness' and 'neglect' have historical analogues.

We now begin to realize, that in both the cognitive and historical domains, the neglected penumbra is indispensable to the construction of both cognitive and historical theories. To conclude, I will argue that historical and cognitive fringe consciousness not only illuminate each other but also illuminate the structure of intentionality.

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## Unreality Feelings: An fMRI Study of Emotional and Self-Related Processing in Depersonalization Disorder

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## July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Depersonalization describes a state of feeling disconnected from one's own mental processes, emotions, and body. Depersonalization is frequently accompanied by derealization, a sense that one's external surroundings are unfamiliar or that the world appears 'unreal'. Although these phenomena frequently occur as comorbid symptoms in other psychiatric disorders they can also amount to a chronic mental illness in the form of "depersonalization-derealization syndrome" (ICD-10, F48.1) or "depersonalization disorder" (DPD; DSM-IV 300.6).

As people with DPD retain full reality testing, the disorder can be understood as a pure alteration of phenomenal subjectivity and its investigation can provide evidence regarding normal conscious experience.

In our fMRI experiment we aim at dissecting two core symptom clusters of DPD constituted by (1) pathological emotional and (2) altered self-related processing. DPD patients, a patient control group of people with social anxiety disorder and no symptoms of depersonalization-derealization as well as healthy controls undergo a sequence of well-established cognitive-affective paradigms.

Preliminary analyses show abnormal activation in cortical midline structures involved in the evaluation of selfrelated stimuli. Furthermore, altered activation in a fronto-parietal emotion regulation network supports the hypothesis that DPD symptoms can be related to dysfunctional emotion regulation.

We will present data from our fMRI study on emotional and self-related processing in DPD, link the results to the existing literature on the disorder, and attempt to embed them in the philosophical debate about a naturalization of phenomenal experience.

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### **Rethinking the Nature of Inner Life**

Silvia Gáliková, University of Trnava, Slovakia

July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

The "hard nut" in contemporary consciousness studies constantly circles around the explanandum itself. In this presentation I reconsider two fundamental sources of confusions on the nature of inner conscious life. Firstly, philosophers carry on underestimating the metaphorical character of the language on the "inner". In everyday experience we intuitively feel that our desires and feelings do not literally exist inside our bodies or heads. A person may well experience their inner life as a kind of "Cartesian theater" or "inner space". From experiencing the seemingly distinct nature of "inner" do not follow any ontological commitments. In theory, however, philosophers use to take metaphors literally, which they are not. This tendency has been represented by the everlasting mentalphysical two-worlds myth, where subjective, phenomenal inner states are considered as first person data "inhabiting"an ontologically separate world (Searle, Chalmers). Recently, we are also witnessing the revival of panpsychist ideas on consciousness, appealing to "quantum physics" and "mathematics" (Penrose, Hammeroff) or to the spiritual "basis of all reality" (Chopra). Secondly, the core of misunderstanding is due to a mistaken approach on the very reality of metaphors. Metaphorical language on "inner"has been often considered as depriving man's thoughts and feelings from their real existence. Instead, I argue, that literal-metaphorical distinction works for conscious states similarly as for other natural phenomena - within the reality itself. Moreover, metaphors play an important cognitive and argumentative role in the study of human mind, language and reality (Lakoff, Johnson). I propose, finally, that clarifying the role of metaphors in philosophy of mind leads us towards the fact that consciousness fits perfectly into the physical world and therefore it really matters.

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#### Thalamic Generator for Propofol-Induced Alpha-Rhythm: A Simultaneous EEG-fMRI Study

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# July 3<sup>rd</sup>, 14:00-16:00: Concurrent Session 1.

Propofol-induced alpha rhythm has been suggested to be involved in loss of consciousness (Supp et al., 2011). However, its generation mechanism remains unknown. We simultaneously recorded 64-channel EEG and 3T fMRI data from 15 volunteers during wakefulness, propofol-induced sedation (Ramsay scale score 3) and recovery state. We searched for correlations between the time course of continuous EEG epochs spectral power in the alpha band (8-12 Hz), convolved with a canonical hemodynamic response function, and regional BOLD signal in the three conditions. A random effects analysis tested for significant group effects within and between each conditions. Results were thresholded at small-volume corrected p<0.05 centered around a priori coordinates (Laufs et al., 2003; Feige et al., 2005). During wakefulness, alpha power was negatively correlated to BOLD signal in thalamus, paracentral lobule and posterior parietal cortex. During propofol sedation, a positive correlation was identified between thalamic activity and alpha power fluctuations (which was significantly different from wakefulness). Such paradoxical thalamic involvement in alpha rhythm generation was reversed during recovery state. Our findings support previous modeling work (Ching et al., 2010) suggesting a thalamic involvement in propofol alpha rhythm generation. The paradoxical thalamic excitation observed during propofol-induced sedation might play a role in the decreased responsiveness observed in this state.

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### Blinded By Your Heart: Awareness of Fear Stimuli Is Influenced By Cardiac Cycle

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Anil K. Seth, Sackler Centre for Consciousness Science & Dept of Informatics, University of Sussex, UK Hugo D. Critchley, Sackler Centre for Consciousness Science & Brighton and Sussex Medical School, UK

## July 6<sup>th</sup>, 11:00-13:00: Concurrent Session 4.

#### Background

Internal bodily signals influence contents of consciousness, notably in emotional processing. Physiologically, the strength and timing of individual heartbeats is signalled each systole by a barrage of neural activity to brainstem from arterial baroreceptors. We tested if this specific channel of interoceptive information alters awareness and reported intensity of fear stimuli while also examining the underlying neural circuitry.

### Method

We time-locked two experiments to each participant's heart trace: 1) In a modified Attentional Blink paradigm, we tested if timing stimuli to begin at systole modulated 'breakthrough perception' of faces presented; 2) in a Fear Perception study, we tested if timing at systole modulated subsequent VAS intensity ratings of fearful and neutral faces. We recorded brain activity via fMRI at 1.5T.

### Results

In the first study, we observed enhanced breakthrough of fearful vs. neutral face stimuli [t(19)=3.3, p-.004], but only for trials time locked to systole [emotion x cardiac cycle interaction [F(1,19)=7.466, p=.013]. Emotional enhancement of fear face detection was blocked for trials beginning at diastole [t(19)=.49, p=.63]. In the second study, reported intensity of fearful faces increased at systole. Early fMRI analyses suggest amygdala and PAG mediate this effect (emotion x cardiac timing interaction; amygdala [-12 -2 -14] Z=3.90; 174 voxels; PAG [-8-26 -10] Z=2.8, 59 voxels).

### Conclusions

Short-term interoceptive bodily fluctuations gate the attention-dependent detection and emotional impact of salient stimuli. Our behavioural and neural observations have implications for understanding the role of interoception in awareness and the mechanisms that preserve a sense of experiential continuity.

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#### Zombies, Ouija, and the Ideomotor Effect: When Implicit Cognition Turns Explicit

Helene L. Gaucho, University of British Columbia, Canada Ronald A. Rensink, University of British Columbia, Canada Sidney Fels, University of British Columbia, Canada

# July 4<sup>th</sup>, 11:00-13:00: Concurrent Session 3.

Ideomotor actions are movements or behaviours that are unconsciously initiated, usually without an accompanying sense of conscious control. We investigated whether such actions could express implicit long-term semantic memory, which is not available to conscious recall. We compared the accuracy of answers to yes / no questions using two different response modalities: volitional report and ideomotor response (Ouija board response). Results showed that when participants believed they knew an answer, responses in the two modalities were similar, with accuracies that were much the same (average: 64%). In contrast, when participants believed they were guessing, accuracy fell to chance for volitional report (50%), but remained significantly higher for Ouija response (65%); similarity of responses was also reduced. Several control conditions ruled out various explanations in terms of properties of the task itself. Instead, these results suggest that implicit semantic memory can be expressed through ideomotor actions, possibly via a nonconscious "zombie" system able to control motor actions when conscious override is removed. We also discuss the extent to which this approach can form the basis of a new methodology for studying implicit processes in perception and cognition.

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### Should HOT Theory Require that Conscious States involve Prefrontal Cortical Activity?

#### Rocco J. Gennaro, University of Southern Indiana, USA

## July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

The higher-order thought (HOT) theory of consciousness says that what makes a mental state conscious is that there is a suitable HOT directed at that mental state. Thus, it seems that any neural realization of the theory must be widely distributed in the brain, but it remains unclear just how widely distributed it needs to be. I argue against the view that HOT theory should treat first-order (i.e. world-directed) conscious states, and thus unconscious HOTs, as requiring prefrontal cortical activity. There are at least two advantages to this view. First, there is little evidence to suggest that typical first-order conscious states involve prefrontal cortical activity as opposed to other more limited cortical activity (such as recurrent feedback loops in other brain areas). However, when HOTs are themselves conscious, we instead have "introspection," "executive control," and other more sophisticated mental abilities, which are rightly associated with the prefrontal cortex. Second, if HOT theory required prefrontal cortical activity for all conscious states, then it is needlessly susceptible to the criticism that HOT theory, such as Block and Kriegel, as well as supporters of HOT theory, such as Rosenthal and Lau. I do agree with the latter pair, however, that there is empirical and philosophical support for the higher-order view and in fact hold a version of HOT theory

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#### Do We Really Know What We Know? Awareness of Own Performance in Transitions to Asleep.

Stanimira Georgieva, MRC Cognition and Brain Sciences Unit. Cambridge, UK. Tristan Bekinschtein, MRC Cognition and Brain Sciences Unit. Cambridge, UK.

# July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Driving on a long and monotonous road in the middle of the afternoon. Do we know whether our ability to assess other vehicles distance is compromised? Or we consider that we are doing just as well as in the morning after a refreshing night sleep? The aim of the current study is to investigate how the capacity to discriminate two categories changes not only with the ambiguity of the stimuli but with the variation in alertness. Moreover, does people's confidence in their discriminative abilities changes between alert wakefulness and relaxed drowsiness? Participants had to decide between two words (tone/cone or oat/oak) with varying degrees of merging (from 95/5% to 45/55% in steps of 10%), rendering the words perceptually ambiguous. Force-choice discrimination was followed by confidence ratings. Preliminary results show that people's accuracy and confidence drop and RTs increase with higher ambiguity. However, there was a tendency for high confidence even in error trials (8/10), though lower than correct (9/10). Using an EEG drowsiness index, we expect to see that when people get drowsy the sharpness in their categorical judgment falls down, increasing error rate and RT. Still, it is unclear if their subjective accuracy ratings will decrease along with accuracy (percent correct and RT). This experiment informs the relationship between metacognition and wakefulness by measuring confidence while falling asleep.

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### Benussi's Hypothesis of Functional Autonomy of Emotions and the Study of Consciousness

Enrico Giora, University of Milano-Bicocca, Italy Natale A. Stucchi, University of Milano-Bicocca, Italy

# July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

Classical psychology in Brentano's tradition offered key contributions to the problem of consciousness. In this research we deal with an appealing idea on the nature of emotions proposed by Vittorio Benussi, one of the most original – although forgotten – scholars in such tradition. According to Brentano, all mental states – both cognitive and emotional – are characterised by intentionality: consciousness is always "consciousness of something". While for Brentano an emotion is necessarily related to a specific content (e.g., to be afraid of something), Benussi hypothesised the existence of pure emotions independent from intentional objects (e.g., to experience a pure fear) and tried to experimentally disentangle emotional functions from cognitive ones. Hypnosis was employed in order to analyse mental states and to induct pure emotional states (e.g., happiness, terror, pleasure) and pseudo-cognitive states (e.g., evidence, assent, denial). Benussi investigated the nature of emotions both through subjects' reports and psychophysiological correlates, such as respiration, and found that the participants' breathing patterns matched with their emotional states. Those ideas deserve to be rethought in the light of the current perspectives of affective neuroscience, which to some extent support the thesis of the independence of emotions from cognition.

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### Time in Mind: an fMRI Study of Temporal Dissociation with Ketamine

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July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Dissociation occurs in up to 80% of psychiatric inpatients (Hunter et al. 2004). One aspect of dissociation is the change in the perception of time. Abnormal temporal perception can lead to "dissolution of the intentional arc" (Fuchs 2007) which may underlie more complex phenomena of consciousness such as misattribution of sensory stimuli and abnormal phenomena including delusions. Twenty-seven volunteers were assessed by double-blind, placebo controlled design in which low dose ketamine (100ng/ml) was compared to placebo (saline) infusion. Participants reported the order of two flashed stimuli shortly after a rapid (saccadic) eye movement (Morrone et al 2005). Psychophysical Results: Both inverted temporal judgement and ketamine lengthened reaction times. Mean response latency for ketamine trials was 611ms and 598ms of placebo (t=2.23, p<0.03). Imaging Results: Full brain corrected comparisons showed highly significant clusters of increased BOLD for inverted trials opposed to noninverted trails (maximal cluster (xyz=-28,22,-8; T=8.53, p<0.0001). Regions were located bilaterally in the dorsal anterior cingulate cortex (dACC) and inferior frontal gyri to insula. Region of interest analysis revealed increased BOLD for ketamine versus placebo in the left tempero-parietal junction (T=2.40, p<0.01). Discussion: The paralimbic network of dACC and bilateral anterior insula has been described as 'the salience network' (Seeley et al. 2007). The experiment reveals activation of this network without conscious awareness or errors. The temporoparietal junction and neighbouring MT area are associated with dissociation. The modulation of these regions by ketamine and sensitivity to temporal tasks provides a powerful tool to investigate temporal awareness.

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# Using Process Dissociation to Understand Implicit and Explicit Attitude Change Resulting From Exposure to Advertising.

#### Alastair Goode, Cogresearch

## July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

A study investigated the affect different kinds of advertising, has on Implicit and Explicit memory, measured using the Process Dissociation Procedure (PDP) (Jacoby 1991). 648 respondents saw two different kinds of adverts, 151 saw a TV advert for a breakfast cereal where the intention was to communicate an explicit product benefit. The other 497 respondents saw one of 3 TV adverts for an alcoholic drink where there was no product benefit explicitly communicated. The PDP used followed that of (Buchner et al 1995). The study was conducted on-line where respondents were initially asked to report existing knowledge about a product, after which they were exposed to the appropriate advert. A day later respondents were asked to respond under inclusion and exclusion conditions and values for Explicit memory (memory attributed to the advert) and Implicit memory (memory not attributed to the advert) and Implicit memory (memory not attributed to the advert), were calculated. A mixed design ANOVA showed no overall effect of advert (p>0.1) but revealed a significant interaction between advert type and memory f(1,644) = 43.6, p<.01, where there was significantly higher implicit memory for the cereal ad that contained the product benefit and significantly higher implicit memory for the drinks adverts. The results are discussed as a demonstration that miss-attribution of ad experience is a viable mechanism for understanding how adverts can intentionally communicate information that influences consumer's personal beliefs, without that consumer necessarily being aware that those adverts have done so.

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#### The Experience of Visual Motion: Empirical Challenges to Philosophical Conventional Wisdom

## Jeremy Goodman, Oxford University, UK

## July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

Consider three claims about motion experience that philosophers take for granted: 1) that in the waterfall illusion experience represents the world to be a way that it could not possibly be; 2) that it is obvious what the content of motion experience is, in a way that it is not obvious what the content of color experience is; and 3) that we can introspect the gross temporal feature of our experience. I argue that each of these claims is false: The way the world looks to those undergoing the waterfall illusion is a perfectly possible way for the world to be; there is no more reason to think that motion experience represents objects' velocities than there is to think that color experience represents surfaces' reflectances; and motion-blind patient L.M.'s widely quoted claim that moving water appears "frozen, like a glacier" is probably false: L.M. may think that her experience has a slow 'frame rate,' but it probably doesn't. Motion After-effects: All philosophers writing on the waterfall illusion agree that it is an experience that represents objects to be both moving and standing still—an impossibility (and therefore a counterexample to Michael Martin's influential epistemic disjunctivism). However, this consensus is mistaken. Such experiences do not represent objects to be standing still. Rather, the waterfall illusion consists in a sequence of experiences each of which has the content that object o is moving with velocity v at location x. This content is possibly true. What the waterfall illusion actually demonstrates that an object can continue to appear at a location without thereby appearing to stand still there. The Content of Motion Experience: When we see illuminated surfaces, our visual experience attributes certain properties to them: colors. Likewise, when we see moving objects, our experience attributes a certain property to them: call it 'whooshing.' Philosophers have found it obvious that whooshing simply is motion. But the analogy with color should give us pause, since it is controversial whether or not colors are reflectance properties of surfaces. I argue on neuropsychological grounds that the analogy runs deep: Whooshing is 'painted onto' the visual world by area V5 just as color is 'painted on' by area V4 (Zeki 1991). We are so quick to identify whooshing with motion because we tend to assume that we visually represent motion 'cinematically': by sequentially representing objects to be at adjacent locations. But vision isn't cinematic, as the waterfall illusion shows. Akinetopsia: Without V5 vision is cinematic: Motion-blind patient L.M. has bilateral V5 lesions, and reports cinematic vision that is "frozen" for appreciable durations, like a slide show. This is odd: Although L.M. can't see motion, her brain processes haven't slowed down. So perhaps she is mistaken, and her vision's 'frame-rate' is higher than it introspectively seem to her to be. I defend this hypothesis, drawing on Fred Dretske's work on change blindness. Just as the spatial resolution of awareness outstrips the spatial resolution of attention, so the temporal resolution of experience outstrips the resolving power of introspection (Cavanaugh 2002). L.M. reports: "When I'm looking at the car first, it seems far away. But then, when I want to cross the road, suddenly the car is very near" (Zihl 1983). If I'm right, L.M. actually saw the car to be at many intermediate locations between "far away" and "very near," although she didn't notice the change until the car was "very near." If so, this is a particularly radical form of change-blindness.

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#### **Cross-Modal Stochastic Resonance in Continuous Flash Suppression**

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## July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

There is extensive evidence of cross-modal integration, particularly in binocular rivalry where visual awareness spontaneously alternates between two monocularly presented images. We extend these findings to the Continuous Flash Suppression (CFS) paradigm, in which a continuously flashing Mondrian pattern presented to one eye has been shown to suppress a stationary image in the other eye (Tsuchiya & Koch, 2004). Unlike previous experiments in cross-modal integration, the current study uses Gaussian filtered auditory white noise that is unrelated to the suppressed image, thus investigating the effect of Stochastic Resonance (SR) on CFS. SR refers to improved stimulus detection due to the addition of an optimal level of white noise. Exploiting the effects of cross-modal SR in the CFS paradigm, we find that intermediate level of noise facilitates the release from suppression in CFS compared to both no noise and high noise. These findings are consistent with those of previous experiments in binocular rivalry and cross-modal SR, and are discussed in terms of predictive coding, cross-modal binding, and their relevance to conscious multisensory perception.

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#### Consciousness-Dependent Interplay between Spontaneous and Stimulus Evoked Activity: An EEG-fMRI Study

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# July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

The functional significance of ongoing BOLD signal fluctuations present during propofol-induced unconsciousness remains unclear. We here investigated the influence of spontaneous auditory activity fluctuations on tone-evoked responses under propofol anesthesia versus wakefulness. Simultaneous EEG-fMRI data were acquired during presentation of pure tones in 13 volunteers during wakefulness, propofol-induced sedation, unconsciousness and recovery. In each subject and for each condition, we identified through ICA-template matching a spontaneous auditory network (not correlated to sounds presentation). Sounds were then classified depending on their onset occurring within the upper half ('up') or the lower half ('down') of spontaneous auditory BOLD activity. A correlation between the effect of spontaneous BOLD fluctuations on differential stimulus-induced fMRI activation and EEG oscillatory activity and the level of consciousness was investigated. Results were thresholded at falsediscovery-rate corrected p<0.05 (SPM8). Results During wakefulness, <sup>7</sup>up' tones induced stronger cerebral activation than 'down' tones in temporal, fronto-parietal and limbic cortices. During unconsciousness, the effect of spontaneous activity was restricted to primary auditory cortices. A linear correlation between the influence of spontaneous BOLD fluctuations on fMRI stimulus-evoked activation and the level of consciousness was found in fronto-parietal and occipital cortices. A consciousness-dependent effect of spontaneous auditory network activity was also found for stimulus-induced beta-band synchronisation 200 ms after stimulus presentation. Our results suggest a correlation between the level of consciousness and the interplay between spontaneous and stimulusevoked activity. They shed light on the (lack of) functional significance of BOLD fluctuations observed during propofol-induced unconsciousness for the processing of external stimuli.

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#### How to Close a Gap: Explanatory Pluralism, Manipulation, and Phenomenal Consciousness

## Joseph Noel Gottlieb, University of Illinois, USA

# July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

A number of philosophers—among them Joe Levine, Jaegwon Kim, David Chalmers, and Frank Jackson-- have argued that a reductive explanation of phenomenal consciousness requires that facts about qualitative character must be a priori *deducible* from or *logically necessitated* by facts about the reducing property in question. This requirement is motivated by an auxiliary commitment to ordinary macroscopic truths being a priori entailed by microphysical truths. Call this the *a priori entailment* thesis. Thus if some phenomenal fact P is not a priori entailed by some non-phenomenal fact F, there can be no reductive explanation of P in terms of F. The failure of a prior entailment of P's from F's is what generates the so-called *Explanatory Gap*. While the above authors differ on whether P's are in fact a priori entailed by F's, they all agree that a priori entailment brings with it a sense of intelligibility—that is, a transparent epistemic connection between the explanandum and the explanans—that is a necessary condition on any adequate account of scientific explanation. I argue that we can get this required notion of intelligibility without a priori entailment by shifting away from epistemic theories of explanation to a 'Hybrid Account', one that marries elements from van Fraassen's account of Why-questions (1980) and Woodward's Interventionist Theory (2000; 2003). The upshot is that the Explanatory Gap, rather than being an in-principle a priori gap, becomes a tractable empirical one.

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### fMRI Analysis of Congruent and Incongruent Conditions in Grapheme-Colour Synaesthesia

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## July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

Grapheme-colour synaesthetes frequently experience perceptual dissonance when the colouring of an externally presented letter is not aligned with their own synaesthetic colour. We sought to identify the neural mechanisms underlying this synaesthetically induced perceptual dissonance, in order to better understand the neural basis of synaesthesia-induced sensory experience.

We report first results from a large fMRI investigation in which subjects (n=20 synaesthetes) passively viewed blocks of inducing and non-inducing graphemes coloured either black, the same as (congruently) or differently (incongruently) to each subjects' synaesthetic colour. Subjects were instructed to internally verbalise the name of the grapheme with no overt motor or verbal response. We tested both "projector" and "associator" synaesthetes and correlated their sub-type score with experimental results. By avoiding overt responses, our design extends previous Stroop-like experiments in which activations reflecting motor conflict may have confounded effects of perceptual dissonance.

Subjectively, incongruent conditions were experienced as "annoying" or made the subject "angry", whilst congruent conditions were experienced as "soothing" or "a treat". Statistical analysis of the interaction between congruency, synaesthetic experience and external colouring has enabled investigation of brain regions involved in the simultaneous processing of both synaesthetic and veridical colouring. We also examine how the perceptual and affective components are modulated by the nature of the synaesthetes colour experience.

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#### Image Statistics Describe Both Early and Late Processing Of Natural Scenes

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## July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

The visual system processes natural scenes rapidly and efficiently. It has been proposed that a global "gist" percept, mediated by feed-forward activity, precedes detailed, scrutinized perception of the scene. If such global gist perception exists, it is most likely based on rapid extraction of low-level scene statistics. We recently showed that simple statistics derived from pooled contrast responses explain up to 80% of single-image variance of early visual responses (ERPs). These statistics also order natural scenes in a meaningful way (degree of clutter, depth, figure-ground segmentation). Surprisingly, we found that scene statistics continue to explain a significant amount of variance up to 300 ms after stimulus-onset. The range of this interval is beyond the score of feed-forward

processing and suggests that global image statistics also describe more complex, possibly semantic, processing. In the present study, we sought to test whether divergence of attention during natural scene processing influences the degree to which low-level statistics still predict evoked activity. If diverging attention away from a scene reduces the explained variance of its evoked activity, this would suggest that the activity is more related to fine-grained processing. If the explained variance does not decrease under divided attention, this would suggest that it is related to some form of recurrent processing that is not influenced by attention. Preliminary results show that the explained variance in the late interval is not influenced by attention. This means that the global statistics derived from a scene could provide a substrate for conscious perception irrelevant of attention.

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#### **Reward-Dependent Perceptual Learning of Objects - an fMRI Study**

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- Marcus Rothkirch, Department of Psychiatry and Psychotherapy of the Charité Berlin - Visual Perception Laboratory
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## July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

Perceptual learning is the improvement in a perceptual task through repeated training or exposure, typically during the course of several days or weeks. Previous studies in perceptual learning have mainly focussed on very simple stimuli (e.g. lines or gratings). In this study we investigate reward-dependent perceptual learning of complex object recognition at the threshold of visual awareness. Human subjects had to recognize briefly presented and backward-masked objects over the course of five days. On days 2 to 4 subjects received either high-reward or low-reward feedback on their choices (training phase). On days 1 and 5 they performed the task inside the fMRI scanner, without feedback, to compare pre- and post-training brain responses. Each object belonged to one of three category pairs, one of which was not shown during the training phase (untrained category pair). The other two pairs were split into a set of trained and untrained exemplars of each category. This allowed us to compare trained and untrained exemplars within trained categories and untrained categories.

Behaviorally we find that the subjects' performance improved significantly more for trained compared to untrained categories with an additional advantage for high-rewarded stimuli. We demonstrate a within-category transfer of perceptual learning from trained to untrained exemplars, while the reward effect was specific to trained exemplars. fMRI data analysis revealed a neural correlate of perceptual learning in the hippocampus. More specifically the pre- and post-training hippocampal activity was consistent with the category specificity of the training effect and the exemplar specificity of the reward effect.

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### **Causal Beliefs Influence the Perceived Time of Action Effects**

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## July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

When a key press causes a stimulus as its effect, the key press is perceived later and the stimulus earlier than key presses and stimuli presented independently of each other. This bias in time perception has been linked to the intention to produce the effect and thus been called intentional binding. In two experiments we examine how causal beliefs about action effects influence the perceived time of the effect. Two participants simultaneously performed the same experiment on connected computers. Each participant's key press actually caused a yellow and a red stimulus appearing simultaneously or separated by delays of up to 50 ms. Participants were either instructed that they caused both stimuli or that each participants judged the temporal order of both stimuli. Participants perceived the stimulus they believed to cause earlier than the other participant's stimulus. This result confirms that higher order causal beliefs change the perceived time of an action effect. In Experiment 2, participants judged if the stimuli occurred simultaneously or not. Participants perceived delayed stimuli more often simultaneous when they believed to cause both stimuli than when they believed that the two stimuli were

caused separately by the two participants. This corroborates the unity assumption stating that two stimuli are rather perceived simultaneously when they are believed to have a common source.

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## Psychological Motives for Attribution of Agency and Phenomenal Experience

Ida Hallgren, University of Gothenburg, Sweden

## July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Attributing mentality may involve both an intentional stance where we attribute agency and a phenomenal stance where we attribute phenomenal experience (Robbins & Jack, 2006). Different proposals on what triggers attribution of agency and experientiality have been given. For example, Arico et al (2011) suggest that certain features triggering the category of agency may also trigger attribution of phenomenal experience. I will argue that interdependency and perceived relative status mediates responses to triggers, and thereby influences both the type and degree of ascribed mentality. An experimentally induced sense of low status has been related to higher empathic accuracy (Galinsky et al 2007). Kraus, Côté and Keltner (2010) replicated these experimental findings, also found correlations between low social class an empathic accuracy, and suggested interdependence as a mediator of mental attribution. That interdependency and relative social status mediates mental attribution points to a functional explanation of why we tend to attribute mentality to certain entities. Such a functional explanation pointing to psychological needs behind mental attribution offers more than a mere causal explanation of what triggers mental attribution. Much works remains in determining which psychological needs motivate mental attribution in what types of social contexts. Also, many studies on mind attribution have not looked for ways to distinguish the attribution of agency from attribution of experientiality. One conclusion to be drawn is that future experiments should be based on a discussion of which different needs that may activate the attribution of agency as compared to those motivating attribution of experience.

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### Perceptual Learning Improves Tactile Acuity and Generalises To Untrained Body Parts.

Vanessa Harrar, University of Oxford, UK Charles Spence, University of Oxford, UK Tamar Makin, University of Oxford, UK

# *July* 4<sup>th</sup>, 14:00-16:00: *Poster Session* 1.

The body is represented in a somatotopic framework such that adjacent body parts are represented adjacently in the brain. We utilised the organisation of the somatosensory cortex to study the generalisation pattern of tactile perceptual learning. Perceptual learning refers to the process of long-lasting improvement in the performance of a perceptual task following persistent sensory exposure. In order to test if perceptual learning generalises to neighbouring brain/body areas, we trained 12 participants on a tactile discrimination task on one fingertip (using tactile oriented gratings) over the course of four days. Thresholds for tactile acuity were estimated prior to, and following, the training for the "trained" finger and three additional fingers: "adjacent", "homologous" (the same finger as trained but on the opposite hand), and "other" (which was neither adjacent nor homologous to the trained finger). Identical threshold estimating with no training was also carried out for a control group. Following training, tactile thresholds were improved (as compared to the control group). Importantly, improved performance was not exclusive for the trained finger; it generalised to the adjacent and homologous fingers, but not the other finger. We found that perceptual learning indeed generalises in a way that can be predicted by the topography of the somatosensory cortex, suggesting that sensory experience is not necessary for perceptual learning.

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#### Jumping the Gun: The Sense of Agency When Sensory Consequences Precede the Action

**Bruno Herbelin,** Ecole Polytechnique Fédérale de Lausanne, Switzerland **Nathan Evans,** Ecole Polytechnique Fédérale de Lausanne, Switzerland **Olaf Blanke,** Ecole Polytechnique Fédérale de Lausanne, Switzerland & University Hospital Geneva, Switzerland

# July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

The ability to recognize oneself as the causal author of a motor action (sense of agency) depends on spatial and temporal congruence between predicted and actual sensory effects. Recent studies have shown that agency decreases as delay is injected between bodily movements and their visual consequences (positive delay). However, agency remains unstudied for the artificial situation where visual consequences precede the movement (negative delay), and no comparison between visual consequences in the form of bodily vs. non-body objects has been made.

Here, participants performed self-paced finger tapping while they saw an animated 3D hand (or an object) in place of their real hand. On a per-trial basis, we predicted the onset of the finger movement in order to provide visual consequences for both positive and negative delays. Agency was gauged with a forced-choice response as to whether the movement participants saw corresponded to the movement they made.

Agency was found to decrease sooner for negative delays than for positive delays (absolute point of subjective equality: 90ms vs. 310ms). Bodily visual consequences shifted equivalent agency judgments to larger positive delays than those for objects. For negative delays, agency judgments changed more rapidly for objects than for bodily visual consequences, indicating that bodily visual consequences increase uncertainty in agency. Taken together, our results demonstrate a complex modulation of agency due to the form of visual consequences and the temporal ordering of action and consequence. We present and quantify the perceptual mechanisms underlying our sense of motor-sensory causality.

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# Inferring Interactions between Emotions and the Self during Reading of Self-Related Words By Means Of EEG and fMRI

# **Cornelia Herbert**, University of Würzburg, Germany **Peter Walla**, University of Newcastle, Australia

## July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

What are emotions and what constitutes the self? Although respective answers still remain unclear, it is well known that both emotional as well as self-related stimuli (e.g., the subject's own name) capture the viewer's attention quite spontaneously. Building upon previous research by Walla and colleagues (2007, 2008), we present event-related brain potential (ERP) and functional imaging (fMRI) results about passive viewing of words describing participants' own emotions. In particular, we tested whether or not this leads to similar facilitated processing as has been shown for emotional or personally relevant stimuli alone. We found that pronoun-noun pairs related to the self or the other grab the reader's attention early during reading, but elicit differentiable ERP patterns during later stages of processing. In particular, emotional pronoun-noun pairs describing the reader's own emotion (e.g., my fear, my fun) were more deeply processed compared to pronoun-noun pairs making a reference to the emotion of others (e.g., his fear, his fun) or emotion words containing no personal reference at all (e.g., the fear). During functional imaging, reading of self-related emotional nouns selectively enhanced activity in medial prefrontal brain structures involved in self-referential processing of one's own internally experienced feelings. Together our results demonstrate that paradigms based on language content provide suitably tools to study the neural correlates of emotional self awareness.

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#### (Never)Mind the Gap: The Timing Experiments and Conscious Efficacy

## Marcela Herdova, King's College London, UK

## July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

I argue that the classic timing experiments conducted by Benjamin Libet as well as more recent timing experiments by John Dylan Haynes do not challenge the causal efficacy of conscious intentions. I propose that the arguments to the effect that the above timing data undermine conscious efficacy draw on unsupported assumptions about the nature of consciousness as well as the nature of intentions and their place in cognitive architecture.

I suggest that the timing experiments do not target conscious intentions in the first place; this is because the timing tasks do not involve conscious intentions immediately prior to the action. I base this conclusion on considerations about the role of intentions in practical reasoning and the nature of the representational content of intentions. The timing tasks involve simple movements which are insignificant in the sense that they have no implications on an agent's other actions and plans. I show that it is implausible to assume that we form intentions and make decisions about such movements, both within and outside the experimental setting. I further argue that due to the experimental design of the timing tasks, no conscious intentions would be immediately involved with mental tasks either.

I suggest, however, that the Libet-type actions are intentional and that their intentionality draws from distal intentions which may or may not be about or represent the relevant actions. In relation to this, I suggest that causation by conscious intentions does not require that conscious intentions immediately precede actions and put forward a model of how conscious intentions can be causally efficacious at a temporal distance.

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# Reflecting Loss of Consciousness or Opioid Drug Level? Mid-Latency Aeps Break Down In A Dose-Dependent Manner during Remifentanil Medication

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# *July* 5<sup>th</sup>, 14:00-16:00: *Poster Session* 2.

Auditory-evoked-potentials (AEPs) are used to assess the loss of consciousness during general anesthesia. Anesthetic depth is usually quantified by a breakdown of the mid-latency cortical AEPs (10-50 ms) induced by hypnotic agents such as propofol. The validity to use the breakdown of midlatency AEPs as an index for the loss of consciousness crucially depends on its robustness against confounding influences of other pharmaceutical agents such as analgesic drugs (e.g. opioids). So far, clinical studies have not provided a consistent answer regarding a potential effect of the opioid remifentanil on mid-latency AEPs, since most studies used a combined administration with hypnotic drugs. Therefore, it remains an unresolved question whether opioids directly affect mid-latency AEPs. In the current study, we addressed this question by electroencephalographic (EEG) recordings of healthy human volunteers during a step-wise increase of a single pharmaceutical agent, either using the opioid remifentanil or the hypnotic drug propofol. Our results revealed that remifentanil decreased the mid-latency AEP components in a dose-dependent manner. In consistence with previous findings, we also found a dose-dependent decrease of the mid-latency AEPs during propofol administration. Neither of the two drugs affected brainstem AEPs (1-10 ms). In conclusion, our study shows that remifentanil modulates mid-latency AEPs. Therefore, a decrease of this evoked brain component does not seem to constitute an unequivocal index for the loss of consciousness. These results challenge the use of mid-latency AEPs as a reliable marker of the depth of anesthesia in clinical settings that often use hypnotic drugs in combination with opioids.

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### **Experience, Representation, and Machine Consciousness**

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# July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Almost all discussion about the relationship between conscious experience and representation takes place in the context of human consciousness, where experience is the given and the nature and content of the representation is the unknown. However, in machine consciousness the situation is reversed; since we can know everything about the internal states of the machine, we can be sure of what is being represented, but it is the nature and content of any conscious experience that is unknown. In this talk I will propose a weak constraint that can be applied to such a machine: what is experienced must be represented, but what is represented need not be experienced. I will then review recent robotic experiments in which an internal model of the robot's body interacts with an internal model of the environment, and can be seen to do so because the representations can be rendered visually. Without making any claims that such robots are capable of experience, I will discuss the possible nature of any experience with that of robots with environmental representation but no self representation, and also of robots with neither environmental nor self-representation. My conclusion will be that a robot capable of experience will require the interaction of both self and environmental representations, and that the possibility that little or nothing further might be required deserves to be taken seriously.

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#### Influence of Cueing on Implicit and Explicit Sequence Learning

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## July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

There is still debate on how people learn a sequence of stimuli in the serial reaction time (SRT) task. Two different theoretical models have been proposed for sequence learning: a continuous statistical process (e.g. Cleeremans, 1993) and a discrete chunking process (Perruchet & Vinter, 1998). There is evidence for the presence of both processes being active in implicit learning tasks. Yet, the learning of discrete sequence fragments has been difficult to show in implicit sequence learning during the SRT task. In order to find evidence of chunk learning in this paradigm, we will compare the effects of visual cueing and learning instructions. A color cue in the target stimuli was used in order to achieve uniform chunk formation across participants. Previous research has shown that while

such cueing can lead to discrete learning, the effects disappear when participants are transferred to a non-cued task. We propose that an explicit learning instruction will lead to lasting uniform chunking, but also to more sequence awareness. Recently developed measures for the assessment of chunking and explicit knowledge will be applied to the data. Results will be discussed at the conference.

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#### Interoception and the Problem of Consciousness

Jim Hopkins, King's College London, UK

July 5<sup>th</sup>, 11:00-13:00: Symposium 2.

Recent studies have shown that "unconscious" processing can be surprisingly powerful (cf work in the labs of Lamme, Dijksterhuis, Mattler, Haynes, Dehaene, Bargh, myself, etc). I had taken these results to be a challenge to the notion that sensory awareness has special functional power. Here I criticize my previous arguments. A useful analogy: People without legs can move around (albeit poorly), but we all agree that legs are for locomotion. Likewise, although certain higher cognitive functions can be performed without awareness (just barely better than chance), it does not mean that awareness has no functional advantage. A different approach is to create conditions where subjects are equally good at detecting and discriminating the stimulus, but they report different subjective levels of awareness. Under these performance capacity-matched cases, we observed functional advantage for awareness only in some specific tasks. These results give powerful constraints for theorizing about sensory awareness in general.

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#### Readiness Potentials and Intentionality: an rTMS EEG study.

Charles Hounsell, Cardiff University, UK Chris Chambers, Cardiff University, UK John Evans, Cardiff University, UK

## July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Using a repetitive transcranial magnetic stimulation protocol we sought to suppress readiness potentials, traditionally thought to be involved with volitional acts, and measured using electroencephalography. Readiness potentials are signals stemming from the motor areas of the brain prior to action, and interestingly, prior to self-reported times of awareness of the intention to act. We observed the preparatory activity in each of three stimulation conditions as well as recording behavioural reports in order to see the causal consequence of suppressing the readiness potential on electrical activity and conscious awareness.

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#### Could Sydney Shoemaker's Theory Of Physical Realization Compatible With Strong Emergence?

Yao-Wen Hsieh, National Yang-Ming University, Taiwan Allen Y. Houng, National Yang-Ming University, Taiwan

## July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Mental causation is a long-term debate. But all available physicalist theories about mental causation, no matter reductive or non-reductive ones, have failed to give a satisfying explanation to the causal power of qualia. Among these physicalist theories, the way emergentism illustrating mental property might be a much intuitive one. Emergentists claim that mental properties (including qualia) are not deducible from the properties plus laws of their underlying physical components. This notion might explain the intractability of the problem about qualia when we trying solve it with neuroscience and other physical sciences. But there seems hardly any example of this kind of non-deducibility in other science discussions. Thus, there is no working scientific model for us to comprehend the mechanism of emergence. I think a mature model from philosophy might help for forming a more detailed emergence theory. I use Sydney Shoemaker's theory of physical realization as the foundation. Shoemaker develops this theory in order to save mental causation from identity theory and Jaegwon Kim's functional reductionism, but he also mentioned the compatibility of his theory with emergentism. He claims that, the reason for a property being an emergent property is due to the latent power owned by its realizers. However, I will argue that Shoemaker's present theory can only contain so called "weak emergence" if he has no further explanation for that 'laten power', and weak emergence is unable to deal with qualia. Therefore, I suggest a more focused research on latent powers of realizers in both science and philosophy.

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#### **Tracking the Wandering Mind**

Christoph Huber-Huber, University of Vienna, Austria & University of Ljubljana, Slovenia Grega Repovš, University of Ljubljana, Slovenia

# July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

If you read, you have most probably experienced a situation in which you were thinking of something else than the actual text you were reading. In that case you were engaged in mind-wandering or daydreaming. Mind-wandering is found to be a ubiquitous phenomenon that permeates our daily lives. It is most commonly studied by thoughtsampling, an inherently interruptive and subjective method in the tradition of phenomenological research. To advance the investigation into this basic human phenomenon, the development of non-interruptive and objective markers of mind-wandering is crucial. The present study investigates the possibility of using eye-tracking as such a marker and tests its viability by correlating periods of zoning-out while reading as assessed by thought-sampling with putative eye-tracking parameters. Seven participants took part in a study in which they were asked to read, report when they feel they have zoned out as well as report their state of attention to the text when sampled at variable intervals. During reading, binocular eye-gaze position as well as pupil diameter were recorded. Results suggest that the reflective awareness of the fact that one's mind has wandered off the text is accompanied by an increase in pupil diameter. In light of related studies, this increase, however, cannot solely be attributed to the reflective awareness of the fact that one's mind has wandered but can also be attributed to decision-making and movement preparation that are required by the task, as well as other possible factors that influence pupil dilation. This study, therefore, suggests that with caution and further studies pupil diameter might be used as an indicator of periods of zoning-out during reading.

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#### The Role of Action-Effect Prediction in Intentional Binding and Sensory Attenuation

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# July 3<sup>rd</sup>, 16:30-18:30: Concurrent Session 2.

Sensory processing of action-effects has been shown to differ to that of externally triggered stimuli, both with respect to the perceived timing of their occurrence (intentional binding) as well as their intensity (sensory attenuation). These phenomena are normally attributed to forward action models, such that when action prediction is consistent with changes in our environment, our experience of these effects is altered. While much progress has been made in recent years in understanding sensory attenuation and intentional binding, a number of important questions regarding the precise nature of the predictive mechanisms involved remain unanswered. We systematically investigated the role of temporal prediction, temporal control, identity prediction and motor prediction in previous reports of sensory attenuation and intentional binding. By isolating the individual processes that have previously been contrasted and incorporating these experiments with research in the related fields of temporal attention and stimulus expectation, we assessed the degree to which existing data provides evidence for the role of forward action models in these phenomena. This analysis revealed that the vast majority of studies did not isolate motor prediction mechanisms to be the cause of binding or attenuation. We also report data from 2 behavioral experiments on intentional binding and an event-related potential study on sensory attenuation, which suggest that while sensory attenuation is modulated by identity specific motor prediction intentional binding is not. These findings have important implications for understanding these phenomena as well as for the implementation of these paradigms in investigating disorders of agency in schizophrenia.

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#### Segmentation in Memorizing Motion Sequences in Recognition and Recall

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## July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

This study explored the segmentation in memorizing motion sequences in the recognition and recall processes, and investigated how the segmentation of recognition processes affects the recall and generation of motion sequences. To simultaneously investigate the relation between recognition and recall, memorization of motion

sequences displayed at various speeds was tested. In our experiment for the recognition process, subjects were required to select critical still frames from pre-recorded task motion sequences necessary for communicating the sequences so that another person might be able to reproduce the sequences from the selected frames. To investigate segmentation in the recall and generation process, subjects watched the motion sequence, and moved two joysticks freely as if they were controlling the motion being viewed. It is known that the input patterns of subjects are organized and segmented according to their memory of the motion sequences. Following the recognition task, the recall task was performed. As a result, we found that the selected critical stills changed according to the speed of motion sequences, which means that recognition depends not on only the motion pattern but also the speed of the motion. Motion recall also changed corresponding to the segmentation of recognition. The segmentation process in the recognition made a specific contribution to motion generation.

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# EEG Symbolic Transfer Entropy (STEn) Indicates Decreased Top-Down Information Exchange between Frontal and Primary Sensory Areas

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# *July* 5<sup>th</sup>, 14:00-16:00: *Poster Session 2*.

Theoretical models describe unconsciousness as an impaired capacity of the brain to integrate information processing across specialized subsystems and it has been discussed whether impaired top–down processes may play a crucial role in impaired consciousness. To study the role of bottom-up versus top-down information exchange between higher frontal and primary sensory areas during anesthesia induced unconsciousness we analyzed the symbolic transfer entropy (STEn) as a measure of information exchange between EEG electrodes in 15 healthy subjects during propofol-induced unconsciousness. We analyzed the area under the curve (AUC) and 95% percentile bootstrap confidence intervals (CI) of symbolic transfer entropy (STEn) and directionality index of STEn from consciousness to unconsciousness over all pair combinations of 63-channel EEG signals. During unconsciousness, the STEn showed a significant decrease in bidirectional information exchange between the frontal and posterior electrodes. This shift of information exchange was caused by a decrease in top–down information flow from the frontal to the parietal and temporal electrodes, while the bottom–up information flow in the opposite direction was maintained. These results suggest that functional decoupling of higher-order frontal processes and primary sensory processes may indeed be a general feature of unconsciousness.

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### **Changes In Functional Connectivity Support Conscious Object Recognition**

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# July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

What are the brain mechanisms that mediate visual consciousness? To investigate this question, it is essential to distinguish between brain processes that cause conscious recognition of a stimulus from other correlates of its sensory processing. Previous fMRI studies have identified large-scale brain activity ranging from striate to high-level sensory and prefrontal regions associated with conscious visual perception or recognition. However, the possible role of changes in connectivity during conscious perception between these regions has only rarely been studied. Here, we used fMRI and connectivity analyses, together with 120 custom-generated, two-tone, Mooney images to directly assess whether conscious recognition of an object is accompanied by a dynamical change in the functional coupling between extrastriate cortex and prefrontal areas. We compared recognizing an object versus not recognizing it in 19 naïve subjects using two different response modalities. We find that connectivity between the extrastriate cortex and the dorsolateral prefrontal cortex (DLPFC) increases when objects are consciously recognized. This interaction was independent of the response modality used to report conscious recognition. Furthermore, computing the difference in Granger causality between *recognized* and *not recognized* conditions

reveals an increase in the directed influence of extrastriate cortex on DLPFC when subjects recognized the objects. We suggest that frontal and visual brain regions are part of a functional network that supports conscious object recognition by changes in functional connectivity.

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## Human Memory Search Patterns Assessed By Web Search Engines

**Tetsuo Ishikawa,** Tokyo Institute of Technology, Japan & Sony Computer Science Laboratories, Inc **Mayumi Toshima,** The Graduate University for Advanced Studies & National Institute of Informatics **Ken Mogi,** Sony Computer Science Laboratories, Inc

# July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

Consciousness is an emergent property of the human, facilitating communication with other brains (Barlow 1980). The old adage, "two heads are better than one" is true in perceptual decision-making (Bahrami et al, 2010). From daily tweeting on a microblogging service to writing a scientific conference abstract, our composition of words is based on both unconscious thoughts and conscious intentions. When searching for appropriate words to express something, hidden associations between unrelated things lead to new meanings and metaphors (Lakoff and Johnson 1980), in some cases resulting in a successful "connecting the dots" (Jobs 2005). Temporal interval of human free recall obeys a special kind of random walk statistics with a heavy-tailed distribution of step size, i.e., Lévy flight or a scaling law (Rhodes and Turvey 2007). Because this pattern is commonly found in animal foraging behavior and thought to be one of the most optimal strategies, human memory search features could also be adaptive. The word frequency of human language (Zipf 1949) and the architecture of the Internet (Barabási and Albert 1999) are also known to follow scaling laws. Here we investigate word associations in word chain ("Last and First") games and its variants (i.e., finding unrelated word as much as possible within a limited time) using the cooccurrence frequencies in web search engines (e.g. Google). Based on the result, we discuss the unconscious constraints in the conscious and voluntary production of words in human subjects.

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#### **Changes in Word-Usage Pattern along Substance Use**

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# July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

The connection between psychoactive substance use and creativity is a widely studied scientific area. The research question of the study was whether differences can be demonstrated in general language behaviour along the subjects' psychedelic substance usage experience. In-depth interviews were recorded with 60 artists who were involved to the sample with snowball technique. The interviews were about the connection between the artistic creative act and the use of psychoactive substances. A questionnaire about the characteristics of legal and illegal substance use was administered, including 13 items. Two groups were formed on the basis of the questionnaire; a psychedelic and a control group. The data were analysed by the Nool linguistic development environment software. The following word categories were studied; creativity, consciousness and spirituality. Significantly more words of the three dimensions were used by the target group than by the control group. Examples of the subjects' viewpoints related to the connection between the three dimensions and the use of psychedelic substances are also presented. The relevance of the topic is unquestionably important regarding to the use of psychedelic substances are also presented. The artistic creative process.

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# Conscious Expectancy Of The Outcome Is Necessary For Cue-Potentiated Behaviour, Emotional Experience Is Not Sufficient.

# **Stephen Jeffs**, University of Sussex, UK **Dora Duka**, University of Sussex, UK

## July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

Background - Items associated with rewarding outcomes, e.g. a bottle with alcohol, come to signal the availability of these rewards. Research confirms that *behaviour* guided by such items is controlled by what we *know* them to predict. But whether behaviour is also guided by the *emotional* response to these items requires investigation. Therefore the current research examined the role of emotional reactivity in cue-potentiated behaviour.

Method – Participants completed a Pavlovian-to-instrumental-transfer task, which comprised three phases. In the Pavlovian phase participants encountered one picture associated with 50p, and another picture associated with nothing. In the instrumental phase participants learned that repeatedly pressing a button would win 50p. In the transfer phase participants were shown either picture and then had the opportunity to press the button.

Results – Participants were divided into two groups on the basis of whether or not they were *consciously aware* of the relationship between each picture and its respective outcome in the Pavlovian phase. Despite differential *awareness*, both groups *liked* the winning picture more than the non-winning picture. However, only *aware* participants *behaved* differentially to winning versus non-winning pictures in the transfer phase. Unaware participants, who developed only an emotional response, did not behave differentially.

Conclusion – It is necessary to *know* what a reward-associated cue predicts for it to encourage reward-seeking behaviour. Simply *liking* the cue is not sufficient for it to affect behaviour. Further investigation should ascertain whether conscious expectancy alone is sufficient to modulate behaviour, or whether a combination of expectancy and emotion is necessary.

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### **Immersion Consciousness**

## Carolyn Dicey Jennings, Boston University, USA

# July 3<sup>rd</sup>, 14:00-16:00: Concurrent Session 1.

The relationship between attention and consciousness seems clearest in the case of normal perceptual experience, where attention is argued by many to play an indispensible role (Dehaene & Naccache, 2001; Grassia, 2004; Hine, 2010; Prinz, 2011), in part because of the success of the Global Workspace Theory in explaining various attentional phenomena (e.g. the phenomenon of inattentional blindness, as discussed in Mack & Rock, 1998). The relationship between attention and other forms of consciousness is less clear. This lack of clarity may derive from a general lack of knowledge about forms of consciousness that appear at the fringe of mainstream research. In this paper I look at a few forms of consciousness that appear to occur with diminished or absent attention, where attention is understood as voluntary selection that occurs through top-down biasing mechanisms (e.g. the "attentional field" of the Normalization Model (Reynolds & Heeger 2009). Namely, I put forward evidence that seems to show that dreaming, hypnosis, and task immersion can occur with diminished or absent attention. I then argue that these forms of consciousness converge in the complete absence of attention to what I call ``immersion consciousness," where I will give reasons to think this form of consciousness exists outside of attention and that it is properly understood as a conscious form of experience (where conscious experience is temporally-extended experience that transcends mere arousal but need not necessarily correspond with self-awareness, situational awareness, propositional knowledge, or episodic memory). Along the way I look at previous attempts to establish the existence of conscious experience outside of attention (Campbell 2002; Koch & Tsuchiya, 2006; Block, 2007) and find them wanting.

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#### Multiple Realizability within the Neuronal Correlates of Consciousness

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### July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Twenty years after its original definition by Crick & Koch, scientists have gathered an astonishing amount of research findings on the neuronal correlates of consciousness (NCC). The wealth of accumulated data allows for research to move away from the mere localization of brain processes that are correlated with conscious experience towards an investigation of their neurophysiological properties. More specifically, once an NCC has been isolated, it becomes possible for researchers to characterize its properties in order to learn more about the nature of brain processes underlying conscious experience. One example for a tangible research question that can be asked in such a setting concerns the correspondence function between neuronal activity and mental states. In particular, one can ask whether any given conscious state is subject to a one-to-one mapping onto a certain neural correlate or whether their relationship is non-exclusive. In other words, one can ask whether one and the same conscious state can be realized by multiple neural correlates or not. We draw from existing neuroscientists data and argue that from the existing literature the current empirical evidence points toward a non-exclusive relationship between phenomenal state and neuronal states. This has consequences for both neuroscientists and philosophers of mind.

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#### Towards A Specification of the Phenomenology of Conscious Thought

## Marta Jorba-Grau, LOGOS, University of Barcelona, Spain

## July 6<sup>th</sup>, 11:00-13:00: Concurrent Session 4.

When we consciously think a thought we undergo a certain cognitive experience. The phenomenal character involved in such an episode is an instance of cognitive phenomenology in the sense that there is some phenomenal character in the episode of thought. While some agreement is reached concerning the existence of cognitive phenomenology, controversies arise with respect to its nature. A question we need to answer is whether cognitive phenomenology is specifically cognitive or it is reducible to more familiar kinds of phenomenologies, such as the sensory/emotional one. Some authors deny the specificity claim on the basis of a fundamental asymmetry with the perceptual (and emotional) case: in the case of conscious thought we do not find any commonalities and differences with respect to phenomenal character that would secure speaking of experiential kinds (Martin, manuscript; Georgalis, 2005). Georgalis (2005) further argues that this is an obstacle to render cognitive phenomenology essential to conscious thought. In this talk I sketch an account that can overcome this objection in a way that also gives evidence for the specificity of cognitive phenomenology. The account is based on two aspects of concepts, the world-tied element and the functional role one (further specified in relation to background knowledge): while the first provides us with commonalities in cognitive phenomenology, the second, together with sensory/emotional elements, accounts for its differences. I further argue that the contribution of these concepts aspects to cognitive phenomenology cannot be understood in terms of sensory/emotional phenomenology, thus making the case for the specificity of cognitive phenomenology.

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# Entropy Based EEG Analysis Indicate Most Prominent Effects of Anaesthesia at Frontal and Between Frontal and Parietal Electrodes

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## July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Electroencephalographic (EEG) "depth of anaesthesia" monitoring completes information given by vital signs during surgery. Therefore, different univariate EEG-parameters have been suggested as measures of the hypnotic component of anaesthesia, such as permutation entropy (PeEn) which quantifies the signal regularity. For further improvements in EEG-based anaesthesia monitoring a specific analysis of the underlying brain dynamics and cortical interactions seems to be necessary. To this end, the symbolic transfer entropy (STEn) can be used to quantify interactions in multivariate EEG to improve the understanding of underlying physiological processes. Based on 64-channel EEG STEn, we investigated the effects of propofol-induced unconsciousness on corticocortical interactions in 15 subjects. EEG (average reference) of 10s length at BL and LOC was analysed using EEG relative b-power, ordinal PeEn and STEn. Thereby, STEn quantifies the mutual information flow between two signals, where the degree of prediction of actual information from past signal content is reflected by a generalised Markov property. 95% bootstrap confidence intervals based on the area under the curve (AUC) indicated effects of propofol on PeEn and STEn, where values of clustered frontal, parietal, temporal and occipital electrodes / electrode combinations were considered. Univariate analysis vielded highest AUC for separation BL/LOC in frontal electrodes (PeEn: AUC=0.84 (0.68-0.99), b-power: AUC=0.21 (0.03-0.40). In contrast, separation was not significant in parietal, temporal and occipital electrodes. STEn indicated significant effects on the bidirectional information transfer with highest AUC=0,95 (0,89-1,00) in frontal-parietal electrode combinations. Our results indicate that 1) STEn reveals effects of propofol which are basically not captured by univariate EEG-parameters such as the "stateof-the-art" PeEn and 2) that the observed decrease of PeEn might be explained by decreased frontoparietal information exchange.

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#### Influence of Non-Dual Awareness on Anti-Correlated Networks In the Brain

Zoran Josipovic, New York University, USA Ilan Dinstein, New York University, USA & Weizmann Institute of Science, Israel Jochen Weber, Columbia University, USA David J. Heeger, New York University, USA

# *July* 5<sup>th</sup>, 14:00-16:00: *Poster Session 2*.

Human experiences can be broadly divided into those that are external and related to interaction with the environment, and experiences that are internal and self-related. The cerebral cortex appears to be divided into two corresponding systems: an "extrinsic" system composed of brain areas that respond more to external stimuli and tasks and an "intrinsic" system composed of brain areas that respond less to external stimuli and tasks. These

two broad brain systems seem to compete with each other, such that their activity levels over time is usually anticorrelated, even when subjects are "at rest" and not performing any task. This study used meditation as an experimental manipulation to test whether this competition (anti-correlation) can be modulated by cognitive strategy. Participants either fixated without meditation (fixation), or engaged in non-dual awareness (NDA) or focused attention (FA) meditations. We computed inter-area correlations ("functional connectivity") between pairs of brain regions within each system, and between the entire extrinsic and intrinsic systems. Anti-correlation between extrinsic vs. intrinsic systems was stronger during FA meditation and weaker during NDA meditation in comparison to fixation (without mediation). However, correlation between areas within each system did not change across conditions. These results suggest that the anti-correlation found between extrinsic and intrinsic systems is not an immutable property of brain organization and that practicing different forms of meditation can modulate this gross functional organization in profoundly different ways. I will discuss the relevance of these findings for understanding the nature of consciousness.

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# Stimulus Size Has Opposite Impacts on the Speed of Unconscious Processing and the Timing of Conscious Perception

## Ryota Kanai, University College London, U.K Chris Paffen, Utrecht University, the Netherlands

## July 3<sup>rd</sup>, 16:30-18:30: Concurrent Session 2.

What is the moment at which a visual stimulus reaches visual awareness? It has been proposed that initial feedforward processing can trigger motor responses without giving rise to conscious perception and conscious perception occurs via a later more elaborated recurrent processing. A difficulty in dissociating the timing of conscious perception from the speed of unconscious processing, however, is that manipulations of stimulus properties such as contrast or intensity simultaneously influence simple reaction times (RTs) and the timing of conscious perception as measured by temporal-order judgment (TOJ) tasks. Although differential effects of stimulus magnitude on RT and TOJ have been known (e.g. Jaskowski, 1992), they always go in the same direction, that is, stimulus manipulations that make RTs shorter also shorten perceptual latency for the stimulus measured in TOJ tasks. Here, we report that a very simple manipulation of stimulus size has opposite impacts on RTs and TOJ. When participants were asked to respond to the appearance of a simple stimulus (e.g. disks, luminance Gaussian blobs, Gabors of various spatial frequencies), the RT is generally shorter for larger stimuli. On the other hand, when the perceived timing of such stimuli were compared against a standard reference stimulus, the perceived timing is delayed (up to 60 ms) for larger stimuli. This perceptual lag is clearly visible when a large stimulus (e.g. 8 degrees in diameter) is presented simultaneously as a smaller stimulus (e.g. 1 degree in diameter). We suggest that the differential effects of stimulus size on RT and TOJ reflect separate neural mechanisms underlying unconscious feedforward processing and emergence of conscious perception. The effect of size on RT can be simply understood in terms of race model (or diffusion model) of neural signals. On the other hand, the longer duration required for perceiving a larger stimulus may reflect the time required to establish synchronized activity over a larger cortical surface.

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## The Effects of Meditation-Induced States of Higher Consciousness

**G. Madhavi Kanakadurga,** Dayalbagh Educational Institute, India **Nandita Satsangee,** Dayalbagh Educational Institute, India

## July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

The term meditation describes a variety of practices with a variety of goals. It usually involves turning ones attention inwards to the mind itself. It is usually defined as either a state that is experienced when the mind is free of all thoughts or when it is focused on a single object. From the point of view of psychology, meditation can induce an altered state of consciousness. The practice of remaining in this altered (higher) state of consciousness has been found to affect the lower levels of consciousness in the awakened state. Many such physical, cognitive and affective correlates of meditational consciousness are being explored. The present paper reports an empirical research study that investigated, under controlled experimental conditions, the effect of meditation on the level of attention regulation of university students. The effect was found to be significant after implementing the meditation programme on students from different disciplines for a period of four weeks. Both quantitative and qualitative parameters were employed to assess the impact which was found to be highly significant, statistically as well as through self reports. The findings of the study have important implications in the field of applied consciousness studies e.g. in the education of general and slow learners.

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# Meditation as a measure of Consciousness to measure Psychological Attributes of Attention and Academic Performance of students.

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# *July* 5<sup>th</sup>, 14:00-16:00: *Poster Session* 2.

Education is the drawing out of the best in humanbody, mind and soul. Education leads to Enlightenment i.e. attainment of Ultimate Bliss/Happiness. An Educated person is Conscious of his Goals, Approaches, Techniques, and Behavioural Modifications. To make his life purposeful, productive and useful. Students now-a-days are facing many problems related to their Mental health. To develop the mental faculties of the Psyche, Meditation is the best technique for Physical, Intellectual, Social and Spiritual development to perform a Conscious Role in their Adulthood. Mind becomes alert and attentive with the practice of Meditation, it gains Attention, regulates the deviating factors of Mind resulting in Better Learning. Meditation reduces some Psychological Problems like Stress, Anxiety, Negative Attitude and Depression. Meditation relaxes the body, freshens the mind and nourishes the soul to know the essence of Happiness. Meditation practiced regularly for a scheduled time in the schools may yield good positive results in Attention regulation which may in turn lead to better Academic Achievement.

Present Study attempts to draw conclusions after a regular practice of Meditation (Practice of Yoga) for a period of one month and this experimental study resulted in a significant difference between pre and post test scores before and after Meditation. Results exhibit a considerable increase of Attention Regulation and Academic Achievement of Secondary students. Meditation thus is a reliable measure to focus Mind, to alleviate Anxiety and Stress and to promote Attention, Self-Concept, Academic Performance and Positive Attitude of the students living in a world of fantasy.

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# The Development Change of Evaluating the Effect of Communication on Distinguishing Knowledgeable Informants from Unknowledgeable Informants

Ishikawa Katsuhiko, Kyushu University, Japan Mikami Satomi, Kyushu University, Japan Hashiya Kazuhide, Kyushu University, Japan

## July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

We tell knowledgeable informant from unknowledgeable one. But it is unclear how we selectively identify who is knowledgeable when several informants communicated with each other to show information.

In Study1, Japanese 17 6-year-olds and 33 adults were tested. The participants were shown two types of videorecorded sequences. Video stimulus started with two boxes on a desk. A male put an object in one box of the two. After he went out, two females came in. Importantly, both females had not seen hiding phase so didn't know the location. In Verbal condition, *Initiator* verbally taught the location to Stater. In Whispering-gesture condition, *Initiator* showed whispering-gesture to Stater silently. Following this, in both conditions, *Stater* nodded and guessed the location facing to the front. Target question was "Which actor did know the location?"

X2 tests revealed more adults selected Initiator in Whispering-gesture condition than Verbal condition (31/24). In contrast, more children did that in Verbal condition than Whispering-gesture condition (15/8).

In Study2, Japanese 17 6-year-olds and 39 adults were tested. The procedure was same except for these: in Verbal condition, Initiator and Stater indicated wrong location. In Whispering-gesture condition, Stater indicated wrong location. Target question was "Which actor did have wrong knowledge for the location?" X2 tests revealed the ratios of Initiator were same in both conditions in both age groups respectively.

The results suggested the way of selecting knowledgeable person according with the manner of transmission was different among age group. And manner of selection changed among accuracy of actor's information.

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#### Non-Conscious Processing Of Motion Coherence Can Boost Conscious Access

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*July* 4<sup>*th*</sup>, 14:00-16:00: *Poster Session* 1.

Research on the scope and limits of non-conscious vision can advance understanding of the functional and neural underpinnings of visual awareness. Here we investigated whether local features in patterns of moving dots can be

integrated into a global coherent flow before gaining access to visual awareness. During continuous flash suppression, a set of moving dots presented to one eye can be rendered undetectable to subjects due to the presentation of rapid masks to the other eye. Our results demonstrate that for radial motion, coherence favors the detection of patterns of moving dots even under interocular suppression. This indicates that the visual system is able to extract and integrate coherence out of radial motion signals before those stimuli access visual awareness. For biological motion, however, we did not observe any increase in the sensitivity of detection. This suggests that biological motion might depend on a second stage of processing beyond the extraction of motion coherence in the visual cortex. This later stage appears to be inhibited during interocular suppression. Our findings show that coherent stimuli posses an enlarged potency to gain access to awareness, in agreement with the hypothesis that certain features can be bound non-consciously. Importantly, interocular suppression operates gradually across multiple sites in the visual hierarchy making the non-conscious binding dependent on the type of features analyzed by the visual system.

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# Detecting the Neural Signatures of Conscious Processing in Non-Communicative Patients: outperforming clinical diagnoses with a systematic EEG approach?

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July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Despite their relatively intact arousal, Disorders of Consciousness (DOC) patients present an inability to demonstrate robust intentional behaviors. Science and modern medicine have been challenged to know whether these patients were conscious but unable to communicate or unconscious of their surrounding environment.

We here implemented a series of analyses extracting most of the neural signatures of conscious processing described in the EEG literature, in order to assess their respective validity and efficiency in the clinics. We performed 197 high-density EEG recordings at bedside while Vegetative (VS), Minimally Conscious (MCS) and Conscious patients (CS) were exposed to repeated series of sounds for 30 minutes.

Results demonstrated that although a large proportion of these markers could be used to predict patients' consciousness states, those focusing on lower frequency ones (delta - alpha) were by far the most discriminatory. Secondly, predictive analyses combining all markers demonstrated successful automatic classifications of patients' clinical states. Finally, VS patients misclassified as MCS or CS by our algorithm presented twice more chances of conscious recovery (44% of recovery) than correctly classified VS patients (20%). On top of providing the first systematic review of the EEG signatures of conscious processing in a large DOC patient cohort, analyses of misclassified patients' outcomes thus suggest the possibility of detecting conscious activity independently of behavior and intentions.

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#### Model of Primitive Consciousness Based On Learning Activity in Autonomously Adaptive System

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July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

A model of primitive consciousness based on learning activity in an autonomously adaptive system using neural networks is proposed. The system adapts to its environment based on a reinforcement learning framework in the

wide sense, and has one evaluation mechanism based on rewards or punishments in the system itself. The system executes two kinds of activities: one is action for the environment, and the other is learning operations which modify states and configuration in the system itself for autonomous adaptation. The function of consciousness is defined clearly as neural network activity at the system level, or global learning operations that activates and modifies functions of the evaluation in accordance with rewards. The system has six modules for different purposes: perception, integration, motor, episodic memory, working memory, and basic control with an evaluation mechanism affected by emotion. The integration module with interconnected massive neural nodes, roughly corresponding to the prefrontal cortex, selects a dominant situation of its environment, and calculates approximately optimum candidates for an action by the steepest descent method based on iterative interactions between nodes. These states of dominant situation combined with an evaluation result that are generated in the system itself, act as a kind of teacher signal at that time and carry out the system level or the global learning operation as a whole system. Moreover, the information of these states directly corresponds to our daily experienced phenomenal consciousness. Dynamic characteristics, such as the timing delay of consciousness in Libet's experiment are depicted by computer simulation.

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#### **HOT Dynamics and Qualia**

### Asger Kirkeby-Hinrup, University of Lund, Sweden

## July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

Higher-order thought theories are elegant accounts of consciousness. However, they lack an important functional feature—namely, an explanation of why any particular mental state, rather than some other state, becomes higher-order represented. As such they are static models. Clearly though, consciousness is not static. It contains dynamic aspects, evident by the changing contents of our streams-of-thought. One can explain these dynamics with the following steps:

First introduce a distinction separating two kinds of qualia. One kind belonging to mental states (qualia instances or Qi), the other kind belonging whole 'system' (the qualia total or QT, akin to the total phenomenal unity thesis proposed by Bayne and Chalmers 2003 p. 33).

Secondly posit that since both QT and Qi's are characterized by what it is like to have them, some amount of similarity between them can be assumed (shortly, one may say that 'what it is like to have a headache' can be more or less similar to 'what it is like to be me right now'). Thirdly employ this similarity in an association mechanism feeding states to higher-order representation. The mechanism selects and feeds states on by comparing Qis with the QT, and this accounts for dynamics. However one could further develop this by using the similarity between a Qi and the QT to generate probabilities.

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#### Japanese Preference for Global Processing In Implicit Learning

Sachiko Kiyokawa, Chubu University, Japan Zoltán Dienes, Sackler Centre for Consciousness Science & School of Psychology, University of Sussex, UK Daisuke Tanaka, Tottori University, Japan Ayumi Yamada, Aoyama Gakuin University, Japan

## July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

Kiyokawa, Dienes, Tanaka, and Yamada (2011) showed for the first time that there are cross cultural differences not only in conscious but also in unconscious processes, such that Asians have a global preference and Westerners a more analytical one. In the present study, we explored the resilience of the Japanese global bias in implicit learning using the artificial grammar leaning paradigm. In the first study, twenty-eight Japanese undergraduates were asked to memorize GLOCAL strings i.e. strings constituted by one sequence of letters at a global level and a different sequence at a local level. Unlike the previous study (Kiyokawa et al., 2011), the global sequence had no structure and only the local grammar was structured. Japanese participants were not able to acquire the grammar at the local level. Even when there was nothing to learn at the global level, the implicit system of the Japanese was not induced to search for structure at the local level. In a second study we compared Japanese and UK participants on GLOCAL strings made of Katakana rather than the English letters used by Kiyokawa et al (2011). In Study 2, we replicated the relative preference for Japanese over UK participants for unconscious knowledge of global rather than local level is sufficiently strong as to persist even when some structure existed at the local but not global level, and regardless of the relative familiarity of the components.

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### **Algebraic Properties of Neural Networks and Their Dynamics**

Johannes Kleiner, University of Heidelberg, Germany Thomas Filk, University of Freiburg & Parmenides Foundation for the Study of Thinking Munich, Germany Harald Atmanspacher, Institute for Frontier Areas of Psychology and Mental Health Freiburg & Parmenides Foundation for the Study of Thinking Munich, Germany

July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Recently, basic concepts of quantum theory, such as non-commuting operations, have been found to be relevant for understanding cognitive phenomena such as bistable perception, decision processes, associative semantics, order effects, and learning behavior. These areas of active current work illustrate clearly that generalizations of quantum theory come to bear on psychology and cognitive science without attributing the phenomena to a direct quantum-physical influence.

In this work, we study the applicability of algebraic quantum concepts on complex networks (e.g. neural networks). They represent abstract versions of networks relevant in both biological and mental processes. It is known that the algebraic properties of the higher-order-functions mentioned above, such as non-commutativity, can be found and we study whether such an algebraic treatment allows for a systematic reconstruction of the attractor-structure of the network in scenarios of the input-internal-output type.

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## Access and the Unity of Consciousness

Michał Klincewicz, CUNY Graduate Center, USA

# July 3<sup>rd</sup>, 14:00-16:00: Concurrent Session 1.

There is some optimism about developing measures of conscious experience, such as changes in skin conductance, neural firing consistency, or widespread brain activation (Seth, Baars, and Edelman 2005). However, subjective verbal reports seem to still be the gold standard as a measure of conscious experience. Subjective verbal reports are driven by cognitive access to conscious experience, so, if one adopts the subjective verbal report standard, it is natural to think that cognitive access exhausts phenomenology (Kouider et al. 2011). All there is to phenomenology, on this view, is what we can verbally report about it. But verbal reports seem to give us only one snapshot at a time of a continuous stream of conscious experiences. The leads to a phenomenological challenge against the "cognitive access exhausts phenomenology" view, which urges that such a view cannot account for the appearance of unity of consciousness over time (Shoemaker 2003). Our conscious experience does not appear to consist of snapshots, but does appear to be a stream (James 1890). Consequently, verbal reports cannot exhaust phenomenology. One atomist response to this challenge is to argue that the so-called unity of consciousness is a version of the refrigerator light illusion (Dennett 1991, Blackmore 2002). However, this response falls short, because it does not account for an important part of the phenomenology of unity over time: the appearance of the passage of time, that is, the temporality of experience (Noë, et al. 2000, Kelly 2005). In this paper I develop an atomist account of temporality based on a theory of temporal mental gualities I developed elsewhere (Klincewicz 2011).

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### The Neurophysiology of Motion-Induced Blindness in Human Visual Cortex

Niels A. Kloosterman, University of Amsterdam, The Netherlands Arjan Hillebrand, Vrije Universiteit, Amsterdam, The Netherlands Bob W. van Dijk, Vrije Universiteit, Amsterdam, The Netherlands Victor A.F. Lamme, University of Amsterdam, The Netherlands Tobias H. Donner, University of Amsterdam, The Netherlands

# July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

During motion-induced blindness (MIB), a salient, small target stimulus repeatedly disappears from perception for some time when surrounded by a moving pattern. How does the brain 'make up its mind' that the target is no longer there? We recorded wholehead MEG to characterize the temporal fine structure of neural activity in visual cortex during MIB. Subjects reported perceptual transitions by pressing a button with their index finger (left or right hand, counterbalanced across subjects). In two separate sessions, subjects either pressed or released the button to report target disappearance (the converse for reappearance). MEG power over visual cortex in an intermediate (9-30 Hz) frequency range decreased transiently, followed by a sustained suppression of power within distinct low (< 9 Hz) and 9-30 Hz ranges. These modulations reflected subjects' perceptual reports (decrease for disappearance, increase for reappearance), but not the motor response (button press or release), or the hand

used for report (left or right). Remarkably, the modulations were not confined to the target representation in visual cortex, but equally strong over both hemispheres, despite the target being presented in either left or right visual hemifield. Similar modulations occurred when subjects reported physical removal of the target. The amplitude of these modulations around the report of target disappearance predicted the duration of the subsequent disappearance state during MIB, but not during replay. We conclude that the reported power modulations reflect a cortical state change during perceptual transitions, which might stabilize the next perceptual disappearance state.

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#### **Resolution of Ambiguous Motion Signals In a Split- Brain Observer**

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David Neville, University of Amsterdam, the Netherlands
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Victor Lamme, University of Amsterdam, Amsterdam, the Netherlands & Cognitive Science Center Amsterdam, the Netherlands

Nicoletta Foschi, Università Politecnica della Marche, Italy Mara Fabri, Università Politecnica della Marche, Italy

# *July* 5<sup>th</sup>, 14:00-16:00: *Poster Session 2*.

Human brains are adept inference machines, able to base perceptual decisions on highly ambiguous sensory information. How important is the large human neocortex for the resolution of sensory ambiguity? We tested a split-brain patient (DDC) who had received full callosectomy, providing a critical test of the role of cortical connectivity in perception. Controlling for influences of eye movements, we find that DDC has severe deficits in motion perception for stimuli in which the direction of motion is ambiguous. This indicates that the human neocortex serves an indispensable role in the resolution of perceptual ambiguities.

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### Studying the Murine Mind using Large Scale Observatories

### Christof Koch, Caltech, USA

## July 4<sup>th</sup>, 18:00-19:00: Special Lecture

Mice are a promising model system for studying the neuronal correlates of consciousness. Their brain structure is similar to that of the human, they display complex behavior, their underlying neuronal responses can be measured using optics and silicon probes at cellular level of resolution and the underlying neuronal networks can be modeled. In contrast to the blunt and edentate tools available to probe the human brain, optogenetics allows scientists to delicately, transiently, and reversibly control defined events in defined cell types at defined times in mice with millisecond resolution. That is, unlike the vast majority of human studies, experiments in mice move from correlation to causation, from observing that this circuit is activated whenever the subject is perceiving something to inferring that this circuit is necessary for a particular behavior or a conscious perception. I shall report on the ten year, large-scale (several hundred scientists and engineers) and high throughput efforts to build brain observatories to understand the mouse visual system that are ongoing at the Allen Institute.

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#### The Time Course and Spatial Distribution of Consciousness-Dependent Activity in the Brain.

Roger Koenig-Robert, CerCo & CNRS Rufin VanRullen, CerCo & CNRS

# July 4<sup>th</sup>, 11:00-13:00: Concurrent Session 3.

Exploring neural correlates of awareness with both high spatial and temporal resolution has been a difficult challenge. Current neuroimaging techniques can attain outstanding temporal resolution (EEG and MEG) or great spatial resolution (fMRI) but rarely both. Epileptic patients implanted with deep electrodes for clinical reasons provide a unique opportunity to explore the neural correlates of awareness with both high temporal and spatial resolutions. We used stereotaxic-electroencephalogram (SEEG) to record activity from both superficial and deep structures, mainly from temporal and parietal lobes. We used an innovative technique called SWIFT (semantic wavelet-induced frequency-tagging), in which periodic scrambling in the wavelets domain modulates an image semantic content (object form) over time, without disturbing its low-level attributes. This technique already

proved highly effective in isolating conscious object representations by EEG frequency-tagging (Koenig-Robert & VanRullen, submitted). In the present study, we presented SWIFT sequences with natural images containing an object, and subjects reported conscious recognition of the object. If it was not recognized after a few scrambling cycles, the original image was shown steadily for 3 seconds to reveal object identity and then the sequence was presented again. Comparing frequency-tagging responses before vs. after conscious object recognition, we found consciousness-dependent activity involving the alpha and beta band, elicited at latencies of 150 to 300ms in different regions of parietal and temporal lobes. We highlight the time course and spatial propagation of this conscious-activity across different brain areas underlying object recognition.

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### The Primate Pulvinar Reports Confidence Level of Visual Percepts

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## July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

When we are aware of a sensory event, we have two aspects of subjective experience. One refers to the perceptual categorization (e.g. a downward moving red ball) and the other involves the confident feeling that we certainly know the perceived world. For the last few decades, sensory awareness has been suggested to emerge from the thalamo-cortical complex. However, its functional logic remains unknown. The primate visual thalamus has two regions: the lateral geniculate nucleus (LGN) and the pulvinar (Pul), the largest thalamic area, which has interconnections with the multiple visual cortices. To explore the functional role of visual thalamus in subjective visual experience, we recorded the single-unit activities in the visual thalamus while the monkeys performed the perceptual categorization task and decision wagering task. We found many Pul neurons showed response modulations in the tasks whereas the LGN neurons did not. In the categorization task, the Pul responses showed no specificity to any perceptual contents, but their magnitude decreased in a graded manner as the stimulus ambiguity increased. In the wagering task, the Pul responses to the identical stimuli decreased when the monkeys chose the safe option, indicating less confidence of the animals in their own perceptual decision. Pharmacological inactivation of Pul increased the monkeys' safe choices in the wagering task without affecting accuracy in the perceptual categorization task. These results show that the primate pulvinar plays an essential role in attaching subjective confidence to the visual percepts.

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#### Attention, Phenomenology, and the Semantics of Questions

## Philipp Koralus, Washington University, USA James S. McDonnell, Washington University, USA

## July 6<sup>th</sup>, 11:00-13:00: Concurrent Session 4.

Attention influences the character of perceptual experience in intricate and surprising ways, including our experience of brightness, space, and time. This pattern of influence has been argued to cause trouble for the attractive thesis that differences in phenomenal character flow from differences in representational content (Block 2010). I present a novel theory of attention that provides a systematic representationalist account of these phenomena. I argue that attention should be understood in terms of the relationship between questions and attentional focus, while not depending on linguistic capacities. Besides providing a novel perspective on surprising perceptual phenomena, the proposed erotetic theory of attention is general enough to bear on attention in action and thought. Unlike the currently most developed general philosophical theory of attention (Mole 2011), the erotetic theory allows for divided attention and provides a plausible account of cases in which attention is an obstacle to action.

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#### EEG Correlates of Stable and Unstable Object Representations Are Similar Across Stimulus Categories

Jürgen Kornmeier, Institute for Frontier Areas of Psychology and Mental Health, Freiburg, Germany University Eye-Clinic, Freiburg, Germany

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July 6<sup>th</sup>, 11:00-13:00: Concurrent Session 4.

During the observation of an ambiguous figure, like the Necker cube, our perceptual system is instable and alternates spontaneously between two (or more) mutual exclusive representations. Tiny figural changes can

disambiguate the ambiguous figure and thus stabilize one representation. We investigated whether and how the ERP ("event related potential") to ambiguous figures, evoking such instable percepts, differ from ERPs to unambiguous figure variants, evoking stable percepts.Results: (1) Tiny figural changes, rendering an ambiguous figure unambiguous, cause a sizable positivity at about 400 ms after stimulus onset ("P400"), which is absent with the ambiguous figures. (2) The P400 amplitude increases linearly with decreasing ambiguity of the stimulus. (3) This P400 effect was found for two different categories of ambiguous figures (geometric, semantic and motion ambiguity).Our results suggest the existence of a neural evaluation instance that estimates the reliability of the perceptual outcome, given limited and ambiguous visual input. This evaluation seems to work on a very abstract processing level and the P400 may reflect its output.

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#### The Topological-Integration Model for Phenomenal Consciousness

### Daniel Kostic, Humboldt University, Germany

## July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

According to the explanatory gap problem it's not intelligible how qualia and brain processes could be identical. This opens a gap in an explanation of their identity. I argue that this idea depends on the intuition that only descriptions of the causal roles constitute intelligible explanations. This intuition can be rejected by showing that there are other bases for intelligibility of explanation. I propose an account of intelligibility of explanation that is based on topological models instead of descriptions of the causal roles. A topological model explains by a reference to the topological properties of the system. Both qualia and neural processes can be analyzed in terms of their relation to the structural features of their topological spaces that share the same basic structure. In this way they can both be integrated in a more general topological space, which contains their isomorphism as a topological property. We can integrate them in a similar way in which Chalmers and Levine suggest we should be able (but we actually can't) to integrate these two domains by using descriptions of the causal roles, i.e. via two-step program of working out a scheme of the casual roles and then finding the role fillers. To corroborate this idea, I will be looking into several very different cases in evolutionary biology and show how topological models that are used to explain certain phenomena in different domains or to integrate phenomena at different levels of explanation can be adapted for consciousness.

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#### The 'Sublink' Effect: Inducing an Attentional Blink from Subliminal Stimuli.

Sid Kouider, Laboratoire de Sciences Cognitives et Psycholinguistique, CNRS/EHESS/DEC-ENS, France Guillaume Collard, Laboratoire de Sciences Cognitives et Psycholinguistique, CNRS/EHESS/DEC-ENS, France Lucille Lecoutre, Laboratoire de Sciences Cognitives et Psycholinguistique, CNRS/EHESS/DEC-ENS, France Vincent Berthet, Laboratoire de Sciences Cognitives et Psycholinguistique, CNRS/EHESS/DEC-ENS, France Sylvain Charron, Laboratoire de Sciences Cognitives et Psycholinguistique, CNRS/EHESS/DEC-ENS, France

# July 3<sup>rd</sup>, 16:30-18:30: Concurrent Session 2.

The attentional blink refers to a situation where the processing of a first target T1 leads to an impairment in perceiving a subsequent target T2 appearing in close temporal proximity. Various accounts exist for this phenomenon. Yet, they share the view that the AB results from a rather late stage of processing involving a limit in the attribution of central resources: while the processing of T1 has not been achieved, T2 might be registered at the sensory level but it will fail to be encoded at the central level. Similarly, theories of conscious access such as the global neuronal workspace theory account for the AB as the failure to reach central/workspace areas because they are already engaged with the processing of T1. This leads to the prediction that the AB can only occur when T1 is perceived consciously. Here we show across a series of experiments that as soon as the central executive system is engaged, even a subliminal T1 can induce an attentional blink on T2. We relied on the recent finding that stop signals that are rendered invisible through masking nevertheless continue to triggers inhibitory control (Van Gaal et al., 2010). In our study we trained subjects to perform a go/no-go task on visible T1 stimuli intermixed with masked ones. We show that although these control signals remained invisible, they induce an attentional blink on subsequent T2 targets. These results are discussed in light of current theories of conscious access, as well as in relation to the dissociation between attention and consciousness.

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## Is Proprioception a Form of Perception?

#### Lana Kuhle, University of Toronto, Canada

# July 6<sup>th</sup>, 11:00-13:00: Concurrent Session 4.

Along with the increasing attention that recently has been given to embodied views of consciousness and cognition has come an increasing interest in proprioception, the sensory modality associated with the detection of limb position, body posture, and bodily movement. One of the issues surrounding proprioception concerns whether to count it as a form of perception. For this, most have relied on the 'object perception model' as outlined by Shoemaker in his 1994 lectures. The point of contention that has resulted is whether proprioceptive awareness meets one of the key constraints of the object perception model, namely, the 'identification constraint'. The issue turns on whether proprioceptive awareness, in its most typical form, involves the identification and tracking of the proprioceptive body through time. In this paper, I consider the main argument for why proprioceptive awareness fails to meet this constraint, and as such does not qualify as a form of object perception. I then defend this view against recent objections that argue, based on subliminal and unconscious perception, that proprioceptive awareness does meet the identification constraint and so is properly understood as a form of object perception. I show that these objections fail because they do not take into account a key distinction between perceptual detection and experiential perception, or between unconscious and conscious forms of perception. As a result, proprioceptive awareness, in its most typical form, is shown to provide us with a particular form of bodily consciousness; namely, consciousness of the body-as-subject.

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#### How Does the Science of Magic Contribute to Science?

Gustav Kuhn, Brunel University, UK

# July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

Over the centuries, magicians have developed extensive knowledge about how to manipulate our conscious experience; knowledge that has been largely ignored by science. However, in recent years, steps have been taken towards utilizing this knowledge to further our understanding of human cognition and consciousness. Here I will explore areas of science in which the science of magic has contributed to our understanding of human consciousness and cognition. I will discuss the types of contributions that this science has made to date, and explore some future directions. For example, what can we learn from the perceptual and cognitive effects that magicians have developed? What can their techniques (e.g. misdirection) tell us about attention and awareness? How can we use magic as a tool to investigate psychological processes? How can magical effects be used to investigate belief systems? What can the experiential states generated by observing magic effects tell us about human experience? What can we learn from the magician's expertise in motor control? I will conclude that there are numerous areas in which magic is not merely a sufficient, but a necessary way of investigation.

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#### Neural Correlates of Musical Hallucinations: an MEG study

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## July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Hallucinations are perceptions of an object (visual, auditory, or somatosensory) in the absence of corresponding object in the physical world. Hallucinations provide a unique window into the brain basis of consciousness as it allows determination of the neural activity corresponding to the conscious experience of an object without being confounded by the neural activity that relates to the sensory representation of that object. Auditory hallucinations are most commonly verbal and associated with psychiatric disorders. Musical hallucinations (MH) most commonly occur in subjects with acquired deafness with no psychiatric disorder. We used whole head magnetoencephalography (MEG) to determine the neural basis of MH in a female amateur musician. Specifically we used a residual inhibition (RI) paradigm. In the RI, hallucinations can be transiently suppressed by playing a specific stimulus (music in the present case): the suppression can continue up to few minutes after the offset of music. The subject rated the intensity of hallucination every 30 s after the offset of external music. Source reconstruction using beamforming analysis showed increased gamma (30-80Hz) activity in the left auditory cortex during periods of high hallucination intensity compared to low. The sources were in contiguous parts of left lateral Heschl gyrus and planum polare. The data support the view that 'abnormal' spontaneous activity in a region of the brain can cause percept that corresponds to the functional specialization of that region.

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#### The Evolutionary Ancestry of Phenomenal Consciousness

#### Lukasz Kurowski, York University, Canada

# July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

The question that needs to be answered if we want to understand phenomenal consciousness-qualia- is: What are the necessary and sufficient conditions for a biological being to possess qualia? One of the suggestions for solving the problem of consciousness that could prove highly fruitful from an evolutionary perspective lies in what is called by biologists as a 'central pattern generator' (CPG). The basic suggestion is as follows: the CPG that begun in a ganglion of one of our ancestors due to a mistake in genetic programming, lost its connection, and instead of going to the muscle and back, it kept cycling inside that ganglion. Thus, it kept moving from perceptual cell to perceptual cell and back, ceaselessly. The lost CPG ended up forming an organ for phenomenal consciousness. Firstly, the paper argues that by studying neural mechanisms such as CPGs we will have a chance of understanding the necessary and sufficient conditions for phenomenal consciousness. And secondly, that CPGs provided a specific evolutionary advantage for certain animals, such as chordates, living at the bottom of oceans' beds by giving them the ability to navigate when looking for food. In short, on this picture, the mechanisms for representation located in the CPG would provide the animal with a monitoring of internal images in phenomenal time and space. Thus, from this perspective, phenomenal consciousness is a navigational organ.

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#### Increase in Cortico-Thalamo-Cortical Connectivity during Human Sleep Slow Wave Activity

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# *July* 5<sup>th</sup>, 14:00-16:00: *Poster Session 2*.

The neural mechanisms of human non-REM sleep slow wave activity (SWA) remains incompletely understood. We here investigate changes in effective connectivity between non-REM sleep and wakefulness in default mode network areas involved in the generation of SWA. We recorded 64-channel electroencephalographic (EEG) nighttime sleep in 20 volunteers. Five minute clean EEG epochs from wakefulness, stage 2 and stage 3 non-REM sleep were source reconstructed using minimum norm and smoothness priors (SPM8). The source-reconstructed time courses of two default mode regions (posterior cingulate and medial prefrontal cortices) presenting significant increase in SWA in stage 3 sleep served as an input for Dynamic Causal Modeling for steady-state responses. Bayesian model selection (BMS) was performed then the best model parameters were analysed in SPSS with a repeated measures ANOVA. All results were thresholded at p<0.05 corrected for multiple comparisons. BMS revealed that the best model for explaining power our data contained the two cortical areas and a reciprocally connected thalamus. Parameter analysis revealed an increase in cortico-thalamic and thalamocortical connectivity along an antero-posterior axis during stage 3 sleep as compared to wakefulness (mirroring the scalp delta power increase observed in this state). Stage 2 sleep and wakefulness did not significantly differ from one another. Our results suggest that the non-REM sleep SWA spreading along an anterior-posterior cerebral backbone might largely be mediated through cortico-thalamo-cortical interactions. This finding supports a role of thalamo-cortical interactions in high amplitude non-REM sleep slow wave generation.

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#### Where is the "Self" During Acting? A Functional MRI Study of Role-Playing in Actors

# Lauren Kutcher, McMaster University, Canada Steven Brown, McMaster University, Canada

# *July* 5<sup>th</sup>, 14:00-16:00: *Poster Session* 2.

In daily life, every person plays multiple roles – for example "friend", "student" or "employee" – and these roles are all facets of the "self" or first-person (1P) perspective. Compared to such everyday role-playing, actors are required to portray other characters and to adopt the thoughts and emotions of these people. Consequently, actors must think and feel not as themselves but as the characters they are portraying, thereby assuming a "fictional first-person" (fic-1P) perspective. The purpose of this study was to use functional neuroimaging methods to contrast character portrayal with the "self" and, more specifically, to identify brain regions preferentially activated when actors adopt a fic-1P during role-playing. In the scanner, amateur actors answered conditional questions from either their own 1P perspective or from that of Romeo (male subjects) or Juliet (female subjects)

from Shakespeare's drama. The results suggested that role-playing during acting may be a departure from selfprocessing, as differences in brain activity between the fic-1P and 1P perspectives were identified, mainly in the medial prefrontal cortex. This study is the first to examine actors adopting the role of a character while being scanned, and thus represents an important step towards elucidating the neural basis of acting. Furthermore, the exploration of role-playing in acting provides a unique and novel approach to the study of self-processing and can contribute to our understanding of the complex concept, the "self".

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### Phenomenal Flatness as a Common Core Element in Depersonalization Disorder and Depression

Jan-Peter Lamke, Charité –Universitätsmedizin Berlin, Germany & Humboldt-Universität zu Berlin, Germany Michael Gaebler, Charité –Universitätsmedizin Berlin, Germany Judith Daniels, Charité –Universitätsmedizin Berlin, Germany Henrik Walter, Charité –Universitätsmedizin Berlin, Germany

# July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Depersonalization and derealization are states of experienced detachment from oneself and the world manifest in emotional numbing and a subjective sense of unreality. Although they frequently occur as comorbid symptoms in other psychiatric disorders they also exist as a primary mental illness in the form of "depersonalizationderealization syndrome" (ICD-10 F48.1) or "depersonalization disorder" (DPD; DSM-IV 300.6). Major depressive disorder (MDD; ICD-10 F32, F33) is characterized by low mood, loss of interest in formerly pleasurable activities, fatigue, and sleep disturbances. These main symptoms can be accompanied by loss of appetite, diminished selfesteem, feelings of guilt, arrest of thought, rumination, and suicidal ideation. Patients often report an allencompassing feeling of numbness or emptiness or an agonizing inability to experience feelings at all (especially during severe or recurrent episodes of depression). I will argue that although regarded as different syndromes, DPD and depression share a common core element in that both conditions are characterized by alterations in the depth of phenomenal experience, more precisely being marked by phenomenal flatness. A recent study investigated the relationship between depressive symptomatology and flat versus deep perception with regard to objects, persons, and self (Kunzendorf, 2010). The results demonstrate that depression is associated with a "flatter" self-perception and a generally "flatter" phenomenal world which is similar to the phenomenal "flattening" as it appears in DPD.I claim that the phenomenological endophenotype of phenomenal depth -- which crosses diagnostic boundaries -can facilitate the neurocognitive investigation of psychiatric disorders and aid the advancement of dimensional psychiatry.

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#### You have Conscious Sensations without Knowing it

## Victor Lamme, University of Amsterdam, Netherlands

# July 2<sup>nd</sup>, 18:30-19:30: Presidential Address

Consciousness has always been defined from introspective and behavioral intuitions. This has gotten us nowhere. What we need is a radical redefinition of what consciousness really is, from a convergence of introspective, behavioral and neural arguments. The criterion for success should be whether such a new definition explains what there is to explain about consciousness, not whether it fits our intuitive notions. From such an approach (Lamme, 2006; 2010), it emerges that it makes sense to acknowledge that we have conscious sensations (in the phenomenal, qualitative sense) without attention, without access, and hence also without thought. In this talk, I will present further arguments that impose such a far reaching conclusion.

Our latest experiments show that vision without attention is rich, detailed, precise, integrated, and - most importantly – shows perceptual inference i.e. goes beyond the retinal image towards a perceptual interpretation of that image. Moreover, we show a further dissociation between various forms of cognition (categorization, control) and consciousness, while the association between integration-segregation and conscious experience is strengthened.

In sum, there is now overwhelming evidence showing that neural representations outside the focus of attention, and outside the realembrem of access or thought possess all the key properties of conscious representations, except – of course – reportability. Moreover, these properties do all the explaining towards the phenomenal nature of conscious experience. The absence of access does little to explain that away. The proper conclusion is that we may have conscious sensations even when we don't know it.

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#### Mineness, Minimal Self, and Self-Related Processing.

## **Timothy Lane**, National Chengchi University, Taiwan, Republic of China **Georg Northoff**, University of Ottawa Institute of Mental Health Research, Canada

# July 6<sup>th</sup>, 11:00-13:00: Concurrent Session 4.

We can be aware of mental states that supervene on our brains, as well as mental states that supervene on the brains of others: for example, we can sense fear in ourselves, and "see" fear in the eyes of a person standing before us. Usually we do not attribute mental states to the wrong persons—we are not wrong about mineness— but empirical evidence can be adduced to show that such errors do happen. Previously the authors have argued that misattribution occurs when (i) tacit expectations about how mental states should cluster are confounded (ii) provided that the confounded expectations concern mental states deemed highly self-related, by sub-personal, neural mechanisms. Our argument is compatible with those who attempt to explain aberrations of mineness without appealing to a narrative sense of self, but we demur when they appeal to a minimal self, one that involves a phenomenal experience of self. Here we focus on (ii) and develop an alternative view of what counts as "minimal" in this context. We argue that sensory states are indeed independent of the mechanisms in virtue of which they are related to self—mechanisms that involve the brain's Subcortical-Cortical Midline Structure (SCMS). But this self-related processing (SRP) should be understood as a basic, enabling process for the experience of mineness—or aberrations thereof; it does not involve phenomenal content or executive processing. SRP and its relevance to mineness are illustrated through reference to alterations in the brain's resting-state activity during schizophrenic psychosis.

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#### Could the Objective Criteria for Sentience Contribute To a Solution of the Hard Problem of Consciousness?

Georgi Lazarov, Bulgarian Society for Cognitive Science, Bulgaria

# *July* 5<sup>th</sup>, 14:00-16:00: *Poster Session* 2.

During the last decades many cognitive theories try to link the subjective experiences with some cognitive abilities; then after, on base of data from evolutionary neurobiology and cognitive ethology, these theories propose objective behavioral and neurological criteria for sentience (phenomenal consciousness). Could such theories contribute to a solution of the hard problem of consciousness (HP); could they help to explain, for example, the difference between unfelt nociception and subjective experienced pain? The most authors of these theories are proponents of the reductive cognitivism, and they give a positive answer. On other side, the proponents of the anti-reductionism (including property-dualists, e.g. David Chalmers, and epiphenomenalists, e.g. Stevan Harnad), claim that HP is left untouched in such theories. Here I present the viewpoint of the materialist emergent representationism (MER), which takes an intermediate position between the reductive cognitivism and anti-reductionism. MER, like most of the cognitivist views, accepts that animal minds are cognitive systems in animal brains and are results of the biological evolution. MER accepts also the idea that the evolutionary first forms of mind lack subjective experience; sentience arises later. The task of finding objective criteria for sentience is important, because it makes possible the localization of the origin of sentience in the animal evolution. According to MER, sentience, as an emergent property of mind, could be explained reductively only at the point of its origin, and only in its simplest form.

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# Activation of Fronto-Parietal Networks in Minimally Conscious State Patients during an Active Own Name Paradigm

Julia Lechinger, University of Salzburg, Austria Nicole Chwala-Schlegel, University of Salzburg, Austria Paul Sauseng, University of Surrey, United Kingdom Robert Fellinger, University of Salzburg, Austria Gerald Pichler Albert-Schweitzer-Klinik, Austria Johann Donis, Geriatriezentrum am Wienerwald, Austria Gabriele Michitsch, Albert-Schweitzer-Klinik, Austria Manuel Schabus, University of Salzburg, Austria

## July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

The study of neural representations of consciousness might have found their most meaningful application in Disorders of Consciousness (DOC). The term "DOC" subsumes patients who suffer from Unresponsive Wakefulness Syndrome (UWS, i.e. presence of alternating sleep and wakefulness without signs of awareness) or are in a Minimally Conscious State (MCS, i.e. additional presence of some reproducible signs of consciousness). In clinical assessments signs of consciousness are easily missed in these patients (e.g. due to extensive motor impairment).

The aim, therefore, is to identify neural correlates of residual cognitive abilities and to introduce neuroimaging and neurophysiology into clinical routine. To contribute to this matter we recorded EEG in 10 UWS and 7 MCS patients and 21 age and sex matched controls during an active own name task. Patients were presented with five different first names including the subject's own name. In the active condition patients were instructed to mentally count a specific unfamiliar target name. Analysis of theta and lower-alpha inter-electrode phase coherence (i.e. phase locking value, PLV) revealed emergence of a fronto-central/fronto-parietal network in controls and MCS patients while they processed any first name. Most importantly, in MCS patients (and healthy controls) connectivity in the theta range was more pronounced for the active target than other unfamiliar names. This indicates that the MCS group was able to maintain the representation of our verbal instruction and apply top-down attention to fulfil task demands. This finding thereby highlights the potential of EEG research for better characterizing DOC patients in clinical settings.

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#### Unconscious Processing of Highly Affective Stimuli: An Intracranial Single Case Study.

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# July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

In search of evidence for a fast subcortical processing pathway for affective stimuli researchers face important methodological issues. If the perception of stimuli is successfully rendered unconscious, behavioral measurements are optimally at chance level whereas imaging methods show a differential treatment of affective compared to neutral stimuli. Imaging methods are either temporally precise but cannot directly measure subcortical neuronal activity (EEG) or spatially precise (fMRI) but temporally too imprecise to assess the temporal precedence of subliminal compared to supraliminal processes. This study investigates intracranial event related potentials (ERP's) from the human amygdala to consciously and unconsciously processed affective stimuli. Depth electrode recordings in the human amygdala have previously shown an emotion-dependant increase in the 200-400ms time range after supraliminal stimulus presentation. Furthermore, time frequency analysis of intracranial amygdala recordings demonstrated emotion induced gamma oscillations at 50-150ms after stimulus presentation.

We report the temporal precedence of intracranial ERP's to subliminally compared to supraliminally presented stimuli. Depth electrodes were implanted in the amygdalae of a patient undergoing presurgical assessments of refractory epilepsy. Backward masked photographs of dressed and naked bodies and scrambles were presented either supraliminally (260ms) or subliminally (16ms). An affective content dependant effect was found at 115-160ms after stimulus onset in the subliminal condition but only at 240-300ms in the supraliminal condition.

To our knowledge this is the first direct registration of neuronal activity to subliminally presented affective pictures, investigating the fast subcortical processing of biologically relevant stimuli.

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#### **Electrophysiological Correlates of Ketamine-Induced Behavioral Unresponsiveness**

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# July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Methods Ketamine infusion was performed in six subjects until reaching complete behavioral unresponsiveness (Ramsay scale 5-6). Spontaneous EEG was recorded during wakefulness, ketamine sedation and recovery using a

60 electrodes system. Clean EEG epochs scalp power spectra were computed and subsequent source reconstruction used a minimum-norm solution with smooth priors (SPM8). The signal of two peak sources of theta activity during ketamine was extracted to perform a steady-state DCM. Scalp and source-level statistics were performed using SPM8. DCM parameter-level analyses were performed using the Wilcoxon rank-sum test. Results were thresholded at corrected p < 0.05.ResultsKetamine infusion induced in all subjects a state of vivid visual imagery, contrasted to a total disconnection from the environment. This was paired to an increase in scalp theta, beta and gamma power as compared to wakefulness. Two source-level clusters of lateral frontal and parietal topography showed a significant increase in theta power during ketamine versus wakefulness. DCM parameter analysis suggested that power spectral changes during ketamine could be explained by an increase in intrinsic frontal cortex excitability as compared to wakefulness. Conclusion Ketamine preferentially alters oscillatory activity in lateral frontoparietal cortices (involved in 'external' awareness), while default network function (involved in 'internal' awareness) is preserved. DCM findings suggest that ketamine-induced unresponsiveness seem to be linked to an intra-cortical action mechanism.

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#### Vestibular Contribution to Multisensory Mechanisms Underlying the Sense Of Self

Bigna Lenggenhager, Sapienza University, Italy

## July 6<sup>th</sup>, 14:00-16:00: Symposium 4.

Data in neurological patients with disturbances in the bodily self suggest an important role of vestibular processes in global aspects of the self such as self-location and first-person perspective. We used mental imagery and multisensory bodily illusions to simulate aspects of such neurological conditions in healthy participants to investigate underlying functional and neural mechanisms. In these experiments both vestibular stimulation as well as visuo-vestibular conflicts interfered with global aspects of the self, confirming a contribution of vestibular processing to a stable sense of self, localized at a specific position in space with a single perspective on the world. Functional magnetic resonance imaging revealed that temporo-parietal junction (TPJ) activity reflected experimental changes in self-location and first-person perspective due to multisensory conflicts. This finding relates again to data in neurological patients that suggest integration of vestibular, somatosensory and visual signals in the TPJ are crucial for a stable sense of self.

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#### Acquirement of Unconscious Knowledge of Chinese Tonal Retrograde

Feifei Li, East China Normal University, China
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## July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

Researches into implicit learning have showed that people can implicitly learn the n-grams (chunks). One type of structure that goes beyond n-grams is symmetry. We explored the acquisition of unconscious structural knowledge of symmetry, specifically, a retrograde rule with respect to the tones of Chinese syllables, where the tone types of the last five syllables of a string were retrograde of those of the first five syllables. During training phase, subjects were asked to listen to tonal syllable strings and to repeat each string silently. In a subsequent test phase, subjects were asked to classify new tonal syllable strings as grammatical or not, and to give the structural knowledge attributions to assess their awareness. Results showed that, controlling both n-gram structure and repetition patterns, people can implicitly learn to discriminate retrograde from non-retrogrades, indicating that people can acquire unconscious knowledge of abstract symmetries

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#### Implicit Learning of Mappings between Forms and Metaphorical Meanings Dissociation of Power and Size

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## *July* 4<sup>*th*</sup>, 14:00-16:00: Poster Session 1.

Dominant theories of implicit learning assume that implicit learning merely involves the learning of chunks. However, it has also been shown that people can implicitly learn abstract structures, such as symmetries or recursive embeddings. Here we explore implicit learning involving a different type of abstract relation: The metaphorical relation between something concrete (e.g., size) and the more abstract idea (e.g., power). This issue was addressed by adopting a paradigm introduced for investigating word form-meaning connections (Williams, 2004, 2005). In the current experiment, participants were first taught four new Chinese characters (which were introduced as determiners) and were told that these characters encoded the distance between the speaker and the social role specified by the noun. What they were not told was that the use of these determiners also depended on the levels of power of the social role. After training on a subset of the determiner-noun combinations, participants performed two tasks in which they had to choose between two determiners for a social role with different levels of power (task 1) or for an object with different size (task 2). The results showed that participants performed significantly above chance in selecting the appropriate determiner in both tasks in a metaphoric-consistent way (powerful=big, powerless=small) without awareness, suggesting that people implicitly obtained the abstract metaphorical relation between power and size. Our results also challenge the classical perspectives on metaphor that metaphors map structure directionally from a concrete concept to a relatively more abstract concept, but not vice versa.

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#### Effects of training time on implicit and explicit probabilistic category learning

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#### July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

There are at least two category learning systems: one system is explicit and based on hypothesis testing, the other is implicit and based on procedural learning or perceptual representation or exemplar (Ashby & Alfonso-Reese, 1998; Maddox & Ashby, 2004). Generally, researchers used rule-based tasks as explicit category task and information-integration tasks as implicit category task to explore the dissociation of the two systems. However, the information integration task was normally more difficult than the rule-based task, thus it might confound the related findings.

The present study was aimed to investigate the differences between implicit and explicit category learning by manipulating the training time in a probabilistic category learning task, i.e. the weather prediction task (WPT), with two different versions. As previous research (Shohamy et al., 2004), in the feedback version, participants were provided with trial-by-trial feedback based on their response to each trial. In the observational version, subjects were shown the stimuli together with the correct outcome. In addition, we manipulated the training time on each trial: training 5s versus training 3s.

The results showed that although observational participants performed better than the feedback people when training 5s but it was reversed when training 3s. Importantly, both groups tended to consciously use strong-predicting cards in predicting when training 5s but tended to integrate strong- and weak-predicting cards to predict the outcome when training 3s. The results provided evidences for multiple category learning and suggested that training time has different roles in implicit and explicit category learning.

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## Self-as-Subject in the Brain

## Caleb Liang, National Taiwan University, Taiwan

## July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

The minimal sense of self-*as-subject* calls for both conceptual and empirical investigations. I first argue that mental ownership and body ownership are two distinct types of self-experiences. Body ownership concerns self-as-subject: whether a body part or a full body belongs to me. Mental ownership concerns self-as-subject: whether I represent myself as the unique subject of experiences. Body ownership presupposes mental ownership, and both types of self-experiences can be misrepresented. Then I discuss the most relevant neuroscientific accounts and argue for the following claims. (1) Panksepp's affective neuroscience (1998, 2005, 2009) and Damasio's most recent account (2010) propose various brain regions responsible for the Core Self, including areas in the subcortical-cortical midline structures (SCMS) (Northoff, 2006, 2008, 2010, 2011). However, the theoretical links between the functions of those brain areas and self-as-subject remain missing. (2) I comment on Legrand and her collaborators' account of the self/non-self distinction implemented by integration of efferent/afferent signals (2006, 2007, 2009, 2011a, 2011b, 2011c). The empirical cases and explanations that they provide are in fact not sufficient to specify self-as-subject. (3) Finally, I propose a revised version of Metzinger's Self-Model Theory (2003, 2008, 2009a, 2009b). I suggest that different grades of mental ownership can be distinguished. Self-as-subject can be understood in terms of what I call *subjective mental ownership*. I argue by offering empirical illustrations that the key to make progress is to study how subjective mental ownership may be misrepresented.

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#### Using Suggestion to Gain Control over Increasingly Automatic Processes.

Michael Lifshitz, McGill University, Canada Noémie Aubert-Bonn, McGill University, Canada Alexandra Fischer, McGill University, Canada I. Farah Kashem, McGill University, Canada Amir Raz, McGill University, Canada & Lady Davis Institute for Medical Research, Montreal, Canada

### July 4<sup>th</sup>, 11:00-13:00: Concurrent Session 3.

Cognitive scientists typically categorize mental processes along a continuum ranging from controlled to automatic. Whereas controlled processes are slow and effortful, automatic processes are ballistic and involuntary. Multiple studies have addressed how controlled processes become automatic, but few have investigated how people may regain control over automatic processes. We have previously shown that suggestion can override deeply-ingrained processes such as word reading on a classical Stroop task. Here, we extend our Stroop findings to several other well-established automatic paradigms, including the McGurk effect. We thus demonstrate how, in the case of highly suggestible individuals, suggestion seems to wield control over a process that is likely even more automatic than reading – the integration of visual and auditory stimuli in speech processing. Finally, we present preliminary findings from a visual paradigm exploring the potential of transforming, without practice, a controlled task into one that is automatic. Such experimental avenues contribute to a more scientific understanding of voluntary control and top-down influence.

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# The Mirror Does Not Tell: Replacing MSR with Comparative Game Theory for Studying Animal Self-Consciousness

ChiaHua Lin, University of South Carolina, USA

# *July* 5<sup>th</sup>, 14:00-16:00: *Poster Session* 2.

In an influential paper, Gordon Gallup reports that unlike humans and chimpanzees, monkeys are not capable of showing mirror-directed behavior related to their bodies. Gallup's pioneer protocol, known as mirror self-recognition (MSR) or the mirror-test, has been widely replicated to study the evolution of self-awareness and, in turn, self-consciousness. While the passing the MSR indicates the individual's mental capacity of self-awareness, failing it suggests the absence of self-awareness and, hence, self-consciousness. Unlike most papers in the literature that focus on the interpretation of positive results of MSR, this paper limits its focus to the interpretation of negative results, from which Gallup infers the cognitive divide conjecture. In particular, this paper asks whether the negative results of MSR support Gallup's conjecture that self-awareness, as an evolutionary trait, does not extend below the great apes. I argue that they do not. I argue that Gallup's conjecture requires three assumptions for the negative results to support the conjecture, and, none of the three assumptions are convincing. Therefore, the cognitive divide conjecture, even if it is true, is not to be supported by the negative results of MSR. Targeting the fallacious inference made by the proponents of the cognitive divide, my analysis adds to the criticism in the literature in which Gallup's influential experimental paradigm is thought neither valid nor the sole method to study the phylogenesis of self-consciousness. At the end of the paper I discuss comparative game theory as a new approach for studying animal self-consciousness.

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#### Do Split-Brain Subjects have Unified Consciousness?

Ting-An Lin, National Taiwan University, Taiwan Allen Y. Houng, National Yang-Ming University, Taiwan

#### July 4<sup>th</sup>, 11:00-13:00: Concurrent Session 3.

The structure of consciousness of split-brain subjects is still a controversial issue. The conventional duality model asserts that the split-brain patients have two streams of consciousness at any one time and thus takes split-brain syndrome as a case of disunified consciousness. In contrast, a recently proposed switch model argues that there is only single stream of consciousness which shifts between both hemispheres from moment to moment and thus concludes that split-brain subjects still possess the unity of consciousness (Tim Bayne, 2008). Both models have their own advantages and problems. The duality model can explain the conflicting behaviors of split-brain patients but has difficulty interpreting the everyday integration while the switch model offers an explanation of the everyday integration but has problems when interpreting the simultaneous consciousness of both hemispheres.

In this paper I argue that the split-brain patients have two streams of phenomenal consciousness but only one stream of access consciousness which shifts between the two hemispheres. According to Block's argument of the different neural mechanisms of phenomenal consciousness and access consciousness (Ned Block, 2007), among

the competing neural coalitions, only the winning coalition can become access conscious and be broadcasted while some other losing but strong coalitions are the neural basis of phenomenal consciousness. I argue that the competitions of neural coalitions happen simultaneously and independently in both hemispheres of split-brain subjects and thus lead to the two disunified streams of phenomenal consciousness. However, there is still only one winning coalition at one time and thus results in the single and unified stream of access consciousness that switches between two hemispheres. This new model can explain both the simultaneous consciousness of two hemispheres and the integration in daily life.

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#### **Confabulation as a Self-Enhancement Mechanism**

Ying-Tung Lin, Johannes Gutenberg University of Mainz, Germany

## July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Confabulation regarded as a syndrome refers to the phenomenon that subjects give an erroneous statement that is made without a conscious effort to deceive (Berlyne, 1972). According to the neurocognitive theories, confabulation has been considered the result of reality monitoring defects (Johnson, et al., 2000), or disconnection of the verbal hemisphere and other brain regions (Gazzaniga, 2000; Geschwind, 1965). However, these studies can only account for the occurrence of confabulation, but are not sufficient to explain the content of confabulation. Moreover, they neglect the fact that a person constantly interacts with its social environment. I will argue that confabulation results from an attempt to stabilize the sense of self by maintaining the coherence of the selfsystem and at the same time to keep accordance with the social environment. Coherence and correspondence are two competing constraints on the organization of autobiographical memory according to the Self-Memory System (Conway, 2005); that is, the construction of memory is affected by these two constraints. Thus, confabulation is resulted from the making of a coherent autobiography about itself and the instant environment rather than the disconnection from the reality. This mechanism for self-enhancement can also be seen in self-reference bias in normal individuals (D'Argembeau & Van der Linden, 2008). That is, in the light of the continuum of confabulatory patients, ranging from those that are neutral and non-delusional to the ones that produce delusional confabulations (Feinberg, 2009), this self-enhancing mechanism occurs not only in pathological cases but also in normal circumstances.

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#### Can We Tell What We Said When We Hear Ourselves Saying Something Else?

Andreas Lind, Lund University Cognitive Science, Sweden Lars Hall, Lund University Cognitive Science, Sweded Petter Johansson, University College London, UK Björn Breidegard, Certec, Lund University, Sweden Christian Balkenius, Lund University Cognitive Science, Sweden

## July 3<sup>rd</sup>, 16:30-18:30: Concurrent Session 2.

A defining assumption of traditional models of speech production is that verbal utterances are guided by robust and well-defined intentions, which provide the benchmark for verbal self-monitoring. We present results that challenge this idea and that point towards a fundamentally interactive relationship between speech and monitoring. We have developed a technical platform that allows us to selectively manipulate speakers' auditory feedback in real time. Participants perform a computerized Stroop test while hearing themselves speaking solely through a sound isolating headset. In the default mode, their speech is relayed unaltered. The crucial manipulation is that we covertly insert a previously recorded segment of the participant's speech at the exact same time as she is uttering something else, and while we simultaneously block out her actual speech. Thus, she may utter the word 'grey', but she hears herself say the word 'green'. Manipulations are often experienced as self-produced, as is revealed when the participant answers a question directly following a manipulated trial indicating that she believes herself to have uttered the inserted word. This demonstrates how we use the auditory feedback of our own voice not only to regulate phonetic factors of our speech or to perform error-monitoring. Rather, we engage this feedback in an incessant on-line interpretive process which actually substantiates and consolidates the very meaning of self-produced speech. This finding has wide implications for models of speech production and selfmonitoring, as well as for theories of consciousness and self-awareness and for the investigation of the agency of the spoken word.

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#### Urbanisation Impacts Perceptual Awareness by Decreasing Cognitive Engagement

Karina J Linnell, Goldsmiths, University of London, UK Serge Caparos, Goldsmiths, University of London, UK Jan de Fockert, Goldsmiths, University of London, UK Jules Davidoff, Goldsmiths, University of London, UK

# July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

Exposure to the urban environment has been shown dramatically to increase the tendency to perceive global or contextual information (Caparos Ahmed, Bremner, De Fockert, Linnell & Davidoff, 2012). Here we propose that urbanisation drives these differences in phenomenal perception by decreasing cognitive engagement and defocusing spatial attention (Linnell & Caparos, 2011). By comparing a remote people, the Himba of north-west Namibia, living traditionally or relocated to town, we show that (i) spatial attention is defocused in urbanised, but focused in traditional, Himba, (ii) imposing a cognitive load makes attention as defocused in traditional as in urbanised Himba, and (iii) using more cognitively engaging stimuli/tasks makes attention as focused in urbanised Himba, and Londoners, as in traditional Himba. These findings are compatible with urbanisation making perception more global by decreasing cognitive engagement and defocusing spatial attention. We suggest that differing cognitive engagement may also contribute to differences in phenomenal perception between individualist and collectivist societies that are usually attributed to differing social orientation (e.g., Varnum, Grossman, Kitayama, & Nisbett, 2010).

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#### Consciousness is the Music of the Hemispheres

Dan Lloyd, Trinity College, Connecticut, USA

# July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Scientific models of consciousness need to find a happy medium between the unconstrained and the tooconstrained. At the one pole, dynamical systems capture every dynamism; this is too loose. At the other, various other forms of computationalism tie consciousness to a syntax and semantics that are too narrow for the broad and fluid content of the phenomenal world. Here we present philosophical (phenomenological) and empirical evidence that the right formal model for consciousness is music. Musical syntax (unlike linguistic syntax) is both synchronic and diachronic, appropriate to multivariate (massively parallel and recurrent) computation as well as thick, temporal phenomenology. Musical semantics, unlike linguistic semantics, denotes features internal to music itself, relying on physical (sonic) resemblance (of rhythms, motifs, etc.); this uncomplicated ontology dissolves a host of problems facing various forms of representationalism, rising readily to the twin challenges of neural and phenomenal interpretation and meaning. Empirically, the many musicological tools applied to world musical traditions adapt to fMRI interpretation. Properties that can be measured in both music and written/spoken language can also be tracked in brain scan data, to reveal close affinity to music at several scales of analysis. Consonance/dissonance measures distinguish healthy subjects from schizophrenia patients. Musical properties like tessitura, melodic mobility, melodic complexity, durational variability, and more can distinguish young and older brains, as well as healthy brain function in contrast to mild and moderate dementia. With suitable sonification, these differences can be made audible (for the presentation version).

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#### Vestibular and Multisensory Foundations of Self-Location and Self-Other Distinction

#### Christophe Lopez, Université de Provence, France

## July 6<sup>th</sup>, 14:00-16:00: Symposium 4.

The vestibular system provides concurrent signals about gravity and one's body position and motion in space. I will argue that vestibular signals play a crucial role in unifying bodily and extracorporeal signals necessary for self-location and self-other distinction. The core vestibular cortex overlaps with the temporo-parietal region, insula and intraparietal sulcus, three brain regions involved in self-processing. First, I will show that artificial stimulation of the vestibular system (caloric and galvanic vestibular stimulation) can interfere with these brain regions and modulate self-location and the conscious experience of the body (mental representation of the body shape and size, body ownership). Finally, I will present psychophysical data showing that, by distinguishing self-motion from other- and environment-motion, vestibular signals contribute to the subjective experience of being a self.

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#### Interocular Suppression Eliminates the Processing of Perceptual Ambiguity

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## July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

Ambiguous visual stimuli are often used as a unique window on perception and consciousness. It remains unclear, however, whether conscious perception is a necessary prerequisite for the processing of ambiguity. To address this question, we tested whether an ambiguous stimulus, rendered invisible by interocular suppression (continuous flash suppression, CFS), affects the perception of subsequently presented visible ambiguous stimuli. In a 2x2 experimental design, a Necker cube was presented either continuously or intermittently (3s on, 3s off) to one eye. CFS masks presented to the other every were either present or absent. When present in the intermittent Necker cube condition, the CFS masks were shown during the stimulus-off periods. In the continuous condition, CFS masks were shown during the same time intervals as in the intermittent condition while the Necker cube was presented continuously. In this latter condition, the Necker cube was thus constantly present but intermittently suppressed from awareness by CFS. We compared the distributions of dominance times, the number of perceptual switches, and the probability of perceptual reappearance of the last dominant percept across conditions. In the condition in which the stimulus was intermittently suppressed from visibility, these measures were highly similar to the conditions in which it was removed from the screen, but differed markedly from the corrected measures of the condition during which the Necker cube was constantly visible. Thus, perception of the Necker cube remained unaffected by periods of invisible stimulus presentation, suggesting that perceptual ambiguity is not processed during interocular suppression.

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# The Effects of Hypnotically Induced Food Aversion on Reward Processing: a Functional Magnetic Resonance Imaging Study

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# July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Hypnosis is used for treating obesity and smoking addiction which require down-regulating the attractiveness of unhealthy rewards. Evidence for the effectiveness of such treatments has been mixed. Here we investigated whether post-hypnotic suggestion can influence reward processing using functional magnetic resonance imaging (fMRI). Activity of the ventromedial prefrontal cortex (vmPFC) is known to correlate with the value that people place on decision options. We tested whether hypnotically induced food aversion would lead to decreased vmPFC activation, and whether this decrease would be stronger in a hypnotised group compared to an instructed control group. 16 participants were hypnotised and 16 other participants were instructed to associate a colour cue (either blue or green) with disgust against a certain type of snack food (either sweet or salty). Afterwards, participants saw pictures of sweet and salty snacks in a virtual auction in the MRI-scanner on alternating blue and green background. Behavioural measures indicated that both hypnosis and instruction induced disgust. Hypnotised participants, however, reported their disgust to be more real, automatic and bodily. In the hypnosis group, vmPFC activation was strongly reduced for snacks shown on the post-hypnotic colour cue compared with the other colour. However, this was true for both sweet and salty snacks. The main effect of the cue on the vmPFC was stronger in the hypnosis group than in the instruction group. Our results indicate that hypnosis might be useful to support endeavours such as weight loss and smoking cessation, although generalization effects need to be considered.

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#### Focusing on Virtual Reality: Predisposition to Absorption Influence on Feeling of Presence.

Marta Lukowska, Institute of Psychology, Jagiellonian University & C-lab, Cracow, Poland

July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Virtual reality (VR) can be used as a tool in the study of consciousness. An important construct is feeling of presence, defined as 'sense of being there' (into VR) connected with illusion of non-mediation. The purpose of the

study is to investigate how individual differences in predisposition to absorption, defined as an ability to intensive focus of attention, influence feeling of presence in VR. It is expected that the higher ones predisposition to absorption, the greater feeling of presence one experiences. The second goal is to compare self-referential and behavioural measures of feeling of presence.

Fifty-five volunteers took part in the experiment. The NoLimits roller coaster simulation was used as a VR environment. Predisposition to absorption was assessed by the Polczyk's Predisposition to Absorption Scale. Two measures of presence was used: polish version of Presence Questionnaire (self-referential), and simple reaction time on auditory signal unconnected with VR (forced break in presence) as behavioural measure. Results show that predisposition to absorption was positively correlated with the self-referential measure of presence. However, an opposite effect was found for the behavioural measure. Moreover, different influence of predisposition to absorption on behavioural measure was found, depending on a frequency of forced breaks in presence and immersive potential of the simulation.

Summing up, predisposition to absorption influences feeling of presence, what encourage to make comparisons between presence and hypnotizability, highly dependent on predisposition to absorption. Secondly, disparities between used measures of presence suggest that they reflect different aspect of the reaction to VR exposition.

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#### Sleeping Beauties. What Can They Tell Us About Personal Identity?

Fauve Lybaert, University of Leuven, Belgium

# July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

I examine what sleeping beauties can tell us about personal identity. I make you fantasise about a harassment of these unconscious beauties and demonstrate that your intuitions about this show that there is something wrong with some popular views about personal identity. In the first part of my presentation I criticize the statements of John Locke that a being can only be a person if she is conscious and that a person can only stay the same person in as far as she is conscious of her past. I further distinguish my view on whether unconscious beauties are (particular) persons or mere human beings from those of animalists and proponents of the constitution view. In the second part of my presentation I point to three differences between my approach to personal identity and that of animalism and the constitution view. I show how these differences are reflected in my discussion of sleeping beauties. In my conclusion I return to our fantasies about sleeping beauties. I demonstrate how my different philosophical approach to the question of personal identity can reveal something unexpected about the way in which we think about sleeping beauties.

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#### The Anticipation/Fulfilment Model of Vision Connects Phenomenology and Cognitive Neuroscience.

Michael Madary, Johannes Gutenberg -- Universität Mainz, Germany

# July 3<sup>rd</sup>, 16:30-18:30: Concurrent Session 2.

I propose that visual perception is an ongoing process of anticipation and fulfillment. Unlike many theories of perceptual content on offer (such as propositional accounts, Searle 1983), the anticipation/fulfillment model fits especially well with recent work in the cognitive neuroscience of vision. I will offer a priori motivation followed by empirical support for my thesis. The a priori support for the anticipation/fulfillment model of vision builds on themes from Husserlian phenomenology as well as more recent work on sensorimotor contingencies (Noë 2004, Siegel 2006). Properties appear to us in different ways as we take different perspectives and we can be surprised if appearances do not change as we expect them to change. The straightforward way to explain this fact is to claim that we implicitly anticipate how things will appear and, when things are going well, our anticipations are fulfilled. Perceptual anticipation is ongoing, implicit, and has varying degrees of determinacy. Recent models of the neuroscience of vision share the theme that vision is anticipatory (Rao and Ballard 1999, Kveraga et al. 2007, and Clark, forthcoming). The brain actively predicts the upcoming retinal stimulus and the information which propagates to higher cortical levels are the prediction errors. In other words, cortical processing may be particularly devoted to sensory stimulation which does not fulfill anticipations. The similarity in structure between phenomenological description, on one hand, and empirical models, on the other, may signal an exciting convergence across disciplines in the science of consciousness.

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#### Culture-Dependent Modulations of Interoceptive Awareness during Self-Observation

Lara Maister, Royal Holloway University of London, UK Manos Tsakiris, Royal Holloway University of London, UK

# July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

There are marked differences between Asian and Western cultures in various aspects of self-related cognition, including self-face processing (Sui & Han, 2007) and self-construal style (e.g. Triandis, 1995). We investigated whether these cultural differences modulated the interaction between external and internal self-perception. Interoception is the awareness of the physiological condition of the body, and has been argued to play a fundamental role in human consciousness (Craig, 2003). Previous findings from our lab demonstrate that looking at one's own face in a mirror improves interoceptive awareness in those with low baseline interoceptive sensitivity. In other words, the perception of our bodies from the outside appears to influence how we perceive our bodies from within. This study investigated whether the beneficial effect of perceiving one's own face on interoceptive awareness differed between Eastern and Western cultures. Interoceptive awareness was measured using an established heartbeat monitoring task. Twenty Western and Twenty East Asian participants were exposed to a photograph of their own face or an unfamiliar other's face whilst performing the heartbeat monitoring task. Changes in interoceptive sensitivity from baseline were calculated for each condition. Results showed that viewing the self-face, but not the other-face, enhanced interoceptive awareness in Western participants. Interestingly, the beneficial effect of viewing one's own face was not found in the Asian participants, whose sensitivity to interoceptive information decreased from baseline in both the self-face and other-face conditions. These findings extend the observation of cultural differences in self-processing in the domain of interoceptive awareness.

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# Auditory, Visual, And Supramodal Representations Are Shared Across Individuals: An Investigation of the Publicity Criterion of Concepts

Kingson Man, University of Southern California, USA Jonas Kaplan, University of Southern California, USA Antonio Damasio, University of Southern California, USA

## July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

Communication involves the transmission of thoughts and concepts among individuals. The publicity criterion of concepts requires, for successful communication to occur, that conversants have similar semantic contents underlying their transmitted concepts. We used multivariate pattern analysis of human fMRI data to determine the extent to which neural representations of sounds and images were shared across subjects. Furthermore, we probed for representations that were both subject-invariant and modality-invariant. We performed an acrosssubjects analysis on a previously acquired dataset from an experiment in which eight subjects were presented with corresponding audio and silent video clips of six common objects. A machine-learning algorithm was trained on data from seven subjects and tested on data from the eighth. Classifier performance was significantly above chance when classifying audio clips using data from early auditory cortices (0.66; chance = 0.5; P < 0.001 uncorrected) and video clips using data from early visual cortices (0.65; P < 0.001 uncorr.). For cross-subject crossmodal classification, the algorithm was trained on video data from seven subjects and tested on audio data from the remaining subject. Out of four predetermined multisensory regions of interest, above-chance classification was only found in a focal region of temporo-parietal cortex (0.56; P < 0.001 uncorr.). However, the converse classification, training on audio data and testing on video, yielded results that were only marginally above chance in all multisensory ROIs. We conclude that subject-invariant neural representations in early sensory cortices and possibly in multisensory cortices may address the publicity criterion of mental concepts.

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#### The Case for Extended Environment

#### Riccardo Manzotti, IULM University, Italy

## July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Dreams, sleep and other conditions are often presented as evidence that an isolated brain is capable of conscious experience – a premise that is crucial to establishing whether neural activity is sufficient to consciousness. This paper challenges such a premise. Is a brain ever isolated from the environment? I propose that dream, sleep, and the like are akin to normal perception with respect to their causal geometry. The notion of environment is here refined to deal with causal and temporal issues. The notion of synchronous environment is contrasted with that of extended environment. The extended environment is defined in causally relative terms. In sum, I suggest that the brain is never isolated from its surroundings since the causally relevant environment is temporally and spatially more extended than usually assumed. From a causal perspective, perception and cognition are thus more similar

than usually assumed. The alleged cases of isolation may then be reconsidered as cases of temporally-longer causal interactions.

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#### Do Subjective Measures Of Consciousness Measure Access To, Or Contents Of, Consciousness?

Mario Martinez-Saito, University of Tokyo, Japan Katsuyuki Sakai, University of Tokyo, Japan

# July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

Research devoted to consciousness has undergone a remarkable growth in the last decade fueled by the endeavor of a batch of scientists seeking to shed light on the functional mechanisms that enable our daily experiences. Both behavioral and subjective measures, each bearing its particular advantages and disadvantages, have been used to assess what kind of information processed in the brain is able to access consciousness. Subjective measures of consciousness, such as confidence ratings (CR) and perceptual awareness scale (PAS), are used commonly under the presumption that they comprise information relevant to the discrimination of conscious from unconscious processes. I will challenge this view from the viewpoint that these measures only draw information on sensory information independent from the accessibility of information to consciousness.

Visual stimuli close to detection threshold consisting on image noise added on Gabor patches were presented to subjects on a screen. In each trial, subjects made firstly a detection or orientation discrimination judgment on the stimulus and also a metacognitive judgment on their decision (CR or PAS).

Preliminary results suggest that subjective measures of consciousness do not comprise information on the accessibility of information to consciousness, but on contents of consciousness. Hence, subjective measures of consciousness would draw on information relevant to the features of the stimulus, and not on information relevant to identifying whether information is processed consciously or unconsciously.

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#### A Higher State Of Self-Awareness Improves Team Performances

Kazuyo Matsuo, Kyushu University, Japan Hiroyuki Yamaguchi, Kyushu University, Japan

# July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

The self-awareness that emerges from human consciousness makes possible a special self-awareness that is vital for task performance in a group. Team-dependent self-awareness, that is, understanding team members and viewing oneself from a third person aspect within the team, assists team members to act effectively. In studies of consciousness and team performance, this type of self-awareness has not been given much attention. We examined the effect of Transactive Memory Systems (TMS) on improving team performance. For individuals in a group to carry out work effectively, meta-cognition is necessary: each group member should know as much as possible about himself or herself and other members' knowledge and abilities. The more group members come to know about each other, the more appropriately they come to anticipate other members' behavior. Previous studies have shown that such understanding improves mutual adjustment. We conducted research to examine the effect of TMS on team communication. A questionnaire was used to collect data from 160 employees at either a broadcasting company or a food manufacturer. The questionnaire was designed to measure TMS (specialization, credibility, and coordination components), subjective team effectiveness and team communication. The results suggest that team communication enhanced recognition and the credibility of members' expertise, and therefore an awareness of other workers' roles and knowledge led to improved team performance. In conclusion, teamdependent self-awareness, an awareness higher than self-awareness, which arises from recognizing the thoughts, skills and capabilities of other team members, is vital for improving a team's performance.

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#### **Conscious and Unconscious Thought In Artificial Grammar Learning**

Andy Mealor, Sackler Centre for Consciousness Science & School of Psychology, University of Sussex, UK Zoltan Dienes, Sackler Centre for Consciousness Science & School of Psychology, University of Sussex, UK

# *July* 4<sup>th</sup>, 14:00-16:00: *Poster Session* 1.

Unconscious Thought Theory posits that a period of distraction after information acquisition leads to unconscious processing which enhances decision making relative to conscious deliberation or immediate choice. Support thus far has been mixed. In the present study, artificial grammar learning was used in order to produce measurable amounts of conscious and unconscious knowledge. Intermediate phases were introduced between training and

testing. Participants engaged in conscious deliberation of grammar rules, were distracted for the same period of time, or progressed immediately from training to testing. No differences in accuracy were found between intermediate phase groups acting on decisions made with meta-cognitive awareness (either feeling-based intuitive responding or conscious rule- or recollection-based responding). However, the accuracy of guess responses was significantly higher after distraction relative to immediate progression or conscious deliberation. The results suggest any beneficial effects of 'unconscious thought' may not always transfer to conscious awareness. Key words: implicit learning, unconscious thought, subjective measures, artificial grammar learning

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#### It'll Be Easy: the Advantage of Predicting a Congruent Successor Can Be Extended to Incongruent Successors

Amavia Méndez, Universidade de Santiago de Compostela, Spain Luis Jiménez, Universidade de Santiago de Compostela, Spain

# July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

In Stroop tasks, congruency effects are modulated by the sequence of preceding trials. Gratton et al. (1992) interpreted this Sequential Congruency Effect (SCE) as the result of repetition expectancies, which lead participants to respond faster to an incongruent trial after another incongruent trial because they expect it. Several researchers have confirmed that using explicit cues to generate congruency expectancies for the incoming trial produces results resembling those produced by the SCE (e.g. Aarts & Roelofs, 2010). In this study, we analyze how we learn about the predictive value of a cue when it is an integral part of the Stroop trial, rather than an external cue. A four-color Stroop task was arranged in which two colors were consistently non-predictive, but the other two colors were probabilistically associated with the appearance of either a congruent or an incongruent stimulus for the next trial. Similar learning about these predictive cues was observed in both intentional and incidental conditions, as attested by faster RT in response to congruent trials when they were correctly predicted. However, in contrast with most previous research, we did not obtain a similar advantage for responding to incongruent trials. Instead, we found that participants responded faster to incongruent trials when they expected an easy trial (i.e., when they had been led to expect a congruent successor), rather than when they expected an incongruent trial. These results are consistent with a threshold-moving model, according to which learning regulates the amount of evidence needed to produce a response.

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#### Cognitive Bias Tasks as Tools for Assessing Conscious Emotion States in Animals?

Michael Mendl, University of Bristol, UK. Elizabeth S. Paul, University of Bristol, UK.

## *July* 5<sup>th</sup>, 14:00-16:00: *Poster Session 2*.

Whether and to what extent non-human animals are capable of consciously experiencing emotion, and therefore have the capacity to suffer, is a major issue of concern for ethicists and animal scientists alike, and establishment of methods by which animals' felt emotions can be objectively measured is a key focus of research in the field of Animal Welfare Science. We argue that the best measures of emotion in animals (i.e. most likely to reflect an animals' conscious emotional experience) are those that are invariantly associated with self-reported emotion in humans. A potential candidate measure is cognitive bias. Cognitive bias tasks require participants to judge whether ambiguous stimuli predict reward or punishment. People experiencing negative emotions reliably show a pessimistic bias - they anticipate less reward and more punishment in such tests. Moreover, it has been proposed that they may use conscious feelings as a tool for making these judgements (the "how do I feel about it?" heuristic). We have shown that rats and dogs can also demonstrate similar cognitive biases, and further studies by other researchers have made parallel findings in species as diverse as starlings, sheep, rhesus macaques, and even honeybees. We describe these studies and discuss how and why affect-induced cognitive biases may arise in both humans and animals. If certain types of cognitive bias occur only in the presence of consciously reported emotion in humans (a subject of our ongoing research), it is possible that the same is true in other animals.

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#### Does Learning Require Consciousness Or Attention? An fMRI Experiment

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July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

It has been proposed that visual attention and consciousness are separate (Koch & Tsuchiya 2007) and possibly even orthogonal processes (Lamme 2003). The two converge when conscious visual percepts are attended, and

become available for conscious report. A lack of reportability can have two causes: the absence of attention or the absence of a conscious percept. This raises an important question in the field of perceptual learning: which of the two ingredients – consciousness or attention – is not necessary for learning? In this fMRI experiment we presented textured figure-ground stimuli, and manipulated reportability either by masking (which only interferes with consciousness) or with an inattention paradigm (which only interferes with attention). 24 hours later learning was assessed neurally and behaviorally, via differences in figure-ground BOLD signal and via a detection task. Preliminary results show that behavioral and neural learning effects are found for stimuli presented in the inattention paradigm, and not for masked stimuli. Interestingly, the behavioral learning effect only becomes apparent when performance feedback is given on the detection task, suggesting that the memory trace that is formed during inattention is latent until accessed. This behavioral expression of latent learning enhanced neural learning effects, as a post-detection BOLD measurement (one hour after the detection task), revealed enhanced BOLD signal for the learned figure compared to the pre-detection BOLD signal on the same day, but only in the inattention group. These results suggest that learning requires consciousness, and not attention, and further strengthen the idea that consciousness is separate from attention.

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#### Bright Lighting Reduces Frontal EEG Theta Activity during the Sternberg Memory Task

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## July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

Since the lighting condition affects our working efficacy in everyday life, we investigated whether the workingmemory load is susceptible to the lighting condition varying with both color-temperature and brightness. EEG was recorded from 23 participants performing the Sternberg memory task with the 3-level memory-load (3, 5, and 7 digit-span) under 4 different lighting conditions that were 2x2 factorial-designed: two brightness conditions (150lux and 700lux) by two color-temperatures (3000K and 7100K). The participants were surrounded with a Ganzfeld dome (2m in diameter) that makes as much lighting rays as possible focused on the monitor where the task-related stimuli were presented. The power of oscillatory activity was investigated by convolving the EEG signals with Morlet wavelets. The bright lighting condition yielded significantly lower frontal EEG theta activity (F(3,57)=2.896, P<0.05), possibly indicating that bright lightning alleviates the working-memory load since frontal EEG theta activity has been reported as systematically reflecting the working-memory load. In particular, as compared to the amount of frontal theta activity in the dark condition (150lux), the bright condition (700lux) in the low color-temperature (3000K) made participants demanding only 74.6% of frontal theta activity whereas 97.2% of frontal theta activity was yielded during the bright condition (700lux) in the high color-temperature (7100K). Taken together, our results imply that the degree of brightness-mediated alleviation of the working-memory load depends on the color-temperature of the lighting.

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### On The Metacognition Of Free Will.

Ken Mogi, Sony Computer Science Laboratories

July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Possession of a sense of free will (Dennett 2003) is necessary for the maintenance of a typical state of mind. Impairment of the subjective feeling of the ability to choose and initiate one's own voluntary action is a reflection of the malfunction of cognitive processes, and has grave implications for the foundations of morality (Gazzaniga 2005).

From the point of view of compatibilism (James 1884), any subjective feeling of free will is one of "illusory" nature, indicating no violation of the causal laws governing all matters in the universe including the brain. A sense of free will is an actively constructed phenomenological entity, and falls within the wider spectrum of the neural correlates of consciousness (Crick and Koch 1995). It is thus interesting to investigate what cognitive elements contribute to the maintenance of a sense of free will, from empirical and theoretical perspectives.

Here, I report an empirical (sensu "experimental philosophy", Nichols 2011) investigation aimed at clarifying the systems cognitive aspects of the active construction of the free will. The subjective estimation of "the capacity of free will" is examined using a variety of situations, involving combinations of parameters not necessarily apparent to the subjects. Specifically, time pressure, number of selections, and the freedom to veto one's own action are examined as factors affecting the subject's sense of the possession of free will. The results reveal the parameters contributing to the metacognition of voluntary actions as a "barometer" of the overall brain function.

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#### Decision Making, Experimental Design, And the Origins of Options.

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## July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Most research on decision making has focused on how individuals choose between two or more options, posed in advance by the researchers. The mechanisms by which options are generated for most decisions, however, are not well understood. We argue that understanding the origins of options is a crucial but untapped area for decision making research. We explore a number of factors which influence the generation of options, which fall broadly into two categories: psycho-biological and socio-cultural. The former category includes factors such as perceptual biases and associative memory networks, while the latter relies on the incredible human capacity for culture and social learning. In this context, we discuss the following key issues: 1) In various real-life situations our options are limited by environmental contexts, social and legal rules, scarcity of resources or possibilities. 2) The existence of experiments with no a priori correct answers and with room for individually-generated responses is already an advance, but we suggest more creativity in experimental design to contemplate the generation of options. 3) A detailed consideration of current experimental protocols, focusing on the differences between more internally and more externally guided decision-making and their relations to individual and social influences. 4) Experimental limitations and prospects to study the origins of options: How is such study currently possible? In which directions might we find a way out of the 'laboratorial bubble'? What kind of experiments could be proposed? Within which experimental protocols? From what types of standpoints would they have to depart?

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#### Exploring the Properties of "Dynamic" Continuous Flash Suppression

Pieter Moors, University of Leuven, Belgium Johan Wagemans, University of Leuven, Belgium Lee de-Wit, University of Leuven, Belgium

## July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

Continuous flash suppression (CFS) is a recently developed technique that builds on binocular rivalry, to reliably suppress stimuli from visual awareness for extended periods of time (Tsuchiya & Koch, 2005). Over the last seven years, it has successfully been applied to study the extent to which several kinds of (mostly static) stimuli are processed in the absence of awareness (for a review, see Lin & He, 2009). Only recently however, researchers have begun to explore the properties that make a CFS mask effective. Yang and Blake (2012), for example, have explored the importance of the spatial frequency match between the CFS mask and the to-be suppressed stimulus. We have recently developed a modified CFS mask to render moving stimuli unconscious. In this research we seek to understand the factors that contribute to the effectiveness of this 'dynamic' CFS mask. Extrapolating from Yang and Blake's research we have tested the importance of the match between the motion profile of the mask, and the motion profile of the to-be-suppressed stimulus.

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#### **Depersonalization Disorder - A Model System for Consciousness?**

Levente Móró, University of Turku, Finland

July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

During the last two decades, scientific studies of consciousness have suggested several viable cognitive and neural theories concerning the nature of the mind. There are also single suggestions for different models of consciousness, such as the visual system, anesthesia, dreaming, or coma. All proposed models should adequately describe and explain the operation of the constitutive subsystems of consciousness, which have been enlisted by using concepts in cognitive psychology. In clinical neuropsychiatry, such model candidates can be found by systematically searching through comprehensive diagnosis lists (e.g., the DSM-IV) for disorders in which subsystems of consciousness are profoundly affected.

In my talk, I will present the results of such a comparative search, and propose Depersonalization Disorder (DPD) as a noteworthy candidate model system for consciousness studies. I argue that DPD as a clinical composite affects practically all subsystems of consciousness, in particular its cognitive, emotional, perceptual, and somatic components. Moreover, the subjective experience of "feeling unreal" has also interesting connections with self-awareness, embodiment, and metacognition, as well as with the idea of "being no-one" in the philosophy of mind.

My presentation will also briefly review the various conditions and methods that can induce or reduce depersonalization and derealization symptoms, with an emphasis on the neuropharmacological relevance of the

kappa opioid receptor system. I will describe a striking similarity between symptoms of DPD and acute effects of salvinorin-A, the active ingredient of the plant *Salvia divinorum* ("diviner's sage"). In conclusion, the idea of exploring consciousness by clinically induced depersonalization will be discussed. Email Address: leve@utu.fi

Synaesthesia, Sensory Motor Contingency and Simulation

#### Aleksandra Mroczko-Wąsowicz, National Yang Ming University, Taiwan

## *July* 4<sup>*th*</sup>, 14:00-16:00: Poster Session 1.

Recently a novel form of synaesthesia, namely swimming-style colour synaesthesia, has been reported by semiswimmers experiencing different swimming styles each with a specific colour, in addition to their more standard grapheme-colour associations. The induction of this kind of synaesthesia took place in laboratory conditions. All what subjects had to do was to take a look at photographs of other people swimming or just to think about a given swimming-style. This form of synaesthesia shows that colour experiences may be evoked even in the absence of any direct sensory stimulation, i.e., proprioceptive and motoric inputs during swimming. In my presentation I will compare this kind of synaesthesia with a phenomenon of the mirror-touch synaesthesia (when visually presented tactile stimulation of others results in the projection of the tactile experience onto oneself) and discuss them from the perspective of the theory of embodied simulation and sensory motor contingency. Since the matching between different modalities and domains enables the observer of another person's sensation, emotion or action, to feel as if he were experiencing that sensation or emotion or performing that action himself, the induction of synaesthetic experiences may be mediated by the activation of a specific phenomenal model, i.e. the simulation of the perceived event. Hence, in synaesthesia through the employment of the mechanisms of sensory motor contingency, there seems to be no difference between observation of various actions and them being enacted, be it a simple touch or a more complex activity such as swimming or dancing. In any case, the respective simulation, e.g. the kinesthetic simulation in the self-model, has to be produced in order the corresponding sensation can be recalled from memory.

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#### Predictive Coding in the Visual Cortex.

Lars Muckli, University of Glasgow, UK Essa Yacoub, University of Minnesota Medical School, USA Fraser Smith, University of Glasgow, UK Petra Vetter, University of Glasgow, UK Kamil Ugurbil, University of Minnesota Medical School, USA Rainer Goebel, Maastricht University, the Netherlands Federico DeMartino, University of Minnesota Medical School, USA

July 3<sup>rd</sup>, 16:30-18:30: Concurrent Session 2.

The predictive coding framework represents a paradigm shift in neuroscience and impacts on concepts of mind and experience. Brain processes are traditionally studied as a function of sensory stimulation. In contrast, predictive coding states that the brain continually generates models of the world based on context and information from memory in order to predict sensory input. In terms of brain computation, a predictive model is created in higher cortical areas and communicated to lower sensory areas through feedback connections.To investigate the information content of feedback projections, we have exploited a strategy based on nonstimulated sections in retinotopic regions (apparent motion path, occluded natural scenes, blindfolded subjects). In these regions we investigate the information content of activation patterns and can therefor decode cortical feedback. Our results show that contextual predictions are processed in V1. High resolution MRI indicates that the cortical feedback is especially strong in outer layers of V1. To investigate prediction error, we have used probe stimuli that were presented in a matching or non-matching context (i.e. apparent motion illusion). The results demonstrate that non stimulated regions in V1 contain predictions that influence subsequent conscious perception.

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#### **Reflexes Objectify Changes in Awareness during Perceptual Rivalry**

Marnix Naber, Philipps University Marburg, Germany & Harvard University, USA Stefan Fraessle, Philipps University Marburg, Germany Wolfgang Einhäuser, Philipps University Marburg, Germany

*July* 4<sup>th</sup>, 14:00-16:00: *Poster Session* 1.

In perceptual rivalry, a constant physical stimulus evokes multiple distinct perceptual interpretations ("percepts") that alternate in dominance over time. Rivalry is frequently used to assess changes in visual awareness, but the

necessity to overtly report perceptual changes and thus to rely on observers' introspective processes has bedeviled many studies of rivalry. Here we present a combination of objective measures to overcome these confounds. We induced binocular rivalry by presenting separate gratings to each eye that differed in both luminance and the direction of movement. This resulted in changes in brightness and motion perception, which were coupled to changes in pupil size and direction of the optokinetic nystagmus (OKN), respectively. We found that both the pupil and OKN were reliable and accurate indicators of the perceptual state of the observers. Both reflexes indicated gradual transitions between percepts and revealed brief intermediate state transitions. In addition, overt report biased durations of dominance, presumably through attention- or decision-related load. We conclude that reflexes reflect a richer picture of changes in awareness as compared to introspective measures. The dissociation of awareness from introspection will likely pave the way for increasingly objectified research into the neural correlates of consciousness.

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#### Neural Substrates of the Temporal Perception during Successive Visual Stimuli: A High-Density ERP Study

Atsushi Nagaike, Kyushu University, Japan Takako Mitsudo, Kyushu University, Japan Yoshitaka Nakajima, Kyushu University, Japan Katsuya Ogata, Kyushu University, Japan Takao Yamasaki, Kyushu University, Japan Yoshinobu Goto, International University of Health and Welfare, Japan Shozo Tobimatsu, Kyushu University, Japan

## July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

Rhythm is important for our communication. Most of the researches on rhythm perception have been carried out in the audition. To clarify the mechanism for perception of rhythmic patterns in a different modality, we investigated the relationship between neural responses and perception of short time intervals in the vision. Thus, we recorded event-related potentials (ERPs) to examine the temporal perception during successive visual stimuli. Stimulus patterns consisted of the two intervals (T1 and T2) marked by three successive visual stimuli. In a 2alternative-forced-choice (2AFC) task, participants judged whether T1 and T2 were equal or not by pressing a button. In a simple-response (SR) task, participants pressed a button without any judgement. In the 'T1 $\leq$ T2' condition, T1 was varied from 240 to 400 ms in 80 ms step while T2 was fixed at 400 ms. In the 'T1 $\geq$ T2' condition, T1 and T2 were reversed. By subtracting responses to 2AFC task from those to SR task, a negative slope appeared about 200 ms after the onset of 1st visual marker in the frontocentral area. This slope declined before the 3rd visual marker appeared in the condition of 240/400 (ms). Moreover, a positive component appeared about 400-500 ms after the onset of 3rd visual marker in the parietal area in the condition of 400/240 (ms). These neural responses corresponded to participants' perception that T1 and T2 were not equal. It turned out that frontoparietal neural responses were related to the temporal perception in the vision.

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#### **Unconscious Attention**

#### Bence Nanay, Cambridge University, UK

## July 3<sup>rd</sup>, 16:30-18:30: Concurrent Session 2.

An important, rarely questioned premise of both psychological and philosophical research on attention was that consciousness is necessary for attention: that there is no such thing as unconscious attention. But there have been more and more research that suggests otherwise (Kentridge et al. 1999, 2008, Kentridge 2011, Enns and DiLollo 2000, Jiang et al. 2006, Koch and Tsuchiya 2007, see also Neisser 1967 and Dennett 1978). But some researchers (especially philosophers) question whether these empirical findings in fact support the claim that attention can be unconscious (Prinz 2010, 2011, Mole 2008, Hine 2010). The most promising of these arguments is Jesse Prinz's who argues that these empirical findings fail to differentiate between attention and what he calls 'orientation' and they in fact show that there is unconscious 'orientation' (rather than unconscious attention). The aim of my paper is to examine whether and how the empirical findings, with special emphasis on Jiang et al. 2006's experiment. My conclusion is that in spite of the philosophical defense of the standard picture, the empirical findings do demonstrate that there is such a thing as unconscious attention. This conclusion is important not only for psychologists, but also for philosophers: supposing that some perceptual states are unconscious, if attention cannot be unconscious, then this would force us to deny that perception is always post-attentive (Nanay 2010, 2011). If, as I argue, there is such a thing as unconscious attention, then we can hold onto the concept of post-attentive perception.

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#### Analyzing Phenomenal Concepts Relying on Mental Files.

#### Albert Newen, Ruhr-Universität Bochum, Germany

July 6<sup>th</sup>, 11:00-13:00: Concurrent Session 4.

We possess concepts of the what-it-is-like aspect of our experiences. I propose a new theory of phenomenal concepts and apply it fruitfully to account for the knowledge argument from the perspective of an antecedent physicalism. The basic strategy is to analyze phenomenal concepts in terms of mental files which have three central dimensions: 1. they have content; 2. we can distinguish three types of information in the file (sensorimotor, image-like and descriptive), and 3. it normally has an anchoring relation to a real entity. The central considerations: When I see a tomato, my experience can be analyzed by distinguishing two properties: the tomato has the object-property of being red that causes the property of having a red-experience. When we start to deal with colors we acquire a perception-based concept RED that refers to the object-property of being red. Later, I acquire a concept RED-EXPERIENCE that refers to my red-experience; this requires a mini-theory about the subjectivity and privacy of my experiences. Application: Mary's new red-image when entering the colored world is integrated into her perception-based concept RED as well as into a theory-based concept of RED-EXP. Since this can be described fruitfully within a physicalist framework, this view of phenomenal concepts supports that the knowledge argument does not imply dualism. Phenomenal concepts – as understood in philosophical debates – are theory-based concepts. There development indicates a complex cognitive organization of the concepts without any implications for the underlying ontology of experiences.

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#### Processing Of Olfactory Stimuli in Patients with Disorders of Consciousness

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#### July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Background: Olfaction is the sole sensory system that reaches the cortex without a thalamic relay [1]. Given the role of the thalamus in conscious processing and its vulnerability in brain injuries [2], olfactory processing is of particular interest in disorder of consciousness (DOC) patients where head trauma is the primary cause.

Objectives: To determine in DOC patients 1) the extent of neural processing of odours; 2) the correlation between CRS-R and activity in the orbitofrontal cortex (OFC), an area associated with olfactory conscious experience [3].

Methods: Fourteen vegetative state (VS) and 10 minimally conscious state (MCS) patients, assessed with CRS-R, and 18 healthy participants were scanned with fMRI during the administration of olfactory stimuli. Whole brain analyses were conducted at group-level in healthy and at single-subject level in DOC patients. Moreover, region of interest (ROI) analyses in right OFC were performed in DOC patients.

Results: Activations in healthy subjects were consistent with previous literature. Six patients (1 VS and 5 MCS) were excluded for excessive movements. Whole brain analysis showed that 9 VS and 6 MCS patients presented activity within the piriform cortex/amygdala; among these, 5 VS and 5 MCS patients exhibited activity also in anterior insula and left or right OFC. No significant correlation between BOLD signal changes and CRS-R in the right OFC. However, ROI analyses demonstrated that 50% of MCS and no VS patient had activity in this area.

Conclusion: All MCS and 70% of VS patients showed a partial or total preservation of the olfactory processing.

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## Losing Consciousness And Getting It Back During Sleep Onset: Evidence From Go (-No-Go) Tasks

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July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

The onset of sleep provides a unique window to investigate psychophysiology of consciousness and its fading. Within several minutes or even tens of seconds, consciousness may fluctuate between alertness, relaxation,

drowsiness and unresponsiveness, each of which is associated with varying capabilities of executive functioning. To investigate psychophysical and neurophysiological markers of these states, two EEG experiments were carried out in which participants performed a Go-left/Go-right task and a decision-wise more challenging Go-no-Go task. Comparison of these tasks allowed us to investigate attention and decision making across the brief cycles of consciousness fading and regaining. In the presentation, we will demonstrate how reaction times and ERP measures change depending on the current state of consciousness and its transitions. Further, we will discuss whether pre-stimulus spectral EEG markers, such alpha/theta power ratio, predict behavioural pattern of post-stimulus responding.

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#### The Relationship between Mood and Learning in the Serial Reaction Time Task

#### Emma Jones, University of Bergen, Norway

Elisabeth Norman, University of Bergen & Haukeland University Hospital, Norway

## July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

Research on the effect of participants' mood on implicit learning is limited and has showed contradictory results. In this experiment we apply the mood-as-information model (Schwartz, 1990) to implicit learning in order to investigate whether the implicit system will use a negative mood to indicate that it needs to learn more. According to this model, a positive mood will inform individuals of a safe environment and reduce their motivation to elaborate information in that environment, whereas a sad mood may facilitate a systematic processing style involving increased attention to detail. Healthy participants (*N* = 80) were trained on a serial reaction time (SRT) task. Mood was induced by using target stimuli that were pictures of human faces expressing either happiness (i.e., the *positive* mood condition) or sadness (i.e., the *negative* mood condition). Mood was assessed with PANAS-X (Watson & Clark, 1994). Response stimulus interval (RSI) was either 0 or 500 ms. Results showed a significant interaction between mood and RSI on the amount of learning: At RSI-500 there was a trend for a negative mood to be associated with more learning. At RSI-0 there was no effect of mood on learning. Results are discussed in relationship to theoretical models of the effect of mood on cognition and in relationship to previous empirical findings.

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### **Object-based attention without awareness**

Liam Norman, Durham University Charles A. Heywood, Durham University Robert W. Kentridge, Durham University

# July 6<sup>th</sup>, 11:00-13:00: Concurrent Session 4.

Attention and awareness are often considered to be related. Some forms of attention, however, can facilitate the processing of unseen stimuli. The validity of this claim has, however, been challenged on the grounds that, in the studies supporting it, attention was not directed towards an unseen object per se, but was rather directed in a spatial manner towards the area which the object occupied. The experiments described here show dissociations between attention and awareness at a processing stage beyond spatial selection. Pairs of objects were continually masked, rendering them invisible to participants performing a cued-target discrimination task. When the cue and target occurred within the same object, discrimination was faster than when they occurred in different objects at the same spatial separation. Participants reported no awareness of the objects and their detection of the objects was at chance in a signal-detection task. Object-based attention, therefore, is not sufficient for object-awareness.

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#### How to build a Robot that Feels.

#### Kevin O'Regan, Université Paris Descartes, France

## July 4<sup>th</sup>, 11:00-13:00: Concurrent Session 3.

Consciousness is often considered to have a "hard" part and a not-so-hard part. With the help of work in artificial intelligence and more recently in embodied robotics, there is hope that we shall be able solve the not-so-hard part and make artificial agents that understand their environment, communicate with their friends, and most importantly, have a notion of "self" and "others". But will such agents feel anything? Building the feel into the agent seems at first to be the "hard" part. I shall explain how the sensorimotor approach proposed in my recent book (O'Regan 2011), provides a solution by taking the counterintuitive stance that feel is a way of acting in the world. This provides a way of accounting for what has been considered the mystery of "qualia", namely why feels

are very difficult to describe to others and even to oneself, why they can nevertheless be compared and contrasted, and, most important, why there is something it's like to experience them: that is, why they have phenomenal "presence". As applications of this sensorimotor approach, I shall show how it predicts change blindness, sensory substitution, and makes a start to explaining why colors are experienced the way they are. To the extent that the sensorimotor approach dissipates the "hard" problem of consciousness, building feel into robots becomes possible.

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# The Dyad of Maternal Depression and its Consequences for Emotional Development in Infancy: Face-to-Face Interaction, Mirror Neurons, and Embodied Simulation of Negative Affect in the Context of Brain Maturation.

Katharina Ohrnberger, University College Maastricht, Maastricht University, Netherlands

## July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

Research on mirror neurons is dominated by studies on social cognition, the ability to infer others' mental states in social contexts. This theoretical contribution takes a different perspective: It investigates the possible role of mirror neurons for emotional development in the context of mother-infant face-to-face interaction during the first year of life. Based on studies that reveal mirroring of depressed mothers' affective states by their infants, a theory on the underlying neurobiological processes is developed. Dynamical systems theory and embodied simulation provide the theoretical framework. It is suggested that imitation of maternal facial expression by the infant during face-to-face play might lead to affect mirroring. The latter might entail the automatic enactment of maternal affective state via infants' mirror neurons, leading to embodied simulation of maternal emotional states at the neurobiological level. Due to infants' high brain plasticity and course of brain maturation, it is concluded that, over time, repeated mirroring of maternal affective states as well as poor maternal ability to regulate negative affect manifest themselves in the organisation of infants' neurobiological structures that are related to the emergence of affective style. Interpreted in the context of research on consciousness, these findings support its genuinely dyadic origin: Mirror neurons, functioning as systems coupling elements, might mitigate internalisation of the external which in turn might underlie the emergence of consciousness at the neurobiological level.

Key words: Affect mirroring, affective style, brain maturation, consciousness, dynamical systems theory, embodied simulation, emotional development, face-to-face interaction, infants of depressed mothers, mirror neurons.

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#### Transfer Entropy Network Characterizes the Default Mode of the Web

Takashi Ikegami, University of Tokyo, Japan Mizuki Oka, University of Tokyo, Japan

# *July* 5<sup>th</sup>, 14:00-16:00: *Poster Session* 2.

In this talk, we make an analogy between the Web and the brain system to propose a new framework for studying a generalized default mode and information integration of a given system. We first take a web data as an example. The Web responds to real-world events. This reactive response, which we call reactive mode of the web, is measured by the number of queries and tweets. However, even without any salient real-world events, the Web can be self-activated. That is, we can consider the internal bursts, which are not driven by real-world events but rather by the internal dynamics of the Web, as a default mode of the Web system. By using the transfer entropy (TE), we measured the mutual effect of tweet postings and Google queries. We then analyzed the behavior of the Web in terms of the default and reactive modes, computing the size and connectivity of the TE network. We found that when the cluster size changes, a network switches between a default mode and a reactive mode. As a result, when the transfer entropy from Google to Twitter decreases, the size of the TE network increases, causing intrinsic bursting behavior. Our hypothesis is that the default mode in general is preparing for future events (in case of the web, which keyword search becomes popular), which we examine by the TE network dynamics.

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#### **Qualia and Information Processing In Local Cortical Networks**

Roger Orpwood, University of Bath, UK

July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

This paper analyses the behaviour of local cortical networks to explore the links between their processing of information and the generation of qualia. Pyramidal cells can recognise spatial patterns of activity in the input they receive, but they cannot differentiate between patterns. However local cortical networks can both recognise input patterns and in response generate output patterns of activity. The output information is the network's representation of the identity it assigns to the input information. If the output information is locally fed back to

itself, as occurs in layer 2/3 and layer 5 cortical networks, then cyclic activity occurs, and a stable attractor state can result. It can be shown that in this state the network is not only able to recognise the representations it is feeding back to itself, but can recognise them as being its representations. Such cyclic behaviour gives the network unique properties. Input information is recognised as having some identity to the network, and output information is generated which represents that identity. Every time the output is fedback it is recognised as being a representation of the previous identity, and a new identity is assigned. The identity therefore evolves from initially being what the input is to the network, to what it is like, to how it seems. The end result is a network that can recognise an inner likeness of how its own activity seems to it, and could provide a local basis for qualia.

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#### Hypnotizability and Prefrontal GABA Concentration

Rikke Overgaard, CNRU, CFIN, MindLab, Aarhus University Hospital, Aarhus, Denmark

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# July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

By far the most research in cognitive neuroscience has until date focused on activity in so-called pyramidal cells, as measured by EEG, MEG or fMRI. The activity in these cells are however regulated by interneurons, the role of which have been overlooked in cognitive neuroscience until recently. Some of the interneurons make use of the neurotransmitter GABA, the concentration of which can be measured by Magnetic Resonance Spectroscopy (MRS). The concentration of GABA has been investigated in few studies in relation to early visual processes, e.g. in the difference between watching lines with different marginal orientation. As GABA is an inhibiting neurotransmitter, negative correlations have been observed between reaction time and motor cortex GABA concentration, and positive correlations between eye movement inhibition and GABA in early visual areas. In recent experiments using hypnosis, different cognitive functions have been inhibited such as the ability to read (thus improving subjects' performance in a Stroop task), or to see colours. It is therefore a reasonable assumption that GABA is involved in the mechanisms of hypnosis and perhaps in executive functioning in general. We have, as the first in the world, performed an MRS experiment focusing on prefrontal GABA concentration and compared this measure to hypnotisability as measured by the SHSS:C scale.

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#### Is The Self Built In Stages?

### Hao Pang, National Yang-Ming University, Taiwan Allen Y. Houng, National Yang-Ming University, Taiwan

# July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Antonio Damasio, a famous neuroscientist, is trying to investigate the self through scientific method. According to his theory (2010), the self is built in stages: from the protoself to the core self to the autobiographical self. But is the self really built in stages? I think it is just a pragmatic way to distinguish three different kinds of self. In addition, claiming there are three kinds of self and proposing the self is built in stages would face some difficulties. First, we only feel one self. It is counterintuitive to say that we have three kinds of self. Secondly, this model is hard to be clarified in some clinical cases, for example, the patient who lives without proprioception. As stated by Damasio's theory, the primordial feeling, which is the feeling of the existence of my own body, is an essential element for building the self. Therefore, the self of the person who lost the proprioception, the feeling of the body, will be undermined. However, the evidences show that the patient in this case can still own a normal self. It seems to be a counterexample to Damasio's theory. In this paper I argue that we only have one self, the unifying process. It unifies two things on the coordinate axis: the experience of here and now and the episodic memory. The brain stem plays a role of presenting the coordinate axis. Once the self, the unifying process, unifies the experience, we will have a single and united conscious experience. Losing proprioception is just losing one kind of material. Thus the self remains intact.

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### Why Did I Stop Myself? The Effect of Non-Conscious Primes on Intentional Inhibition of Actions.

## Jim Parkinson, University College London, UK Patrick Haggard, University College London, UK

## July 6<sup>th</sup>, 11:00-13:00: Concurrent Session 4.

Intentional choice is a fundamental facet of human behaviour, often linked to consciousness. Intentional inhibition is a late, endogenously generated process that "vetoes" an about-to-be-executed action. Previous research suggested that such intentional inhibitory control requires conscious effort and awareness. Here we show that such decisions to inhibit are influenced by non-conscious processing. In a novel version of the Go/No-Go task, participants responded to on-screen directional arrows with a button press action: One arrow was a Go target, requiring speeded button press responses; another arrow was a No-Go target. Double-headed arrows required participants to make a free, spontaneous choice whether to execute or inhibit the prepared action. Prior to each target, subliminal masked prime arrows were presented. These could be congruent with the Go or No-Go arrows, or neutral. Response times and proportion of action choices were measured. Primes were presented at latencies that would give either positive or negative compatibility effects, based on previous literature. Go-primes at positive-compatibility latencies facilitated speeded Go and Choice response time as expected, but did not influence actual behavioural choice. However, primes were presented at negative-compatibility latencies produced a reverse effect, significantly increasing free decisions to inhibit. Decisions to act or not can be non-consciously manipulated, but, intriguingly, only via inhibitory rather than facilitatory mechanisms: Intentional, endogenous "Veto" mechanisms can be influenced by non-conscious processing.

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### **Objective Markers of Detection Process during a Choice Blindness Task.**

Philip Pärnaments, Lund University, Sweden Lars Hall, Lund University, Sweden Petter Johansson, University College London, UK Thomas Strandberg, Lund University, Sweden Christian Balkenius, Lund University, Sweden

# July 3<sup>rd</sup>, 14:00-16:00: Concurrent Session 1

Our everyday notion of unrestricted introspective access to the content of our own decisions has been undermined through recent work on choice blindness (Johansson et al. 2005, Hall et al. 2010). In a choice blindness experiment participants are given false feedback about some of their decisions and, thus, accept as their own a choice they didn't originally make. However, on some trials participants will detect the manipulation, and until now their subjective responses have been the only measurement of detection available. This has raised doubts as to possible demand effects masking the true detection rate. In the current study we address this by measuring participants' gaze and pupil dilation while choosing between pairs of faces. We found a clear pupil dilation effect during feedback for detected trials compared to both non-detected and non-manipulated trials, with no differences between the two latter groups. Furthermore, differences in the time course of the pupil dilation signal were found depending on whether it was the first detection or later detections that participants were making. Analysis of fixation patterns and response times further corroborate and expand these results. We conclude that detection of false feedback can be objectively measured using pupil dilation. The findings also allow us to propose a first tentative process model of introspection during the feedback phase of a choice blindness task.

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#### The Toggling Effect: Disentangling the Tangled Loops of Concepts and Consciousness

#### Joel Parthemore, Lund University, Sweden

## *July* 5<sup>th</sup>, 14:00-16:00: *Poster Session* 2.

This paper presents the Toggling Effect: a powerful tool toward understanding concepts as the building blocks of structured thought and of consciousness in particular. Part of the Unified Conceptual Space Theory of concepts, the Toggling Effect holds that there are two, seemingly mutually exclusive perspectives one should take on concepts – mutually exclusive only because of our inability to step outside our conceptually shaped perspectives on them. On the one hand, concepts just are representations when we reflect on them as concepts; on the other, when we possess and employ them non-reflectively, they should rather be seen as non-representational abilities. The Toggling Effect exploits a natural and – I claim – logically unavoidable limitation in our ability to offer a *complete and consistent* account of concepts or of consciousness, as a consequence of the implicit yet intrinsic self-reference implied by any science of the mind. Taken on their own, the one perspective threatens an eternally receding target (reflecting on our reflections to try to determine the facts of the matter), the other an eternal oscillation between two opposed and contradictory positions (the consequence of reflecting on what is going on

when we are not reflecting on what is going on). If one attempts to resolve them into one perspective, one arrives at simple contradiction; but by switching between the two perspectives as necessary – the observer in the foreground for one, hidden in the background for the other – one achieves a *more complete* view on concepts, whilst retaining consistency.

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#### An Evolutionary Based Mathematical Model for Consciousness

Suketu Patel, Zicklin School of Business, USA

# *July* 5<sup>th</sup>, 14:00-16:00: *Poster Session 2*.

In order to develop a general theory of consciousness we must focus and analyze the most significant event in human history. This is the great leap that led anatomically modern humans to behave behaviorally modern. The major artifacts that contribute to the development of a theory of consciousness and also exhibit modern behavior is the Lebombo1 and Ishango2 bones. These both demonstrate modern behavior through complex mental capabilities such as rudiments of counting and time keeping. The importance of an understanding of infinite enumeration is that it also implies that humans have the potential capability to implement an infinite succession of steps when creating tools. In addition to explaining the complexity of our behavioral tendencies, this paper will also present how enumeration also lends itself to the pivotal concept of how and why we possess a theory of mind.

Acquiring a theory of mind ability took millions of years of evolution through the hominid linage. I believe the most dominating facet of this evolutionary period is that social groups become increasingly complex. In order to maintain social groups, similar notions of morality were necessary between group members. These group dynamics necessitated that the nervous system evolve to increase the amount of available information for an individual to be aware. By applying Block's distinction of access and phenomenal consciousness to the physical structure of the brain, we can infer that the evolutionary direction took hominid development from the formally dominant phenomenal consciousness pathways toward a prevailing access-consciousness pathways.

This analysis of the components of consciousness ultimately leads to a conceptual understanding of qualia and subjective experience. The historically hypothesized fundamental nature of subjective experience becomes logically evident as a quale is interpreted and evaluated through the survival needs, desires, and limitations of an individual to then ultimately compute a valence. The fundamental nature of any experience is its valence and whether it is beneficial (positive), detrimental (negative), or in fact neutral to the biological or artificial system.

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#### **Alexithymia - Emotional Blindsight?**

Elizabeth S.Paul, University of Bristol, UK Ralph R.J. Thompson, University of Bristol, UK Michael T. Mendl, University of Bristol, UK

# July 4<sup>th</sup>, 14:00-16:00: Poster Session 1

The trait of Alexithymia is characterised by self-reported difficulties in identifying and describing emotions, and it has been suggested that these difficulties represent "emotional blindsight". Alexithymic individuals react to emotive stimuli with relatively normal physiological and behavioural responses, but these appear to be accompanied by significantly dampened conscious feeling states. We conducted two studies to investigate which of the core facets of conscious emotional experience, "valence" (feelings of pleasantness vs. unpleasantness) and "arousal" (feelings of activation and alertness), are diminished in alexithymic individuals. In Study 1, participants (n=178) varying in trait alexithymia (Toronto Alexithymia Scale; Bagby et al 1994) were asked to rate the arousal and valence qualities of 16 emotion terms (contented, depressed, happy, tense, etc.). In Study 2, participants (n=164) rated their perceptions of the similarities and dissimilarities of 16 pairs of these emotions, matched according to valence but not arousal (e.g. elated/contented), and arousal but not valence (e.g. contented/depressed), thereby providing an implicit measure of each individual's tendency to focus on the arousal and valence components of the emotions compared. While alexithmia was not associated with deficits in the capacity to explicitly identify the arousal and valence qualities of emotion terms in Study 1, it was linked with a reduced tendency to distinguish negative emotions varying in arousal in Study 2. In particular, alexithymics showed relatively little differentiation of the terms depressed/stressed, nervous/lethargic, and fatigued/tense. This may indicate a circumscribed form of emotional blindsight, in which attention to negativity overshadows attention to arousal.

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#### 'Learning' Masked Eye-Blink Conditioning: Lowered Detection Threshold Or Unconscious Conditioning?

Moos Peeters, Cognition and Brain Sciences Unit, Medical Research Council, Cambridge, UK Agustín Petroni, University of Buenos Aires, Buenos Aires, Argentina Mariano Sigman, University of Buenos Aires, Buenos Aires, Argentina Belen Lafon, University of Buenos Aires, Buenos Aires, Argentina Tristan Bekinschtein, Cognition and Brain Sciences Unit, Medical Research Council, Cambridge, UK

## July 4<sup>th</sup>, 14:00-16:00: Poster Session 1

Is conscious awareness necessary to acquire differential trace conditioning? Clark and Squire (1998, 2002), Manns et al (2002) and Lovibond and Shanks (2002) all argue in favour of this claim, whereas Ohman and Soares (1993, 1994) are more sceptical. Our study aims to shed more light on this issue by using an auditory masking differential eye-blink conditioning task. Two words were used as conditioning stimuli; one of them predicted a subsequent airpuff delivered to the eye, whereas the other word did not have predictive value (was followed by silence). Participants completed three blocks of conditioning: in the first block the words were presented in between an indistinguishable babble of words, making them extremely hard to perceive. In the second block the words were presented without any babble and were easy to perceive. The third block was identical to the first. Participants were asked to indicate the audibility of the word and their expectancy of an air-puff in all blocks. We hypothesized that in the first block participants to develop conditioning, since the stimuli were no longer masked. For the third block we expected significantly more conditioning than in block one since the words were unmasked in the previous block. Data from healthy volunteers is presented, and we discuss if the higher conditioning in block three is attributable to a lowered threshold for perceiving the words, induced by block two, or to a form of unconscious conditioning.

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### **Tripartite Synapses: Modulation of Cognitive Processes by Astrocytes**

Alfredo Pereira Jr., São Paulo State University (UNESP), Botucatu, São Paulo, Brasil Fabio Augusto Furlan, University of Marilia (UNIMAR), Marília, SP, Brasil

# July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Recent research focusing on the participation of astrocytes in glutamatergic tripartite synapses has revealed a connection between four cognitive functions: learning, perception, conscious processing and memory formation/retrieval. We review (Pereira Jr and Furlan, 2010) molecular mechanisms present in tripartite synapses and discuss the cognitive roles of astrocytes according to the following stages: a) Glutamatergic heterosynaptic converging input to a neocortical or hippocampal neuron activates AMPA receptors and opens NMDA receptors, promoting calcium ion entry that cause membrane potentiation, signaling cascades and gene expression that leads to an increase in AMPA-dependent response; b) Glutamatergic input from a population of neurons converging to metabotropic receptors of one astrocyte elicits coherent, amplitude and/or frequency modulated calcium waves with the potential of integrating neuronal local field potential patterns carrying sensory, cognitive and affective messages; c) Glutamate released from astrocytes to neurons in tripartite synapses opens NMDA receptors to slow inward calcium currents, sustaining excitability (a process we called "meta-potentiation"), or, alternatively, causing neuronal membrane depression. Neural potentiation and depression can occur both by post-synaptic (as discussed by Pereira Jr. and Furlan, 2010) or pre-synaptic mechanisms (as modeled by De Pittà et al., 2011). This analysis leads to a suggestion that information processing mediated by astrocytic calcium waves can determine if a cognitive pattern is going to be reinforced by the astrocytic glutamatergic output to pre- and post-synaptic neurons, increasing the chance to form long term memories, of if it is going to be "vetoed" by means of membrane depression.

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## **Electrophysiological Correlates of Phenomenal Consciousness**

#### Vitor Manuel Dinis Pereira, University of Lisbon, Portugal

# July 4<sup>th</sup>, 14:00-16:00: Poster Session 1

Phenomenal consciousness is "what is like to be" a mental state: the stinging sharpness of a pin prick, the taste of dark chocolate or the vibrant red of the experience of a fire truck. "Access consciousness" refers to the possibility of a mental state to be available to the rest of the cognitive system (to be available, for example, to our language production system as in describing the appearance of the white paper you are reading). For many neuroscientists, we have no empirical evidence of the distinction between access consciousness and phenomenal consciousness (which some philosophers advocate).

The subjective experience is essential in our everyday life. We have very strong intuitions about it. However, in contrast with the access consciousness, it remains open whether there is empirical evidence of the distinction between access consciousness and phenomenal consciousness: if there are two electrophysiological correlates or just one (if the conceptual distinction made in these way maps different things in the world).

Our goal is to design two experiments and analyze related behavioral data such as if electrophysiological correlates of both are distinct, we obtain empirical evidence that phenomenal consciousness is distinct from that of access consciousness: waveforms of electrophysiological signals, distinct ERPs (event related potentials) and the ERPs associated with this behavioral data.

We hope to show that proposals such as those of Lamme 2004 of the early negativity 330-420 ms (phenomenology) and Sergent et al. 2005 of the late positivity 500-600 ms (access) are far from being all that there is to say about the alleged distinction between phenomenology and access and that phenomenology may well be correlated with late negativity (800-900 ms) but not access.

Using metacontrast paradigms with visibility diverted attention in one experiment (access consciousness) and invisibility in another experiment (phenomenal consciousness, arguably) we studied ERPs waveforms related to each experiment.

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### Infants' Sensitivity to Others' Belief: Unconscious Theory of Mind?

Josef Perner, University of Salzburg, Austria

# July 6<sup>th</sup>, 09:15-10:30, Keynote Lecture

At Sussex we (Clements & Perner 1994) discovered a dissociation. A majority of three year old children anticipate in their looking that an agent, who didn't witness an object's unexpected transfer to a new location will mistakenly return to the object's original place. In contrast, when these children are asked where the agent will go to get the object, they adamantly claim that she will go to where the object actually is. Subsequent studies indicated that the dissociation is not one of explicit considerations between certain and uncertain possibilities (Ruffman et al 2001) and that not one between verbal and nonverbal measures. It also affects action responses that are given spontaneously and those that are given hesitantly. These results provided an analogy to the availability of unconscious (implicit) and conscious (explicit) knowledge in studies with blindsight patients and healthy adults with illusory stimuli and, thus, evidence for unconscious knowledge of a mistaken agent's future action.

This dissociation has gained new relevance with reports that infants as young as 14 months (Onishi & Baillargeon 2005, and many studies since) or even 7 months (Kovács et al 2010) show similar sensitivity to belief in their looking and other spontaneous responses. Although the dissociation between spontaneous and deliberate responding has affinity with the distinction between unconscious and conscious knowledge, we have no good understanding what leaves the one un- and makes the other conscious. I will elaborate the idea that spontaneous responding is based on abstraction of behavioural regularities, which may be causally shallow (behaviour rules) or deep (belief formation), while deliberate responding is based on understanding the agent's reasons for acting.

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## Unravelling the Enigma of Visual Associative Memory Formation & Retrieval: A Comparison of Young Grapheme-Colour Synaesthetes with Young and Elderly Control Subjects.

Gaby Pfeifer, Brighton and Sussex Medical School, UK Nicolas Rothen, Sackler Centre for Consciousness Science & School of Psychology, University of Sussex, UK Dennis Chan, Brighton and Sussex Medical School, UK Jamie Ward, Sackler Centre for Consciousness Science & School of Psychology, University of Sussex, UK Natasha Sigala, Sackler Centre for Consciousness Science & Brighton and Sussex Medical School, UK

#### July 4<sup>th</sup>, 14:00-16:00: Poster Session 1

Accumulating evidence suggests that grapheme-colour synaesthesia, a condition in which letters or numbers automatically elicit a secondary colour experience, facilitates memory for visual associations. By contrast, visual associative memory gradually deteriorates in healthy aging. The precise mechanisms leading to these associative memory differences, encoding and/or retrieval, are a matter of debate. The present study compares the performance of synaesthetes with young and elderly control subjects in learning a set of abstract, monochrome fractal picture-pairs to criterion. Task difficulty was manipulated by altering the visual similarity of the cue-target pairs. The effectiveness of this manipulation has been demonstrated by preliminary results, indicating a significant negative correlation between the pair-associates' subjective similarity ratings and response-time measures at recognition. Using a forced-choice recognition test, we aim to determine the number of trials needed to reach the success-criterion (memory formation), and subsequently to examine memory accuracy using a pair-associate

retrieval test. Key questions to be addressed are a) whether conscious memory for associations is the result of improved perceptual abilities at encoding, b) less information decay at the point of retrieval, c) improved temporary storage abilities that may aid the recollection process and d) the effects of visual similarity on associative memory at encoding and/or retrieval. Significant differences in memory formation and retrieval are expected across participant groups. We will discuss the effects of individual differences, age and visual similarity of the pair-associates (memory load) on visual associative memory formation and retrieval. Email Address: G.Pfeifer@bsms.ac.uk

#### Your Unconscious Knows Your Name

Roland Pfister, Julius-Maximilians-University of Würzburg, Germany Carsten Pohl, Julius-Maximilians-University of Würzburg, Germany Andrea Kiesel, Julius-Maximilians-University of Würzburg, Germany Wilfried Kunde, Julius-Maximilians-University of Würzburg, Germany

# July 4<sup>th</sup>, 14:00-16:00: Poster Session 1

One's own name constitutes a unique part of conscious awareness – but does this also hold true for unconscious processing? The present study shows that the own name has the power to bias a person's actions unconsciously even in conditions that render any other name ineffective. Participants judged whether a letter string on the screen was a name or a non-word while this target stimulus was preceded by a masked prime stimulus. Crucially, the participant's own name was among these prime stimuli and facilitated reactions to following name targets whereas the name of another, yoked participant did not. Yet, participants were not aware of any of the prime stimuli, including their own name. These results extend traditional findings on "breakthrough" phenomena of personally relevant stimuli to the domain of unconscious processing. Thus, the brain seems to possess adroit mechanisms to identify and process such stimuli even in the absence of conscious awareness.

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#### Attention and the Passing of Time

Ian Phillips, University College London & All Souls College, UK

# July 3<sup>rd</sup>, 16:30-18:30: Concurrent Session 2

According to a naïve conception of time consciousness our perceptual experience inherits its temporal properties from its objects (Helmholtz 1925; Dainton 2000; Phillips 2012). Thus, for any temporal property apparently presented in experience, your experience itself has that temporal property.

Recently it has been claimed that this naïve conception is subject to empirical counter-example. Lee (2008) cites the finding that the durations of oddball stimuli embedded in trains of repeated standard stimuli are relatively exaggerated (Rose and Summers 1995; Tse et al. 2004; Pariyadath and Eagleman 2007; Xuan et al. 2007; Eagleman 2008) as a counter-example to naïve matching. Relatedly, Watzl (forthcoming) argues that the phenomenon of visual silencing (Suchow and Alvarez, 2011) is inconsistent with the naïve view.

I argue that the appearance of counter-example is predicated on a failure properly to consider the relation between duration perception and attention (Stout 1932; Thomas and Weaver 1975; Block and Zakay 1996). Specifically, on the hypothesis that degree of attention provides our measure of elapsed time, we can account for the various phenomena entirely consistently with the naïve view.

This simple connection between experienced duration and attention further accounts for apparently much more dramatic counter-examples to the naïve view, such as the slowing down of time commonly experienced in threatening situations (Noyes and Kletti 1977; Langer et al. 1961; Campbell and Bryant 2007; Droit-Volet et al. 2010; Tipples 2011), as well as the common intuition that time consciousness can span a complete mental freeze (Dainton 2000; Tye 2003).

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### The Duration of Bistable Perception Is Predicted By EEG Alpha Power

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Netherlands & VU University Medical Center, the Netherlands

**Van Someren E.J.W**, Netherlands Institute for Neuroscience, the Netherlands & VU University, the Netherlands July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

Most of our perception is driven by changes in the sensory input. However, when presented with an ambiguous image, such as the Necker cube, our perception spontaneously alternates between two incompatible

representations, even if the stimulus does not change. The alternation between the percepts is entirely dependent on our internal states, but the neuronal correlate of these internal states remains unknown.We recorded highdensity EEG from eight participants, who were presented with a Necker cube image and reported the changes in perception by pressing a button. The data show that the perceptual switch was preceded by a dip in alpha power and followed by a return to its pre-switch level after 500 ms. After returning to the pre-switch level, the amount of alpha power was a very strong predictor of the subsequent perceptual duration.Because eyes-open alpha is higher when a subject is fatigued, we manipulated the endogenous level of alpha power by repeating the experiment on the same participants after a night of sleep deprivation. If alpha plays a functional role in determining the perceptual duration, a higher level of alpha power should lead to a lower switch rate. In agreement with this hypothesis, we found that the mean perceptual duration was significantly longer after sleep deprivation. Mediation analysis supported the interpretation that sleep deprivation increased percept duration by increasing alpha power. In conclusion, alpha is a robust correlate of the persistence of endogenously generated percepts. These results suggest a functional role of alpha oscillations in stabilizing perception.

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#### If You Are Not In the Group, You Will Not Be In Consciousness

Yair Pinto, University of Amsterdam, the Netherlands Marte Otten, University of Amsterdam, the Netherlands H. Stefan Scholte, University of Amsterdam, the Netherlands Victor A.F. Lamme, University of Amsterdam, the Netherlands

## July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

What is the influence of social cognitions on consciousness? There is ample data that our response to visual stimuli depends on our social biases. However, perhaps visual perception per se is not altered, but only our responses to these percepts. In the current research we directly assessed the impact of social cognitions on consciousness. Specifically, we tested Dutch participants, and compared the perception of either black (experiment 1) or Moroccan (experiment 2) faces to the perception of Dutch faces. We employed a binocular rivalry task. One eye viewed a low contrast face, while the other eve viewed constantly changing Mondrian patterns. Initially the changing patterns dominate, so the picture of the face is invisible. By gradually increasing the contrast of the face. and decreasing the contrast of the Mondrian patterns, the face breaks through to conscious perception. Both experiments showed that Dutch faces enter consciousness quicker than non-dutch faces. Moreover, this effect is reduced/eliminated when the faces are inverted, and this effect correlates with how biased the participant is (measured with an implicit association task). We concludes that social cognition can directly change conscious perception. Specifically, stereotypes seem to slow down the entry of unwanted information into consciousness. Our findings suggest that entry into consciousness is not purely a matter of low-level factors, but may come about in the interplay between high-level pre-settings, and low-level input. Importantly, although previous research suggests that faces of outgroup members draw attention, this increased attention does not speed entry into awareness.

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#### Intentional Binding in Self-Made and Observed Actions: Implications for Sense of Agency

Simandeep Poonian, The University of Queensland, Australia Ross Cunnington, The University of Queensland, Australia

## July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Intentional binding occurs when there is a perceived shortening of the time interval between a goal-directed action and its sensory consequence. This causal binding of the intended action and sensory consequence is thought to be an implicit measure of agency. Much of the research into intentional binding has focused on self-made actions, as the intentions, actions and predictions of sensory consequences are clearly defined. In the little research conducted on others' actions, intentional binding results are variable (Engbert et al., 2008; Wohlschlager et al., 2003). Recent research into observation of actions has revealed a network of neurons that are thought to encode the intentions of another biological agent performing a goal-directed action (Rizzolatti et al., 2010). The aim of this research was to investigate intentional binding in self-made actions and matched observed actions using an interval-estimation behavioural paradigm. Participants were required to recreate the intervals between tone-tone, self-made action-tone and observed action conditions (self-made and observed) in comparison to no action tasks (tone). These results demonstrate intentional binding is a phenomenon that occurs in both self-made and observed goal-directed actions. We conclude that intentional binding is still an implicit measure of agency, but is specific to sense of a causal agent and is not just a measure of self-agency.

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#### Is There A Diffuse Mode Of Attention?

#### Adrienne Prettyman, University of Toronto, Canada

# July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

The view that attention or cognitive access is necessary for consciousness remains a popular position in the study of consciousness. This view is challenged by cases that seem to show consciousness outside selective attention. DeBrigard & Prinz (2010) and Cohen & Dennett (2011) have responded to this challenge by appealing to a non-selective, diffuse mode of attention. The problem with this response is that the concept of diffuse attention is not well established in the empirical or philosophical literature. In this paper, I summarize the outstanding questions in the research on diffuse attention and provide a starting point for answering those questions. I argue that the main philosophical challenge for a theory of diffuse attention is to provide an account of what makes diffuse attention a mode of *attention* rather than diffuse *awareness*. I then briefly attempt to answer this challenge by motivating a principle that distinguishes attention from other cognitive processes. Specifically, I propose that a cognitive process is a mode of attention just if it brings an object into the domain of availability for thought and action. Forthcoming research suggests that diffuse attention can meet the conditions set out by this principle. I summarize a recent study from Wilson and colleagues (in progress) that shows diffuse attention can be recruited in the performance of experimental tasks, and so makes objects available for action.

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# Simulated Artificial Illumination Influences Neural and Behavioural Correlates of Presence in Virtual Environments: An fMRI Study

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# July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

In Virtual Environment (VE) studies, presence describes a 'sense of being there' or realistic behaviour within the VE. Experiential reports of VEs can inform understanding of how aspects of an environment influence feelings of both presence and detachment. We scanned healthy participants in a VE paradigm adapted for functional Magnetic Resonance Imaging (fMRI) to identify behavioural and neural correlates of presence. The VE consisted of indoor and outdoor scenes at different levels of illumination mimicking natural light (at morning, midday and afternoon), and different artificial light conditions. Participants navigated around and then rated each scene in relation to perceived reality, presence, and comfort. Functional brain datasets were pre-processed and analysed using SPM8.Participants divided broadly into an 'engaged group' who rated the VE conditions as real and a 'detached group' who rated VE conditions as unreal. As a check, presence score differed between realistic and degenerate 'wireframe' scenes. Only one type of artificial light, the Tungsten 100W, influenced ratings of presence in realistic VE scenes; this effect distinguished between the two groups. Across participants, activity within insula, cingulate gyrus and thalamus correlated with presence score. Activity within occipital areas, precuneus and cerebellum differed between daylight and artificial light conditions. In the Tungsten 100W condition, activity within precuneus and insula distinguished between engaged and detached participants. Our study identifies neural and behavioural correlates of presence, associated individual differences and environmental (lighting) influences. implicating brain regions linked to self-awareness and relevant to understanding the basis of dissociative psychological symptoms.

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#### Attentional Biases Affect Metacontrast Masking: Right Visual Field Advantage for Target Detection and Visibility

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# *July* 4<sup>th</sup>, 14:00-16:00: *Poster Session* 1.

Metacontrast masking decreases the conscious visibility of a preceding target, while its suppressive effect on target detection performance is typically smaller. By examining hemifield asymmetries during exogenous cuing and metacontrast masking, we studied whether inherent spatial biases affect the strength of metacontrast masking. Exogenous cuing was employed as a follow-up on our recent results that revealed a right hemifield advantage in contrast perception during an endogenous cuing/metacontrast paradigm. Right-handed participants (N = 25) were

presented with uniform grey target stimuli (10 ms) in either the left or right visual field. The targets were preceded by an exogenous attention cue (valid, invalid, or neutral), and on two thirds of the trials the targets were followed by metacontrast masks at both, left and right target locations (no mask, 60, or 160 ms SOA). Briefly, attentional cuing yielded expected results: cuing modulated target detection and reaction times, and also the strength of metacontrast masking (valid cues facilitated and invalid cues attenuated target processing, when compared to neutral cues). With respect to asymmetries, we replicated our previous result that subjectively perceived contrast is higher in the right than in the left hemifield, with and without metacontrast masking, at all cue conditions. What is more, effective metacontrast masking especially suppressed left hemifield target detection rates, particularly during the neutral cue condition. Our results suggest that inherent asymmetries in attention influence the strength of metacontrast masking, affecting not only target visibility ratings, but also detection performance.

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#### ERP Correlates Of Consciousness Depend On The Measurement: Decisional Confidence Vs. Visual Experience.

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# July 3<sup>rd</sup>, 14:00-16:00: Concurrent Session 1

Commonly, a distinction is made between subjective and objective measures of consciousness, with subjective measures having a higher threshold than objective ones. We propose that there are also two distinct types of subjective measures: decisional confidence and visual experience, with a higher threshold for reporting visual experience. We hypothesized distinct ERP correlates for these two types of subjective measures. In a masked forced-choice discrimination task, observers submitted two ratings after each trial: they reported whether they had a clear or an unclear visual experience of the stimulus and in addition whether they guessed or rather knew their response. Behavioural results of a pre-test session revealed that the threshold for reporting a clear experience was significantly higher than the threshold related to decisional confidence. In line with this behavioural finding, ERP results of a subsequent experimental session indicated that earliest observed differential ERP effect (as measured by mean amplitudes in a time window between 170 and 230 ms) was associated with decisional confidence and not visual experience of the stimulus. Differential effects related to visual experience were observed only later, i.e., between 230-290 ms. Consequently, we argue that ratings of confidence and visual experience are two distinct measures of consciousness.

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#### Unconscious Detection of Analogous Relationships between Current and Past Events: An fMRI-Study

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## July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

The detection of analogies is considered a hallmark of conscious thinking or even "[...] the very blue that fills the whole sky of cognition" (Hofstadter, 2001). To what extent analogy detection could also emerge from purely unconscious processing, however, remains a matter of debate (Leech, Mareschal, & Cooper, 2008). In this fMRI study, we investigated whether analogous relationships between current and past experiences can be detected without the awareness of the past experiences. Awareness was stringently excluded because we presented encoding word pairs too briefly to be consciously perceived (i.e., subliminal). After five minutes of quiet rest, the participants judged the semantic fit between words in novel pairs that were presented for conscious inspection. Although the test pairs were novel, the conceptual relations that were established between words during subliminal encoding (e.g., 'table – car') were either kept intact at test (analogs condition; e.g., 'desk - truck') or not (broken analogs condition; e.g., 'counter - banana'). Unconscious detection of analogous relationships was suggested by shorter reaction latencies to analogs than broken analogs across all participants and by more frequent fit responses to analogs than broken analogs in a subgroup of participants. Neural activity was decreased under the analogs versus broken analogs condition in medial frontal, lateral prefrontal, and lateral temporal areas. These results suggest that analogous relationships between current and past experiences may also be detected if the memories for the past experiences are unconscious.

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#### **Decoding Consciousness**

#### Geraint Rees, University College London, UK

*July* 4<sup>*th*</sup>, 09:15-10:30, *Keynote Lecture*.

Everything we know about the world comes to us through our brain. Yet for each of us our own conscious mental world of thoughts and feelings is isolated and private. Despite several centuries of research on the brain, communication through language or gesture remains the only way we can discover the conscious thoughts and experiences of others. This makes it difficult to compare our conscious experiences and discover whether we all experience the world in the same way. In this talk I will discuss recent work using non-invasive brain imaging showing that not only does our conscious perception of the world differ across individuals, but also that these individual differences are correlated with the structure and function of primary visual, parietal and prefrontal cortices. I will explore the implications of these findings for both neuroscience and society.

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#### Adaptation to Unconscious Conflicts in Unconscious Contexts.

Heiko Reuss, Julius-Maximilians-University Wuerzburg, Germany Kobe Desender, Ghent University, Belgium Andrea Kiesel, Julius-Maximilians-University Wuerzburg, Germany Wilfried Kunde, Julius-Maximilians-University Wuerzburg, Germany

## July 3<sup>rd</sup>, 14:00-16:00: Concurrent Session 1

Conflict adaptation processes are highly flexible and can adjust to a rapidly changing context of high or low interference. We investigated whether such context-specific conflict adaptation is also possible when both the conflicting stimulus and the context are presented unconsciously. To this end, we used a priming paradigm in which the visibility of the prime was varied and the format of the prime represented the context. A prime of one particular format was response congruent in 80% of all trials (low-interference context), and a prime of the other format was response incongruent in 80% of all trials (high-interference context). The difference between congruency effects in one context compared to the other context is an indicator of conflict adaptation. In Experiment 1, we found that congruency effects were larger in the low-interference context than in the highinterference context. Crucially, this effect was found both with visible and with masked primes. To rule out mechanisms of event-learning, inducing trials and test trials were implemented in Experiment 2. Test trials feature particular stimulus combinations and occur equally often in each context, while inducing trials constitute the difference in interference between the contexts. With masked primes, larger congruency effects in the lowinterference context than in the high-interference context were found, both in inducing trials and in test trials. With visible primes, however, this effect was present only in inducing trials, but not in test trials. To explain these results, we discuss an account of conscious specific stimulus representations and unconscious general stimulus representations.

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#### There is No Introspective Attention.

### Kevin Reuter, University of London, UK

# July 3<sup>rd</sup>, 14:00-16:00: Concurrent Session 1

Process-based theories of introspection often characterise introspection as voluntary attention to conscious experiences (Chalmers (2003), Gertler (2001), Schwitzgebel (2011)). In this paper I discuss and reject the existence of such a top-down mechanism - often called 'introspective attention'. Its existence is motivated by an epistemic and a phenomenological claim: (1) introspective attention is the best explanation for how people acquire phenomenal concepts that refer to their experiences; (2) when a person introspects, it feels to the person like attending to experiences. However, both motivations are unwarranted. First, for a person to voluntarily attend to his experience, he needs to have the intention to do so and thereby activate the concepts necessary for voluntary attention. This implies, however, that introspective attention does not yield the acquisition of phenomenal concepts, but presupposes them. I use two examples to demonstrate that this circularity objection holds for both primary and secondary qualities. Second, while most psychologists and philosophers are convinced that the 'transparency of experience' rules out the plausibility of higher-order phenomenal states, many remain in the grip of the idea that it 'feels' different to attend to one's experiences compared to attending to objects and properties in one's environment. I suggest that this phenomenal aspect of introspection can be explained by a tendency to imagine oneself in a 'Cartesian theatre', i.e. to imagine perceiving one's own experiences.

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#### Does Implicit Learning Compete For Resources? Evidence from D2 Test of Attention.

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## July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

The series of studies were conducted to verify resource dependent nature of implicit learning process. Using modified D2 Test of Attention (Brickenkamps, 1998, in the original tool the exact same arrangement of letters is repeated every three rows) as a sequence learning paradigm, we constructed several conditions that differed in complexity of hidden regularity and task difficulty.

In study 1, designed to verify our expectation about effect of regularity in such task, the original (regular) and modified (irregular) version of D2 Test was used. Unexpectedly, we observed better performance in irregular condition. The results lead to a supposition that - 3-line block/such a complicated rule, does load the processor and in spite supporting processing even debilitate it.

In study 2 we tested this supposition using 2x3 experimental design. The D2 test was presented in three conditions – without regularity, with 1-line regularity repeated every three rows, with regularity in 3-line blocks. To verify resourcive nature of suspected phenomenon task difficulty was included to the experimental design as second factor. The semantical vs perceptual nature of signal was taken into account. The study 3 replicates this design with even less complex regularity. We expect to observe supportive effect of simple regularity. The results are under analysis.

The results showed that a) perceptual signals were easier to detect than semantical; b) the 3-line blocks debilitated performance in both conditions; c) semantical signal impaired performance in one-line regularity only.

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## Testing a Measure of Brain Complexity in Wakefulness, Sleep, Anesthesia and Coma

Mario Rosanova, University of Milan, Italy Adenauer Casali, University of Milan, Italy Olivia Gosseries, University of Liége, Belgium Melanie Boly, University of Liége, Belgium Steven Laureys, University of Liége, Belgium Fabio Ferrarelli, University of Wisconsin, USA Giulio Tononi, University of Wisconsin, USA Marcello Massimini, University of Milan, Italy

# July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

An emerging idea in theoretical neuroscience is that consciousness is tied to brain complexity, defined as an optimal balance between functional differentiation and functional integration of thalamocortical networks. This intuition led to the general prediction that brain complexity should be high when consciousness is present and low when consciousness is lost. Testing this prediction requires quantifying brain complexity. Formal measures, such as Neural Complexity (CN), integrated information (F) and causal density (Cd) have been developed. While CN, F and Cd have been successfully tested in small simulated systems, their application to actual brains presents practical challenges. Hence, so far, the general hypothesis that changes in the level of consciousness are linked to changes in brain complexity has not been tested empirically. We test this hypothesis by introducing an empirical measure of complexity, called Perturbational Complexity Index (PCI) that gauges the amount of information generated when different modules of the thalamocortical system engage in rapid, causal interactions in response to a direct perturbation. Calculating PCI involves: (i) employing a combination transcranial magnetic stimulation (TMS) and high-density electroencephalography (hd-EEG); (ii) performing source modeling and non-parametric statistics, in order to extract a binary matrix (1=active, 0= non active) that describes the deterministic pattern of spatialtemporal activation caused by this perturbation; (iii) calculating the information content of this matrix using measures of algorithmic, or entropic, complexity. We calculated PCI on a large dataset (116 TMS/hd-EEG sessions in 36 subjects) deriving from a series of experiments where TMS-evoked potentials where recorded during wakefulness, dreaming, anesthesia as well as in patients who emerged from coma. Experimentally, we invariably found high PCI values in conditions in which consciousness was unambiguously present (alert wakefulness in healthy and locked-in patients); these values were reproducible across subjects and were independent on the stimulated area, on the intensity of stimulation and on the strength and the extent of brain activation. By contrast, PCI values where invariably low in all conditions in which consciousness was unambiguously reduced (NREM sleep, anaesthesia, vegetative state). In brain-injured patients who evolved from the vegetative state, PCI values had intermediate values. These results provide quantitative empirical support to the general prediction that complexity, defined as the differentiation of causal interaction within thalamocortical networks, correlates with the level of consciousness.

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#### **Psychosemantics as a Four-Dimensional Theory Space**

#### David Rose, University of Surrey, UK

# *July* 5<sup>th</sup>, 14:00-16:00: *Poster Session* 2.

Psychosemantics has developed into a theory with a complex structure, as it has become apparent there is no simple single answer as to how mental states have intentionality. The theory is here argued to comprise a multidimensional space of relevant factors. Four dimensions will be described here, with axes drawn between the polarities: (1) atomism-holism, (2) synchronic-diachronic functionality, (3) innate-learned origins and (4) extrapersonal-intrapersonal level of organization. For example along dimension 1, atomist causal reference and holistic functional role theories can both be relevant, combined in a hybrid theory of modules. Dimension 2 is needed to explain misrepresentation: diachronic teleofunctionalism links meaning to what has worked in the past, and synchronic functionalism to what works in the current system or context. Which is more relevant depends which question you ask: what is a representation supposed to mean or what does is actually mean now? Thirdly, to explain the variety of representanda, the origins of different representations must be possible over evolutionary or individual lifetimes. Finally, dimension 4 accommodates the apparently indeterminate lengths of chains of causeand-effect. Social-cognitive-neural multilevellism allows a representation to have multiple layers of meaning, in which functionality operates over larger spatiotemporal scales at higher emergent levels of system organization, integration and complexity. Thus intentionality can be simultaneously broad and narrow, applying to internal activity within the brain as well as to interactions with external objects or people. All four dimensions (if not more) need to be considered.

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#### How Synaesthesia Affects Different Memory Systems and Processes

Nicolas Rothen, Sackler Centre for Consciousness Science & School of Psychology, University of Sussex, UK Anil K Seth, Sackler Centre for Consciousness Science & Dept of Informatics, University of Sussex, UK Jamie Ward, Sackler Centre for Consciousness Science & School of Psychology, University of Sussex, UK

# July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

Synaesthesia is a condition causing ordinary stimuli to be consistently associated with supplementary perceptuallike experiences. Although recent group studies have provided evidence for enhanced memory performance in synaesthesia, not much is known about the specific affected memory systems and processes or the underlying mechanisms by which synaesthesia influences performance. In order to shed more light on this issue, we tested grapheme-colour synaesthetes and demographically matched controls with three different memory paradigms. In the first, we used a continuous identification task with recognition (CID-R) to compare explicit and implicit memory processes in synaesthetes and non-synaesthetes. In the second, a digit-span task was used to evaluate the impact of presentation mode (visual v. spoken digits) on short-term memory performance between these two groups. Finally, a partial report paradigm was used to compare iconic memory performance between synaesthetes and non-synaesthetes. Overall, our results provide new evidence for a recognition and short-term memory performance advantage in synaesthesia, but not for an iconic memory performance advantage. They also reveal a priming effect for words judged as new in the CID-R (i.e. correct rejections minus misses) for the controls, but not for the synaesthetes. However, presentation mode does not seem to influence synaesthetic modulation of shortterm memory performance. Collectively our results shape a new understanding of the interaction between perceptual features of synaesthesia and memory processes.

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## Looking Without Seeing: A Direct Oculomotor Correlate of Unconscious Visual Processing.

Marcus Rothkirch, Charité - Universitätsmedizin Berlin, Germany Timo Stein, Charité - Universitätsmedizin Berlin, Berlin & Berlin School of Mind and Brain, Germany Maria Sekutowicz, Charité - Universitätsmedizin Berlin, Berlin Philipp Sterzer, Charité - Universitätsmedizin Berlin & Berlin, Berlin School of Mind and Brain, Germany

# July 4<sup>th</sup>, 11:00-13:00: Concurrent Session 3.

Despite extensive research into the mechanisms of consciousness it has remained elusive to what extent our behavior can be guided by unconscious information. Can we, for instance, make use of visual information to locate an object in our environment despite being completely unaware of it? In this context, the critical point is that observers' reports about their conscious experience of a particular stimulus depend on their response criterion, which is why they may deny seeing a stimulus although being partially or even fully aware of it. In the present study, participants (N = 20) were asked to search for a visual stimulus that was rendered invisible using continuous flash suppression. Concurrently, their eye movements were recorded. Participants were not able to report the stimulus location with above chance accuracy in a 2AFC task, which reliably indicates that they were objectively unaware of the stimulus. In contrast, their eye movements were more frequently directed towards the invisible

stimulus compared to a contralateral control area of the same size. This dissociation shows that goal-directed behavior can be performed even in the complete and objective absence of awareness. Thus, the system controlling motor actions can make use of visual information to effectively guide behavior, while at the same time this information does not give rise to a conscious visual experience of the stimulus. This may either be mediated by two separate cortical visual pathways supporting action and perception, respectively, or by a subcortical circuit involving superior colliculus.

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#### Prior Knowledge Enhances Conscious Perception Early In Time

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Lucia Melloni, Max-Planck Institute for Brain Research, Germany

## July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

Previous experience with the world helps us perceive objects when external information is degraded. It is at present unknown through which mechanisms previous experience affects visual perception and how this is different from the effects of simply providing more sensory information. Here we investigate the timing at which prior knowledge influences perception. Such knowledge would help constrain theories of visual object recognition.

We presented natural images and manipulated sensory evidence and prior knowledge. Sensory evidence was manipulated by degrading them with different levels of noise. Prior knowledge was manipulated by presenting half of these images without any noise in a preceding familiarization phase. Behavioral results showed that recognition was enhanced both for images with prior knowledge and for pictures containing more sensory evidence. To understand the neural mechanisms underlying these perceptual effects, we recorded MEG from 24 healthy subjects. MEG results revealed an early (80-95 ms) correlation across subjects between the difference of the global field power of pictures with and without prior knowledge and the perceptual gain of prior knowledge. No comparable correlation was observed for the enhancement of perception through sensory evidence. We conclude that prior knowledge has a beneficial effect on conscious perception early in time and achieves it through mechanisms that differ from simply increasing sensory evidence.

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#### **Kinds of Access and Phenomenality**

## Jérôme Sackur, Ecole Normale Supérieure, France

# July 5<sup>th</sup>, 14:00-16:00: Symposium 3.

The science of consciousness seems to face a recurrent dilemma: either accept a non fully reportable phenomenal quality of conscious contents or repudiate phenomenality altogether. In this talk I will argue that this dilemma seems to arise only because of the delusive simplicity of the notion of cognitive access. I will show that access is more diverse than commonly acknowledged, and that it can be probed in many ways. Cognitive access is not uniform: for one given stimulus, it may vary in completeness, and also in regards to levels of processing. Therefore, any report of a conscious state must integrate an array of disparate fragments of accessed information, and take into account prior knowledge of the context. I argue that with this richer notion of access, we can aim for a functional construal of consciousness which obviates the need for a special kind of phenomenal consciousness.

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#### When Social Cognition Meets Cross-Modal Interactions: Mirroring Other People's Experiences

Noam Sagiv, Brunel University, UK Sean Williams, Brunel University, UK Alireza Ilbeigi, Brunel University, UK Adrian L. Williams, Brunel University, UK

## July 6<sup>th</sup>, 11:00-13:00: Concurrent Session 4.

The human brain takes advantage of correspondences between different sensory inputs in order to make sense of the barrage of sensory data we are routinely confronted with. However, navigating in the social world also involves consideration of other types of correspondences - between the self and others. Understanding others' actions and intentions is associated with activation of the mirror neuron system but recent finding from mirror-touch

synaesthesia suggest that we do not only mirror other people's actions but also their experiences. Such individuals experience tactile sensations when viewing others being touched. Furthermore, the observation of touch activates the somatosensory cortex, to some extent even in non-synaesthetes (Blakemore et al, 2005). Here we report two neuroimaging studies and show that merely observing other individuals smelling aromatic objects or tasting recognisable foods, is sufficient to activate the olfactory and gustatory cortices respectively. Such findings were observed in non-synaesthetes and we are currently extending the work to synaesthetes with mirror-smell and mirror-taste experiences. We propose that such phenomena can be described as variants of 'social synaesthesia' in which the mapping between the self and others plays a key role. Finally, we will argue that many aspects of everyday social cognition can be conceptualised as a synaesthesia-like projected experience.

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#### A Subjective Stance: Body Position Affects Visual Awareness

Roy Salomon, Laboratory of Cognitive Neuroscience, Ecole Polytechnique Fédérale de Lausanne, Switzerland Bruno Herbelin, Laboratory of Cognitive Neuroscience, Ecole Polytechnique Fédérale de Lausanne, Switzerland Lim M, Laboratory of Cognitive Neuroscience, Ecole Polytechnique Fédérale de Lausanne, Switzerland Olaf Blanke, Laboratory of Cognitive Neuroscience, Ecole Polytechnique Fédérale de Lausanne, Switzerland & University Hospital, Switzerland.

# July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

We consciously perceive only a fragment of the information our senses collect. Vision is often considered to be the dominant sense in humans and has been shown to influence tactile, auditory, vestibular and proprioceptive perception. The effects of bodily senses, such as proprioception, on visual awareness are frequently overlooked. Embodied cognition approaches suggest that our bodily state influences our cognition and perception. Here we demonstrate that the position of the body influences visual awareness. We induced perceptual suppression in human participants by using continuous flash suppression (CFS). Participants had to judge the orientation of lines in a target stimulus embedded in a task irrelevant picture of a hand. The picture of the hand (palm up or palm down) could either be congruent or incongruent with the participants' actual hand position. Trials in which the viewed and the real hand positions were congruent escaped the perceptual suppression more rapidly than incongruent trials. Results from a control indicated that this congruency effect is specific to perceptually suppressed stimuli. Our findings provide the first evidence of proprioceptive bias of visual awareness.

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#### Decoding the Contents of Conscious Perception.

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# July 4<sup>th</sup>, 11:00-13:00: Concurrent Session 3.

The search for the Neural Correlates of Consciousness (NCC) has become one of the most challenging issues in current neuroscience. Diverse putative correlates have been described in the spatial and in the temporal domains. Dehaene, Sergent and Changeux (2003) suggested that these different correlates constitute different reflections of a single underlying phenomenon: the settling of brain activity into a transient but stable state of global activity that links distant areas including the prefrontal cortex through reciprocal connections, and thus makes perceptual information reportable by multiple means. Accordingly, this global activity is content specific, and not a general amplification. The aim of the research was to determine whether the widespread neuronal activation that normally corresponds to seen trials is general or it manifests the broadcasting of specific stimulus-related information among widespread regions of the brain. While MEG-EEG were recorded, stimuli were presented in one of eight possible locations and masked immediately afterwards. In order to reduce irrelevant differences between "Aware" and "Unaware" conditions, participants produced two responses (Lamy, Salti& Bar-Haim, 2009). First they made a forced-choice response to the location of the target, and then reported on their subjective awareness of the target's presence. We examined how spatial information is coded in the brain over time in "Aware-Correct" and "Unaware-Correct" trials. Applying a state of the art support vector machine classifying algorithms on the MEG/EEG data allowed us to decode stimuli presentation location.Spatial information was available for decoding in both critical conditions. When participants consciously perceived the target classification was more effective and lasted longer. Our results show that this difference in correct classification stemmed from different neuronal coding in the "Aware-Correct" and "Unaware-Correct" condition. Consciously perceived stimuli gain "extra" processing, so when a classifier trained on unseen trials is applied on seen ones, decoding performance drops to
the level of "Unaware-Correct" but not vice-versa. Moreover, when consciously perceived, information is coded in a more stable manner, as classifier generalizes over time.

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#### Motor Aspects of Auditory Imagery: Evidence for a Broca's Area Network

Jason M. Samaha, San Francisco State University, USA Ezequiel Morsella, San Francisco State University & University of California, USA Mark W. Geisler, San Francisco State University, USA

# *July* 4<sup>*th*</sup>, 14:00-16:00: *Poster Session* 1.

The act of *refreshing*, or of intentionally foregrounding one representation over other representations, as when one willfully brings to mind a particular thing that was just heard, is believed to be a reflective component process of working memory and of other complex cognitive tasks (Johnson & Johnson, 2009). Neuroimaging findings suggest that the dorsal lateral prefrontal cortex (DLPFC) is associated with initiating the 'top-down' signal responsible for refreshing. However, the distribution of all brain areas involved in the act of refreshing remains unspecified. For example, in the phonological loop, it has proven difficult to identify the neural correlates of refreshing verbal (auditory) information: it seems that perceptual and/or motor areas may be involved (Buchsbaum & D'Esposito, 2009). To determine the extent to which motor-speech areas are active while refreshing speech, we used electroencephalography coherence analysis (e.g., sites F3, F7, and TP3) to index communication between DLPFC and Broca's area while participants refreshed one syllable nouns, presented auditorally. We assessed whether the refreshing of verbal (auditory) information is associated with (a) greater coherence between DLPFC and Broca's area, or (b) greater coherence between DLPFC and the supramarginal gyrus, an area proposed to store phonological representations (Salmon et al., 1996). When compared with trialby-trial pre-stimulus coherence, we observed a significant increase in coherence between the DLPFC and Broca's area when refreshing speech. These new data about refresh have implications for our understanding of cognitive control, imagery, conscious processing, and the nature of mental representation.

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#### Value by Architectural Transversality, Emotion and Consciousness

**Guadalupe Sanchez-Escribano**, Universidad Politecnica de Madrid, Spain **Ricardo Sanz**, Universidad Politecnica de Madrid, Spain

# July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

The domain of emotions is becoming a mainstay in robotics when trying to improve adaptive responses. There are plenty of studies accepting the relationship between emotion, cognition and consciousness, mostly related to the virtues of suitable self-representations [Kriegel 2009, Lau 2011]. Robot engineering has taken the challenge of building better systems by means of adding new capabilities for self-restraint, self-management and inner control. This situation has lead to the study of what factors trigger self-x functionalities and what are the proper variables to handle. The functional inner perception of systems may have strong influence on the performance of externally imposed tasks and autonomous systems must do a trade-off between intrinsic and extrinsic objectives. Responses do cross through mixed sets of system goals that are interconnected with non-lineal relationships into a complex web of working levels. Emotions operate by closing a metafunctional loop between these levels of work and managing a fitness trajectory among system goals. Understanding how emotions are necessary in this context becomes a basis for designing robust self-adjusting systems. Establishing a proper autonomic architecture is a critical stepping stone in this research: the agent must handle internal flows of proprioceptive and interoceptive information, self-build its inner-models and use them as a key part of a coherent cognitive functionality. We reject the naïve vision of single perception-action work-cycles even when augmented with additional adjacent levels [Nzekwa 2010]. Feedback loops represent a key feature of adaptive systems and this configuration doesn't allow a proper closure. The system cannot cope with the significant influences between actions and consequences into the internal system. Epistemic control loops and meta-regulation [Sanz 2010] are the core patterns we are exploring: a) control of basic processes, b) managing upper-order perception and control and c) handling the metacapabilities of its own inner processes.We are studying a layered control architecture with a transversal design to manage three architectural integration buses allowing feedback of inter-level and intra-level information, i.e. inside each control layer and across the whole epistemic control loop hierarchy. The intra-bus systems manage each level being essentially isolated among them and the inter-bus works as a sub-systems management middleware that transfers information between adjacent levels. Finally the loop-line-bus interconnects inter and intra buses featuring the basis for artificial consciousness design by allowing a) inner feedback loops, b) evaluation of informational flows and c) suitable skills for reconfiguration control of the whole system.

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#### Are The Neural Correlates Of Conscious Contents Stable Or Plastic?

 Kristian Sandberg, Aarhus University Hospital, Denmark & University College London, UK
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Geraint Rees, University College London, UK & Wellcome Trust Centre for Neuroimaging, Institute of Neurology, UK

# July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

Two frequent implicit assumptions of consciousness research are that the neural correlates of a particular conscious experience are both universal (shared between subjects) and stable over time. In the present study we examine the second assumption. We recorded magnetoencephalographic (MEG) signals from healthy human participants while they viewed an intermittently presented binocular rivalry stimulus consisting of a face and a grating. During binocular rivalry, the stimulus remains constant, but conscious content alternates between each monocular stimulus. Using a multivariate classification algorithm, we found that it was possible to decode the conscious experience of a participant 100-300ms after stimulus presentation using data gathered on different trials of the same recording session. Very similar accuracies were obtained when the data used to train and test the classifier were gathered on different days within a week. However, when training/testing data were separated by 2.5 years, prediction accuracy was reduced drastically, to a level comparable to when the classifier was trained on a different participant. We discuss whether this drop in accuracy can best be explained by changes in the predictive signal in terms of timing, topography or underlying sources. Our results thus show that the neural correlates of conscious perception of a particular stimulus are stable within a time frame of days, but not across years. This may be taken as an indication that our experience of the same visual stimulus changes slowly across long periods of time, or alternatively the results may be understood in terms of multiple realizability.

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#### Escaping the Human Trap. Towards A General Theory of Consciousness

**Ricardo Sanz**, Universidad Politecnica de Madrid, Spain **Guadalupe Sanchez-Escribano**, Universidad Politecnica de Madrid, Spain

# *July* 5<sup>th</sup>, 14:00-16:00: *Poster Session* 2.

A scientific, General Theory of Consciousness should be much more than just some "scientific progress towards understanding how consciousness can emerge form the activity of neurons and their interactions" [Ortigue 2010]. While it is clear that human brains are the best source of information about consciousness, the construction of a universal, general theory of consciousness is strongly hampered by the almost absolute and obviously excessive focus on human brain, human cognition, human neurophysiology and human physiology. Human brains are not the only systems to consider in this quest; a general theory should also address at least other three kinds of systems: animals, social groups and machines. A general theory of consciousness would offer the opportunity of putting experimental results in a suitable theoretical framework. A solid theoretical framework would eventually lead to enable the development of technological assets for medical, ecological, technical and economic actuation.Not much work has been done in the pursue of such a general theory. In most cases the "general" aspect is restricted to a concrete domain: e.g. the search of neural correlates of consciousness or point-time measurements of awareness levels. We should focus on developing a universal, positive theory of consciousness centered on functional architecture. This would imply sidetracking most philosophical discussions on the nature of content and leveraging the value of concrete measurements in real systems. An increase in measurement and system-level modeling rigour is necessary [Tononi-2008, Seth-2008a]. This rigour cannot stay just at the level of informational measures but shall scale up to the dynamic architectural patterns realised in the cognitive system. Information integration isn't enough for consciousness and certain classes of mental architectures seem necessary. There are plenty of architectural insights concerning consciousness (e.g. the comparator model of selfhood [Synofzik 2008] or the extended reticular-thalamic activating system [Newman 1997]) but we have to empty them from the concrete -neural- implementation details. The use of engineering system modeling tools seems the adequate method for attacking this problem [Sanz-2009, Healy-2010]. The paper will show a first attempt at precise architectural modeling of cognition and emotion integration up to the level of world and self-awareness. This may be a first step in this quest for a general theory of consciousness.

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#### A Mechanism to Cause the Sense of an Extended Body-Boundary

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*July* 5<sup>th</sup>, 14:00-16:00: *Poster Session 2*.

We propose an experimental setup to investigate the sense of an extended body boundary. Our body boundaries are not simply limited by our skin surface. For example, a blind man's stick has ceased to become an external

object and becomes an extended arm. Understanding the recession of a stick behind the cognitive landscape is the target of our study here. A system we propose here consists of coupled windmills of different number of vanes. A subject is required to answer the number of vanes on the second windmill by blindly moving the first one. The subject uses the first windmill as a blind man's stick to determine the number of vanes on the second windmill. So the subject's body boundary can shift from its arm tip to the boundary between the first and second windmill. The experiment is based on the computational model originally proposed by the authors, in which the simulated agents successfully discriminate the different number of vanes of the second windmill. Analysis of the human experiment revealed the subjects who are sensitive to the second windmill (thus successfully discriminates the different number of extension of the subjects (who are not sensitive to the second one) tend to move the windmills randomly. Based on these findings, we hypothesize that a shift from an irregular to regular movement of a windmill is an indication of extension of the body boundary, because such periodic behavior is the paraphrase of predictability of the body action thus implying a part of self-body. On the other hand, irregular unpredictable motion can be taken as an external to the body. We also claim that, in order to extend the body boundary, it is important to touch the windmill constantly by the hand. The continuous touch facilitates extending the body boundary.

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# How Do Adults Evaluate the Process of Social Interaction on Distinguishing Knowledgeable Informants from Unknowledgeable Informants

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July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

We tell knowledgeable informant from unknowledgeable one. But it is unclear how we selectively identify who is knowledgeable when several informants communicated with each other to show accurate information.

In Study1, 33 Japanese adults were tested. The participants were shown two types of video-recorded sequences. Video stimulus started with two boxes on a desk. A male put an object in one box of the two. After he went out, two females came in. Importantly, both females had not seen hiding phase so didn't know the location. In Verbal condition, *Initiator* verbally taught the location to Stater. In Whispering-gesture condition, *Initiator* showed whispering-gesture to Stater silently. Following this, in both conditions, *Stater* nodded and guessed the location facing to the front. Target question was "Which actor did know the location?"

X2 test revealed more adults selected Initiator in Whispering-gesture condition (31) than in Verbal condition (24) (p<.05). Interestingly, more adults regarded the one who made whispering-gesture as being knowledgeable than the one whom made verbal instruction, although whispering-gesture had no information about what was told.

In Study2, another 30 Japanese adults were participated. The procedure was same as Study1 except for the number of alternatives for target question: "both of them" were newly added. X2 test revealed more adults selected "both of them" (11/3) and less Initiator (18/24) in Verbal condition than Whispering-gesture condition (p<.05).

These results suggested the manner of transmission affected the manner of attribution of knowledge, and specifically, whispering-gesture prompted the attribution to sender.

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#### Mirroring Of a Real-World Motor Behaviour in Disorders of Consciousness

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# July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

In patients suffering from Disorders of Consciousness (DOC) electrophysiological recordings at bedside could serve as a complimentary and economical tool to improve clinical diagnosis. We utilized a motor observation and imagination paradigm to gain new insights on preserved cognitive processing in DOC.EEG from 10 Unresponsive

Wakefulness (UWS) and 7 Minimally Conscious State (MCS) patients as well as from 21 sex and age matched controls was recorded during observation and imagination of a grasping movement. The signal was analyzed in four frequencies bands between 4 and 15Hz and group statistics were conducted.While control subjects showed a typical desynchronization (ERD) between 8 and 15Hz during the observation of the movement, MCS patients presented a similar ERD response between 8-10 Hz, yet exhibited a synchronization (ERS) at 12-15Hz. During the subsequent imagination period an EEG response was only evident for the first 1500ms, and only for controls.Our results indicate that MCS patients are still able to process an everyday motor behaviour (grasping a cup) on a basic sensory and perhaps even pre-motoric level, yet they failed to show clear motor imagination behavior in the present EEG study design. Interestingly, also the EEG signature while mirroring a simple motor behavior appears shifted in oscillatory frequency when comparing MCS patients and healthy controls.We conclude that "real-world" tasks as presented here carry important information about residual cognitive capabilities of DOC patients and should become matter of further EEG research using oscillatory measures such as ERS/ERD or coherence.

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#### **Mind Is Consciousness**

Michael Schmitz, University of California, USA & University of Vienna, Austria

# July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Decades after the revival of consciousness it is still all too commonly assumed that the notion of a mental state can be understood independently of any reference to consciousness and that consciousness can be explained in terms of inner-mental relations, for example, through some higher-order state theory. From this perspective, unconscious mental states are entirely unproblematic – they are just mental states without whatever innermental relations are taken to make them conscious. It is therefore no wonder that virtually all proponents of the unconscious since Freud have im- or explicitly assumed this picture. By contrast, the contribution argues that states of consciousness are the paradigm mental states and that consciousness is an inherent or intrinsic property of such states. Given this shift of perspective, the notion of unconscious mentality becomes immediately problematic. Unconscious mental states rather appear like a symphony without sound or a painting without colour. Moreover, we understand other people's mind primarily by taking up their perspective, but this method has no application with regard to nonconscious states. Nor is it possible to straightforwardly account for the mental character of unconscious states in terms of their causal role, since they cannot duplicate the causal powers of conscious ones on pain of epiphenomenalism. It is therefore argued that the myth of the unconscious mind should be abandoned. Mind just consists in states of consciousness and dispositions to be in such states. Talk of the unconscious is at best a useful heuristic device for getting at neurophysiological structures.

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# Information, Its Integration, and Consciousness: Constructing a Theoretical Model for Information Integration in Search for Its Implementation in the Brain

#### Marcin J. Schroeder, Akita International University, Japan

# *July* 5<sup>th</sup>, 14:00-16:00: *Poster Session 2*.

What is the status of Integrated Information Theory of Consciousness? Judging from publications for the general audience, there is such a theory around the corner, but it is in its infancy and is facing transitional computational obstacles. Closer look shows that such a view is overly optimistic. Tononi proposed a measure "phi" of information integration characterizing coordination of neural firings, but as long as we do not have a theoretical description of information integration, or at least its clear definition, it is difficult to say what actually phi measures. When it is identified with a measure of consciousness and some level of consciousness is attributed to a proton, the need for clarification of the conceptual framework becomes urgent. Shannon introduced entropy as a measure of information sixty years ago, but in spite of continuing discussions, introduction of a dozen of other measures, there is no commonly accepted definition of information has to refer to very clearly formulated definitions of information and its integration and to a theory which allows modeling mechanisms of integration. Only then the search for implementation of such models in the brain will become realistic. This paper is an outline of such approach based on earlier publications of the author on information, its integration and their theory formulated in terms of closure spaces and irreducibility of the lattices of closed subsets, but without technical, mathematical details of the original works.

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# Stability as a Hallmark of the Neural Dynamics Underlying Conscious Sensory Perception.

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# July 4<sup>th</sup>, 11:00-13:00: Concurrent Session 3.

Although the duration and intensity of a neural response are known to be factors in determining whether or not the sensory information "reaches" awareness, it seems likely that there is at least one other factor. Theorists have referred to this using metaphor, such as a "dominant consensus" or "coherence with the dominant focus". Empirically, subjective experience has been associated with recurrent neural interactions in the cerebral cortex, perhaps mediated by the thalamo-cortical system, and we interpret the coherence or consensus metaphors in the context of a recurrent neural network. A recurrent neural network is characterized by a settling process during which the activity in the network converges toward a stable state. In sensory perception the landscape in state space is determined by learned connectivity patterns, context, and sensory input. The settling process progresses from a relatively unstable / low-certainty state, to a relatively stable/high-certainty state, consistent with evidence accumulation models of perceptual decision making. What Marcel Kinsbourne refers to as a coherent neuronal interaction might correspond to such a stable state, where one from among many possible states is selected in the form of a global perceptual decision. I will present new results obtained using novel data analysis techniques applied to combined MEG / EEG recordings aimed at measuring the relative stability of content-specific neural representations over brief intervals. The goal of this research is to test whether or not conscious representations can be distinguished from non-conscious responses based on differences in stability. Preliminary results suggest that they can. This approach may help to further our understanding of the difference between conscious and nonconscious perception and has potential applications in detecting signs of consciousness in non-communicating patients.

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#### Memory Training Can Induce Synaesthetic Experiences in the Normal Population

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# *July* 4<sup>th</sup>, 14:00-16:00: *Poster Session* 1.

In synaesthesia, stimulation of one perceptual class automatically leads to additional experiences in one or more different modalities (e.g. visually presented achromatic numbers inducing colours). A critical question related to this condition is whether it is congenital, or the result of early developmental learning. A robust synaesthesia verification technique involves an adaptation of the Stroop task, where synaesthetes are slower to say a number if its colour is incongruent with their induced percept. Intriguingly, one previous study has shown that nonsynaesthetes who undergo appropriate training (10 minutes/day for 7 days) can also exhibit synaesthetic Stroop interference effects. Critically, however, no phenomenology consistent with synaesthesia was induced. The current study investigated whether a considerably more intensive, varied training regime in normal participants would lead both to behaviour and phenomenology equivalent to synaesthetes. Training sessions, based on a variety of working memory tasks designed to establish robust number-colour associations, were administered 40 minutes per day, 5 days a week, for 8 weeks. Robust synaesthetic-Stroop interference effects were observed, replicating the previous study. In addition, phenomenological interviews revealed that number-colour associations had become automatic, and several participants experienced additional synaesthetic phenomenology. These findings argue against a purely congenital view of synaesthesia, suggesting instead the existence of a learned component. Such a view may help explain a number of features of synaesthesia, including the high frequency of learnt cultural constructs (e.g. letters and numbers) and the semantically laden association's common between inducer stimuli and synaesthetic percepts.

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## Knowing If They Know: A Novel Bias-Free Method for Incentivising Accurate Metacognitive Reports.

Ryan Scott, Sackler Centre for Consciousness Science & School of Psychology, University of Sussex, UK Zoltan Dienes, Sackler Centre for Consciousness Science & School of Psychology, University of Sussex, UK

# July 3<sup>rd</sup>, 14:00-16:00: Concurrent Session 1.

Establishing whether a person is aware of possessing some knowledge is a key requirement for much of consciousness research. Subjective reports of awareness, typically confidence ratings, are commonly employed in

subliminal perception and implicit learning paradigms. However, the use of subjective report is subject to criticism for its potential susceptibility to response bias – failure to report low levels of confidence leading to an inflated estimate of unconscious knowledge. Post-decision wagering (Persaud et al., 2007) partially addresses this issue by linking the accuracy of metacognitive judgements to reward; pitting the participant's self interest against any tendency for underreporting. However, this approach is confounded by the individual's attitude to risk; metacognition measured using post-decision wagering correlates with risk aversion (Dienes & Seth, 2010). The alternative no-loss gambling successfully eliminates the influence of risk aversion but removes the link between reward and the accurate reporting of guesses; participants don't benefit from choosing to bet on a metaphorical coin toss (indicating a guess) rather than on their judgment. Here, we introduce a method that incentivises accurate reporting of confidence in a symmetrical manner that avoids issues of risk aversion. We evaluate the method against standard confidence reports in artificial grammar learning. In this context it significantly reduces the proportion of guess responses but leaves the accuracy of guesses and the confidence-accuracy relationship reliably unaffected; suggesting that in this paradigm standard reports do not underestimate metacognition. We propose symmetrical confidence incentives as a means to improve the veracity and defensibility of subjective reports of awareness.

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#### Authorship of Thoughts in Thought Insertion.

# Max Seeger, Heinrich-Heine-University, Germany Gottfried Vosgerau, Heinrich-Heine-University, Germany

# July 4<sup>th</sup>, 11:00-13:00: Concurrent Session 3.

According to the standard model of thought insertion, subjects of inserted thoughts consciously experience a thought of which they claim not to be the author or agent. In this talk we discuss what it exactly means to be the author of a thought. We review and reject the existing analyses and argue for an analysis of authorship in causal terms.

Several approaches analyze 'authorship' in terms of a connection between an occurrent thought and one's background psychology. According to the *Personality Analysis* one is the author of an occurrent thought if it fits one's background beliefs. Adding a causal twist, John Campbell holds that an authored thought has to be causally connected to one's background psychology. The *Rationalist Analysis* holds that one is the author of a thought iff one endorses the thought's content based on one's best reasons.

It is argued that none of the above approaches can accommodate all paradigmatic cases of authorship. The appeal of psychological approaches is explained away as a conflation of two quite different properties: having a *sense* of being the author of a thought and actually *being* the author.

In analogy to bodily agency (more precisely: in analogy to the distinction between moving oneself and being moved), we develop a *Causal Analysis* of 'authorship'. Being the author, we claim, means being the proximal cause of the thought. We argue that intention, consciousness, and control of the thought (or the thinking process that leads up to it) are not relevant to authorship.

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#### The Effect of Alcohol on Hypnotic Suggestibility

**Rebecca Semmens-Wheeler**, Sackler Centre for Consciousness Science, University of Sussex, UK **Zoltan Dienes**, Sackler Centre for Consciousness Science & School of Psychology, University of Sussex, UK

# July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Neuro-cognitive theories of hypnosis suggest that for hypnotic experience to occur frontal lobe activity must, at some point, be attenuated (e.g. Bowers, 1990; Gruzelier, 1998). Cold control theory (Dienes and Perner, 2007) further posits that inaccurate higher order thoughts (HOTs) about first order intentions may be responsible for the experience of involuntariness and/or subjective reality of suggestions in hypnosis. A candidate brain region for the production of accurate higher-order states is in the frontal lobes, and comes from an fMRI study, which demonstrated that the mid-dorso-lateral prefrontal cortex (DLPFC )was responsible for producing accurate conscious perceptions (Lau and Passingham, 2006).

In this study, we administered 0.8mg/kg of alcohol or a placebo drink, to 32 medium susceptible participants. They were subsequently hypnotised and given 8 hypnotic suggestions. All participants believed they had received alcohol, regardless of the condition they were in. Participants in the alcohol condition were more susceptible to hypnotic suggestions than participants in the placebo condition. This finding supports the idea that impaired frontal lobe activity is necessary for hypnotic responding. This could result from impairment in the DLPFC leading to an absence of or reduction in accurate HOTs.

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#### Retro-Attention: Triggering Conscious Perception After The Stimulus Is Gone.

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# July 3<sup>rd</sup>, 16:30-18:30: Concurrent Session 2.

Whether we become conscious of an external stimulus depends on initial parameters such as stimulation strength, attention, and spontaneous fluctuations of brain activity before and at the moment of stimulation. However, several empirical findings suggest that conscious processing does not start at stimulus presentation but rather corresponds to an optional second phase of processing following a first preconscious extraction of sensory information. So far it has not been explored whether this second phase can indeed be triggered independently of the initial parameters. Here we show that attracting attention with a post-cue 100 to 400 ms after the disappearance of a single near-threshold visual stimulus can cause its conscious perception, as assessed by psychophysical measures of both objective sensitivity (d') and subjective perception. We observed this new phenomenon both with voluntary and involuntary cueing of attention. This retro-attention effect demonstrates that even without influencing initial sensory processing it is possible to trigger the conscious perception of a sensory event that would otherwise have escaped consciousness. So far post-stimulus attention had only been found to influence visual short-term memory. By showing that conscious perception itself can be time-locked to retro-attention rather than to stimulus onset, the present results profoundly challenge a common intuition that the perceptual fate of a stimulus is entirely determined at its presentation. This new finding lends strong support to the idea that conscious perception corresponds to a secondary phase of processing and more generally calls for an update of current theories of consciousness and its relationship to attention.

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#### An Interoceptive Predictive Coding Model of Conscious Presence

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# July 3<sup>rd</sup>, 16:30-18:30: Concurrent Session 2.

We describe a theoretical model of the neurocognitive mechanisms underlying conscious presence and its disturbances. Presence, defined as the subjective sense of reality of the world and of the self, is a fundamental dimension of normal conscious experience; however, theoretical accounts of its underlying neural mechanisms are lacking. Our model is based on interoceptive prediction error and is informed by predictive models of agency, general models of hierarchical predictive coding and dopaminergic signalling in cortex, the role of the anterior insular cortex in interoception and emotion, and cognitive neuroscience evidence from studies of virtual reality and of psychiatric disorders of presence, specifically depersonalization/derealisation disorder. The model associates presence with successful suppression by top-down predictions of informative interoceptive signals evoked by autonomic and somatomotor control signals and, indirectly, by visceral responses to afferent sensory signals. The model connects presence to agency by allowing that predicted interoceptive signals will depend on whether afferent sensory signals are determined, by a parallel predictive-coding mechanism, to be self-generated or externally caused. Anatomically, we identify the anterior insular cortex as the likely locus of key neural comparator mechanisms. Our model integrates a broad range of previously disparate evidence, makes predictions for conjoint manipulations of agency and presence, offers a new view of emotion as interoceptive inference, and represents a first mechanistic account of this fundamental phenomenological property of consciousness. We also describe initial tests of the model using an integrated experimental setup combining augmented reality, Microsoft Kinect 3D modelling, and physiological monitoring.

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#### **Connectivity and Consciousness in Birds**

Murray Shanahan, Imperial College London, UK

July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

In this talk I will present recent work on the structural connectivity of the avian brain. A meta-study of several decades of tracer work has allowed a full connectivity matrix for the forebrain of the pigeon to be constructed.

When subjected to analysis using the tools of graph theory, the resulting matrix is seento exhibit many topological features in common with macaques and humans, despite the fact that the avian brain lacks the laminar cortical organisation of mammals. In particular, the pigeon brain possesses a connective core of hub nodes that includes the avian prefrontal analogue and the avian hippocampal homologue. The connective core of a brain's structural network has previously been proposed as the basis for a global neuronal workspace in the sense of Baars and Dehaene (Shanahan, 2010). Under this hypothesis, the presence of such a connective core in the avian brain lends support to the assumption that birds are conscious in a similar way to mammals.

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#### Perceptual Learning Incepted by Decoded fMRI Neurofeedback without Stimulus Presentation.

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July 4<sup>th</sup>, 11:00-13:00: Concurrent Session 3.

Many studies have examined how activity changes in the brain are correlated with visual performance improvements resulting from repetitive training, known as visual perceptual learning (VPL). However, such a correlational approach has not conclusively settled a controversy about whether adult early visual cortex has sufficient plasticity to cause VPL, partially because most VPL studies have examined correlations between VPL and neural activities rather than cause-and-effect relationships. To address the question of whether early visual areas are that plastic, we developed a new functional magnetic resonance imaging (fMRI) online-feedback method (Shibata, Watanabe, Sasaki & Kawato, 2011, Science), by which activation patterns only in early visual areas corresponding to the pattern evoked by the presentation of a real and specific target orientation stimulus were repeatedly induced without subjects' knowledge of what is being learned and without external stimulus presentation. We found that, after this fMRI online-feedback training for several days, the mere induction of the activation patterns in early visual areas resulted in significant VPL on the target orientation, but not on other orientations. Our results indicate that the adult early visual cortex is so plastic that mere repetition of the activity pattern corresponding to a specific feature in the cortex is sufficient to cause VPL of the feature, even without stimulus presentation, conscious awareness of the meaning of the neural patterns that subjects induced, or knowledge of the intention of the experiment. The newly developed fMRI online-feedback method has a potential to reveal cause-and-effect relationships between neural activities and conscious perception.

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#### Direction of Alpha Traveling Wave Associated With Detection of Near-Threshold Stimuli

Daisuke Shimaoka, University of Tokyo, Japan & RIKEN Brain Science Institute, Japan Keiichi Kitajo, RIKEN Brain Science Institute & PRESTO, JST Kunihiko Kaneko, University of Tokyo, Japan Yoko Yamaguchi, RIKEN Brain Science Institute, Japan

# *July* 4<sup>th</sup>, 14:00-16:00: *Poster Session* 1.

In the search of Neural Correlates of Consciousness (NCC), scientists have intensively studied two-stages of stimulus processing; the early (< 200ms) in the occipito-temporal pathway (P1, N1) and the late (> 430ms) that is highly distributed but originated from the frontal activation (P3). To understand NCC as a stream of neural processes, it is of importance to reveal in what form the early stage activity influences the late stage. We hypothesized that the information processed in the early stage would be conveyed to the late stage as a spatio-temporal wave in the excitable system. Assuming that the excitable wave is reflected by traveling wave observed in EEG, we investigated the direction of EEG traveling wave while subjects saw a near-threshold stimulus by analyzing the phase gradient and the Global Phase Synchrony. Moreover, we studied the effect of wave direction on P3 as a function of N1. Prominent occipital-to-frontal wave of less than 2 cycles, which we call "late feed-forward sweep (LFFS)", was observed more frequently in the hit than in the miss condition. We found significant difference of the wave direction in the left centro-parietal area at around 300ms and alpha-band frequency, irrespective of the stimulus location (left or right visual field). Furthermore, P3 was enhanced only when high N1 and the subsequent LFFS enhances late stage P3, thereby leads to conscious perception

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# Is Asymbolia The Only "Genuine" Case Of Dissociation Between The Affective And Sensory Dimensions Of Pain?

# Adam Shriver, Washington University, USA

# July 3<sup>rd</sup>, 14:00-16:00: Concurrent Session 1.

Several philosophers studying consciousness (Murat Aydede 2005, Colin Klein forthcoming, and David Bain forthcoming) have suggested that pain asymbolia caused by damage to the insula cortex may be the only "genuine" dissociation between the affective and sensory dimensions of pain. These philosophers have largely based their claims on the arguments provided in the excellent book Feeling Pain and Being in Pain by Nicola Grahek, who argued, among other things, that cingulotomies do not produce true sensory/affective dissociations. I take a closer look at Grahek's arguments and propose that some of the considerations he uses to suggest that insula damage produces the only true dissociation are not directly relevant to whether the affective component is impaired. Furthermore, I argue, the fact that cingulotomy patients say they are no longer bothered by the pain should lead us to conclude that the affective pain component is absent, even if the phenomenon ultimately is explained by something like an inability to attend to the pain. Since the affective but not the sensory component of pain is directly linked to the morally important concept of pain-related suffering, we should place more evidencial weight on the fact that cingulotomy subjects say they are no longer suffering as a result of the pain, and less weight on spinally-mediated behaviors such as withdrawal reflexes.

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# Fluent Action Selection Increases The Sense Of Agency Despite Unexpected Outcomes: The Importance Of Prospective Agency.

Valerian Chambon, University College London, UK Nura Sidarus, University College London, UK Patrick Haggard, University College London, UK

# July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

The sense of agency (SoA) refers to the feeling that we are in control of our own actions, and, through them, of events in the outside world. One influential view claims that the SoA depends on a retrospective matching between the predicted outcome of an action and its actual outcome. However, recent studies revealed a prospective component to the SoA. Motor actions that were preceded by a compatible subliminal prime led to stronger feeling of control over the outcomes of an action (Wenke, Fleming & Haggard, 2010) relative to incompatibly primed actions. Therefore, the fluency, or ease, of action selection may prospectively inform the SoA.

To assess the relative contribution of prospective and retrospective cues to the SoA, we combined priming manipulations of action selection fluency, with varying predictability of action effects. Consistent with previous studies, both compatible action priming and frequent outcomes increased SoA ratings. Interestingly, there was an interaction between the two factors. After compatible action priming outcome frequency had little effect on agency ratings, whilst for incompatible action priming, infrequent effects led to much lower SoA ratings than frequent ones. This suggests that the extent to which action outcomes (i.e. retrospective cues) are taken into account when judging control firstly depends on whether action selection was, or not, fluent (i.e. prospective cues). To extend this research programme, a similar experiment was conducted with subliminal priming of motor actions and of action-effects, as well as combined action and effect primes. Behavioural and neurophysiological ERP results will be considered.

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# Subjective Scales Of Consciousness In Problem Solving: Affective Stimuli Influence The Validity Of The "Feeling Of Warmth".

Marta Siedlecka, Jagiellonian University, Krakow Borysław Paulewicz, Warsaw School of Social Sciences and Humanities, Katowice Edward Nęcka, Jagiellonian University, Krakow

# July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

Recently, several scales have been introduced to measure access to knowledge that is not fully conscious. In the field of problem solving there is a question concerning the awareness of one's own cognitive states and processes that lead to a solution. This kind of knowledge is sometimes called intuitive metacognition and is subjectively experienced as feelings and guesses. It is hypothesised that it is based on progress monitoring and gives rise to affect serving as a subtle cue about "being right".

In this experiment we used the "feeling of warmth" scale (FOW) in an attempt to find out if intuitive metaknowledge is based on performance and whether it can be biased by affective stimuli that is not consciously

perceived. Subjects were asked to solve two difficult problems (insight and incremental) and give their FOW ratings (closeness to solution) every 20s. They were also peripherally presented with negative and positive affective pictures unrelated to their performance.

The data showed that an unconscious negative affect improved the accuracy of FOW ratings. This effect did not appear when subjects were getting close to the solution of an incremental, well-defined task – their ratings increased regardless of affect. The results suggest that although emotional stimuli do not influence subjects' subjective "warmth" judgements they can enhance monitoring of the solving process. This happens unless subjects have a clear representation of a solution.

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# Subjective and Objective Measures of Affective States in REM sleep Dreams

**Pilleriin Sikka**, University of Turku, Finland & University of Skövde, Sweden **Katja Valli**, University of Turku, Finland & University of Skövde, Sweden **Tiina Virta**, University of Turku, Finland **Antti Revonsuo**, University of Turku, Finland & University of Skövde, Sweden

# July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Research on the affective content of dreams remains controversial. Results disagree as to the frequency with which emotions occur in dream reports (ranging from predominantly non-emotional to predominantly emotional) and to the prevailing affective valence of dreams (ranging from predominantly negative to a balanced affective tone). These inconsistencies occur due to differences in (1) the methods used to obtain the data (retrospective questionnaires, home dream diaries vs sleep laboratory awakenings), (2) level of analysis of emotions (overall affective valence of dreams vs discrete emotions), and (3) who evaluates and categorizes the emotions (subjective self-ratings vs objective content analysis by judges). The present study addresses these issues by using a multimeasure approach to investigate the affective content of REM sleep dreams at different levels of analysis using both objective and subjective instruments in a standardized laboratory awakening paradigm. A novel content analysis system is devised and used to code the affective content of dreams in as much detail as possible. Results demonstrate that subjective self-ratings of dream emotions differ from the objective ratings of dream reports with respect to the overall amount of emotions as well as the prevailing affective valence. Compared to external ratings, subjects evaluate (1) a larger number of their dream reports to be emotional (as opposed to non-emotional); (2) their dreams to contain more discrete emotions; and (3) their dreams to be more positively valenced. The results are discussed with respect to the differences in the measurement instruments used.

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#### Social Emotions from the Lens of Social Neuroscience: Modulation, Development and Plasticity

Tania Singer, Max Planck Institute for Human Cognitive and Brain Sciences, Germany

# July 5<sup>th</sup>, 09:15-10:30, Keynote Lecture.

With the emergence of social neuroscience, researchers have started to investigate the underpinnings of our ability to share and understand feelings of others. After a definition of concepts, I will shortly revise the main results of neuroscientific studies investigating empathic brain responses elicited by the observation of others in pain and show how these empathic brain responses are modulated by several contextual and stimulus intrinsic factors such as perceived fairness or ingroup/outgroup membership. Furthermore, I will present data from a novel paradigm on empathy for pleasant and unpleasant touch allowing the investigation of the neural mechanisms underlying affective egocentric bias in adults. These data will be complemented with developmental findings showing age-differences in egocentric bias, social emotions such as envy and Schadenfreude as well as strategic decision making during childhood. Finally, I present evidence of affective brain plasticity based on mental training of social emotions. These data will be discussed in lights of their relevance for recent models of social cognition.

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#### Cognitive Capacity But Not Sedation Level Predicts Neural Signatures of Conscious Processing.

Jacobo D Sitt, INSERM, Cognitive Neuroimaging Unit, France Ram Adapa, University of Cambridge, UK David K Menon, University of Cambridge, UK Adrian M. Owen, University of Western Ontario, London, Canada Srivas Chennu, MRC Cognition and Brain Sciences Unit, Cambridge, UK Lionel Naccache, Groupe hospitalier Pitié-Salpêtrière, Université Paris Stanislas Dehaene, University Paris-Sud, Collège de France Tristan Bekinschtein MRC Cognition and Brain Sciences Unit, Cambridge, UK

# July 3<sup>rd</sup>, 14:00-16:00: Concurrent Session 1.

Mild sedation impairs cognitive processing and may lead to unconsciousness. We designed an experiment, exploiting the cognitive mist created by low and mild doses of the anesthetic propofol while measures Rts and high density EEG. Normal participants had to make perceptual decisions pressing one of two buttons in the first task; in the second, they were asked to detect, without motor report, local and global temporal auditory irregularities. Response capacity on task 1, but not sedation level, predicted the occurrence of neural signatures of conscious rule extraction in task 2 and vice-versa. Those participants showing motor responses in task 1, albeit slower and more variable than in full wakefulness, also showed electroencephalographic signatures (P3b and Global CNV) consistent with consciousness processing of a global rule. On the contrary, barely responsive or completely unresponsive subjects only showed unconscious sensory processing ERPs (MMN and P1) but not top-down markers. Only Global CNV and P3b components constitute markers of consciousness processing of the rule extraction task that are directly modulated by anesthesia. These results point towards a one-to-one mapping between decision making responses and neurophysiological markers of conscious processing. In this study the independence from report validates the rule extraction task for its use in unresponsive patients. Moreover, it constitutes evidence that in the mist of consciousness people may be arousable but not aware; still unable to integrate sensory information in the brain to produce behavioral and cognitive markers of consciousness processing.

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#### **Making Perceptual Consciousness Accessible**

# Ilja Gabriël Sligte, University of Amsterdam, the Netherlands

# July 5<sup>th</sup>, 14:00-16:00: Symposium 3.

In recent years, we have published several papers showing the existence of a high-capacity (up to 15 objects) and long-lived (up to 4s) form of sensory memory that can be clearly dissociated from pure iconic memory (Sligte, Scholte, Lamme, 2008) and from working memory (Sligte, Wokke, Tesselaar, Scholte, & Lamme, 2010; Vandenbroucke, Sligte, & Lamme, 2011). However, all these results were based on partial-report experiments where subjects had to choose between change and no-change responses. This fact has triggered the criticism that subjects were just guessing (Phillips, 2011) on the basis of unconscious representations, as in blindsight. To explore this alternative explanation of our findings, we tested how subjects performed on a partial-report task with continuous response options (see Zhang & Luck, 2008; Bays & Husain, 2008 for examples of the task; we added retro-cues to this paradigm similar to Sligte, Scholte, & Lamme, 2008). We observed that subjects could report 7 objects (out of 10) with high precision on pure iconic memory conditions, about 6 on retro-cue (long-lasting and fragile form of iconic memory) conditions, and only 4 on postcue, working memory conditions. This suggests that all our previous studies validly make perceptual consciousness available for cognitive access.

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#### What Creeps Into Consciousness

# Barry C Smith, University of London, UK

# July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

What shows up in consciousness doesn't carry any trace of the processes that gave rise to it. And yet we often think we know what kind of experience we are having as if the experience merely announced itself to us as a seeing or hearing, a touching or a tasting. But now that we know more about how what we are conscious of when we taste, say i not produced by just sensations on the tongue, we are learning that we are often seriously misled about the nature of the conscious experiences we are having. What we are conscious of, or rather our way of being conscious of it, gives us little clue as to the true nature of the phenomenon we experience; such as their dependnce, for example, on the mustisensory integration of many sensory inpouts. So where do we get our ideas about the nature of our experiences? What, for example, makes us take a conscious experience to be a case of tasting or smelling? I will show that how we take our experiences to be depends on a faulty conception of those

ecxperience, which we do not sufficently distinguish from the experiences themselves. This disparity between what we take ourselves to be conscious of and the real nature of the elements that surface in consciousness is one of the main reasons why we find it hard to connect the conscious experiences reported by subjects with the neural systems that support them.

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## The Neural Effects of Pictorial and Auditory Induced Emotion on Logical Reasoning

 Kathleen W. Smith, University of Sussex, UK & Université Picardie Jules Verne, Groupe de Recherche sur l'Alcool et les Pharmacodépendances, France
Oshin Vartanian, University of Toronto, Canada
Laura-Lee Balkwill, Interagency Secretariat on Research Ethics, Canada
Vinod Goel, York University, Canada & University of Hull, UK

# July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

What is the effect of induced emotion on logical reasoning? Previous neuroimaging research has suggested a reciprocal relationship between ventromedial prefrontal cortex, associated with reasoning about emotionally-provocative material, and dorsolateral prefrontal cortex, associated with reasoning about non-emotional material (Goel & Dolan, 2003). We conducted two neuroimaging studies exploring a) the effect of emotion induction prior to syllogistic reasoning about non-emotional material. The first study found that positive mood appears to bolster a reliance on beliefs rather than logic whereas negative mood appears to distract the reasoner because of ongoing effects of the images. In the second study, non-emotional syllogism material was delivered auditorially in sad, angry, or neutral tone of voice, with no instruction regarding the vocal character of the voice itself. Behavioural results indicate that overall performance tends to be facilitated by auditory delivery of that content in angry tone of voice, and is unaffected by auditory delivery in sad tone of voice. The finding of different underlying patterns of neural activation associated with sadness and anger is consistent with LeDoux's (1996) postulate of separate neural emotion systems, and suggests that the successful regulation of interference from sad and angry emotions involved different mechanisms. A new dual-mechanism model is proposed, of the interaction of reason and emotion.

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#### Processing and Representing Verbal and Non-Verbal Information Within and Across the Cerebral Hemispheres

Sara Spotorno, University of Dundee, UK & University of Nice-Sophia Antipolis, France Julie Deshayes, University of Nice-Sophia Antipolis, France Pierre Thérouanne, University of Nice-Sophia Antipolis, France Sylvane Faure, University of Nice-Sophia Antipolis, France

# July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

Literature illustrates that verbal information is represented in long-term memory by Transcortical Cell Assemblies (TCAs) that, while having their functional epicenter in the left hemisphere, are distributed across the cerebral hemispheres. This study investigates whether analogous cerebral networks, but with a right-lateralized epicenter, subtend representation of non-verbal information. Moreover, it explores how cell assemblies are activated in the two hemispheres when processing multi-format (verbal and non-verbal) stimuli. In a divided-visual-field realitydecision task, meaningful (words and objects) or meaningless items (pseudo-words and pseudo-objects) were displayed for 150 ms either unilaterally or bilaterally. The bilateral presentation consisted of two identical items or of a verbal and a non-verbal item, referring to the same entity or both meaningless. A bilateral gain, reflecting a processing benefit due to the collaboration between the hemispheres, was obtained for words and objects, but not for meaningless stimuli. While a functional dominance of the left hemisphere was observed for words, no evidence of a right hemisphere advantage emerged for visual objects. In the case of multi-format displays, a bilateral gain was found for meaningful items, whereas meaningless items resulted in a bilateral cost. These findings indicate that both long-term verbal and non-verbal representations are subtended by interhemispheric distributed cell assemblies, and that functional asymmetries within the TCAs may be greater for coding verbal than non-verbal information. They also suggest that the co-activation of the hemispheres facilitates the retrieval of information represented by a dual code in TCAs that are strongly interconnected, but specific for verbal and nonverbal information.

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# Opposites in Experience and Their Way of Coding In Words: Enantiocemy vs. Ambivalence

# Maxim Stamenov, Institute for Bulgarian Language, Bulgarian Academy of Sciences, Bulgaria

# July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Words are used to categorize in a definite way what is going on in experience and in the world. They may have more than one sense and the senses may be related to each other, but we would find it quite surprising for a single word to have two senses one of them being, e.g. "life" and the other "death". As counterintuitive as it may look like, there are indeed paradoxical looking cases when one and the same word may be used to signify what looks like obvious opposites in experience and meaning. The phenomenon in question is called enantiosemy and it is attested in different languages of the world. The first author who wrote explicitly about it, and in a challenging way, was Karl Abel (1884) and his publication drew the attention of Sigmund Freud (1910) who attributed certain psychological significance to the words that are their own antonyms. Since then the expressions with opposite meanings became subject of a standing controversy both in linguistics and in psychology. Up to the present day there are both skeptics and enthusiasts in terms of what enantiosemy is supposed to reveal about the nature of the mind. We will be in a better position to judge what is genuine in this phenomenon if we compare it with another one that seems to come close to it from certain points of view – ambivalence, – as the latter can also become coded in single words and express antithetical senses.

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#### Indeterminate Perceptual Consciousness and Cognitive Access

# James Stazicker, New York University, USA

# July 5<sup>th</sup>, 14:00-16:00: Symposium 3.

Does perceptual consciousness require cognitive access? Those who think it does often appeal to 'inattentional blindness' experiments to confirm their view. Those who think it doesn't often appeal to partial report experiments to confirm theirs. I'll argue that these experiments seem to provide this sort of evidence about perceptual consciousness and cognitive access, only because of an assumption about the determinacy of perceptual consciousness. To assess this assumption, we have to face up to a more ancient philosophical controversy about the difference between perception and cognition.

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#### Training Object Recognition with an Image-To-Sound Conversion Based System

#### Petra Stoerig, Heinrich-Heine-University, Germany

# July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

To what extent do sighted-blindfolded subjects learn to recognize familiar objects from novel sound patterns generated by image-to-sound conversion software? Using Meijer's vOICe system, we trained 30 volunteers to recognize common everyday objects from three categories, Bath, Kitchen and Food. Everyone was trained individually for 15 sessions with one of three training variants. All variants used 15 objects per session, 5 per category. From three perspectives, subjects listened to each object's sound pattern to indicate its category and type (C: 'Bath', I: 'hairbrush') before reaching for the object to (dis-)confirm responses. Only in variant 1 were object types unrestricted; 2 and 3 used different exemplars of the same 15 object types each session. In variant 3, subjects listened to sound patterns generated from photographs of the objects, whereas in 1 and 2, as in the 1st and 15th session of 3, a mobile system with a head-worn camera was used. Across sessions, mean percentage correct categorization and identification improved with all three variants but least in 1 (C:9, I:8% increase) that differed significantly from 2 (C:22, I:55%) and 3 (C:25, I:18%). Training thus improved recognition of common objects in sighted subjects who learned to interpret the new sound patterns and the use of the mobile system with its small and cyclopean field of view. Functional object parts like handles and spouts and surface properties like reflections and textures seemed particularly informative, suggesting that interpreting novel sensory information profits from previous experience with objects and is not built afresh from basic geometric features.

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# Lifting the Veil of Morality: Choice Blindness and Self-knowledge in Moral Decision Making

Thomas Strandberg, Lund University, Sweden Lars Hall, University College London, UK Petter Johansson, University College London, UK

*July* 5<sup>th</sup>, 14:00-16:00: *Poster Session 2.* 

What exactly are opinions? What does it mean to express an attitude? Given the ubiquitous use of introspective reports in surveys and polls, it seems we ought to have firm answers to these fundamental questions, but we do

not. Across the behavioral and social sciences researchers struggle with limited predictability from what people say to what they actually do. To help remedy this situation we present a novel approach to investigating attitudes. We created a self-transforming paper survey of moral opinions, covering both foundational principles, and current dilemmas hotly debated in the media. This survey 'magically' exposed participants to a reversal of their previously stated attitudes, allowing us to record whether they were prepared to endorse and argue for the opposite view of what they had stated only moments ago. The result showed that the majority of the reversals remained undetected, and a full 69% of the participants failed to detect at least one of two changes. In addition, participants often constructed coherent and unequivocal arguments supporting the opposite of their original position. This result provides a dramatic extension of our previous studies on choice blindness and the limits of introspective access in decision making (Johansson et al. 2005, 2006, Hall et al. 2010), indicating a clear role for self-attribution and post-hoc rationalization in attitude formation and change.

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# Block of Intracortical Communication by Propofol-induced Neural Hypersynchy

# Gernot Supp, University Medical Center, Germany

# July 3<sup>rd</sup>, 11:00-13:00: Symposium 1.

Manipulating consciousness by anesthetic agents is everyday clinical practice. However, the key mechanisms underlying pharmacologically induced breakdown of consciousness are still largely unresolved. Unraveling the neural determinants of loss of consciousness, apart from its obvious medical advances, may shed new light on brain processes relevant for the emergence of consciousness. The presentations of this symposium will discuss complementary findings that suggest convergent conclusions and highlight the implications of anesthesia research for understanding the neural mechanisms of consciousness. The first and the second presentation will focus on propofol anesthesia as a model of drug-induced loss of consciousness, and discuss recent experimental evidence suggesting that propofol anesthesia induces hypersynchronous ongoing activity leading to a brain state during which information processing is severely compromised, and functional integration across different areas is strongly reduced. The second presentation will also highlight potential similarities between the neurophysiological changes induced by propofol and those observed during sleep. The third presentation of the symposium will, in addition to discussing recent modeling work on the mechanisms of propofol anesthesia, provide a broader framework for understanding changes in neural dynamics under general anesthesia.

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# Novel Technologies and Methodologies for Co-Manipulating Interoception and Exteroception in the Experience of Body Ownership

**Keisuke Suzuki**, Sackler Centre for Consciousness Science & Dept of Informatics, University of Sussex, UK **Anil K Seth**, Sackler Centre for Consciousness Science & Dept of Informatics, University of Sussex, UK

# July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

The experience of body ownership (EBO) is one of most consistent phenomenal features of human consciousness. Disruptions of EBO arise in certain clinical conditions (e.g., somatoparaphrenia, phantom limb syndrome), however they can also emerge in healthy subjects. For example, in the rubber-hand illusion (RHI), a fake hand can be experienced as part of the subject's body if (fake hand) visual signals are integrated with tactile input applied synchronously to both hands. While the classical RHI depends on exteroceptive sensory integration, recent work has begun to explore how of perception of internal physiological states (interoception) can modulate EBO. For example, individual sensitivity to heartbeat modulates RHI strength, and experienced RHI also leads to a cooling of the subject's real hand. To extend investigations of the relationship between interoception and exteroception in EBO, we have developed a novel experimental platform using state-of-the-art virtual reality technologies. The system integrates Microsoft Kinect, a custom-designed augmented reality (AR) system, and physiological sensors. In the system, a 3D model of a hand captured by Kinect can be projected in real-time in a flexible spatial relationship to the subject's real hand using AR. Cardiac and/or respiratory signals can then modulate the projected hand image in arbitrary ways. The system allows objective control of 1) visual-tactile conflict, 2) degree of agency, 3) interoceptive feedback, and 4) immersiveness of the VR environment (stereoscopy, field of view, etc). We will present data showing how these factors differently affect EBO, with particular attention paid to predictive components of interoceptive signals.

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# Can You Feel It? Intuitive Hunches Precede Insight Based On Semantic Associations

Joanna Sweklej, Warsaw School of Social Sciences and Humanities Robert Balas, Polish Academy of Sciences

# July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

The presented research considers implicit processing of semantic coherence. Previous research has shown that the activation of semantic network precedes insight into complex verbal puzzles that include word hints to the semantically associated solutions. Furthermore, this process can be facilitated or inhibited when the solution word induces positive or negative affective response, respectively. Current research examines the dynamics of intuitive hunches produced by converging activations and whether induced affective states intervene in this process. Affect was induced in two ways, i.e. by modifying participants' mood and by manipulating affective valence of solution words. The results show that intuitive hunches build up on accumulating activation of semantic network and are introspectively detectable short before the insight. Furthermore, whilst positive mood seems to generally increase the rates of insight, the positive affective response induced by positively valenced solutions facilitates intuitive hunches.

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#### Action Sounds Recalibrate Perceived Tactile Distance Action Sounds Recalibrate Perceived Tactile Distance

 Ana Tajadura-Jiménez , Royal Holloway, University of London, UK & NTT Communication Science Laboratories, NTT Corporation, Kanagawa
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# July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

Almost every bodily movement, from the most complex to the most mundane, such as walking, can generate impact sounds that contain spatial information of high temporal resolution. Despite the conclusive evidence about the role that the integration of vision, touch and proprioception plays in updating body-representations, hardly any study has looked at the contribution of audition. We show that the representation of a key property of one's body, like its length, is affected by the sound of one's actions. Participants tapped on a surface while progressively extending their right arm sideways and in synchrony with each tap participants listened to a tapping sound. In the critical condition, the sound originated at double the distance at which participants actually tapped. After exposure to this condition, tactile distances on the test right arm, as compared to distances on the reference left arm, felt bigger than those before the exposure. No evidence of changes in tactile distance reports was found at the quadruple tapping sound distance or the asynchronous auditory feedback conditions. Our results suggest that tactile perception is referenced to an implicit body-representation which is informed by auditory feedback. This is the first evidence of the contribution of self-produced sounds to body-awareness, addressing the auditory-dependent plasticity of body-representation and its spatial boundaries.

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#### Preference for the Laterality of Physical Proximity with an Attachment Figure

#### Tsugumi Takano Tokyo Institute of Technology

# July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

When one is with someone, one feels as if the "self" is extended and is in close contact with others. Physical proximity plays an essential role in this extended awareness of self. The function of the mirror systems (Arbib 2005) suggests that consciousness is at least in part a social entity.

The social construction of the self starts from the relation with the caregiver. The affectional bond between a child and the caregiver is an important instance of attachment (Bowlby, J. 1958). Attachment is considered to function in adulthood, while attachment figures are changed to one's romantic partner, friends, and so on (Ainsworth, MS. & Bowlby, J. 1991). Just looking at the photo of an attachment figure could decrease one's physical pain (Eisenberger, NI, et al., 2011). The attachment style (secure, anxious-avoidant, or anxious-ambivalent, Ainsworth et al. 1978) affects a person's character development.

Physical contacts with an attachment figure are important in childhood, while their role in adulthood is less clear. Here we investigate the importance of the physical proximity in the contact with the attachment figure, in relation to one's attachment style. We investigate the preference for the laterality of the physical proximity, as it continues to affect the social construction of the self as a person encounters and communicates with established or potential attachment figures. The caring postures of the subject's mothers were correlated with the preferences. Based on the results, we discuss the resonant embodiment mechanisms at work in the development of the self into adulthood.

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#### Relationship between Implicit Learning and Reading Skill of Japanese Kanji

Daisuke Tanaka, Tottori University, Japan Ayumi Seki, Tottori University, Japan Hitoshi T. Uchiyama, Tottori University, Japan Nozomi Okutani, Tottori University, Japan

# July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

First language acquisition has been executed by implicit learning system and it seems that implicit learning ability influences some aspects of language activity. For example, there are some different ways of reading per one character in most Japanese kanji characters. The proper way to read a character is probabilistically decided by other characters which are continuously and / or previously presented. Since probabilities of reading rules vary with each kanji, sensitivity of co-occurrence relation between kanji characters is critical to reading skill of kanji. However there are few opportunities for native Japanese to learn a series of rules explicitly. Furthermore, it is impossible for Japanese learners to explicitly memorize every probability about reading kanji taking into account the fact that about 2000 kanji commonly used. Although kanji reading skill is influenced by vocabulary ability and the total amount of reading experience, it seems that implicit learning ability also become the basis of it. More specifically, high sensitivity to co-occurrence relation results in their high kanji reading skills without consciousness. Individual differences of sensitivity to probabilistic reading rules could be measured by the nonword reading task. Those who acquire probabilistic reading rules with high sensitivity to co-occurrence relation can read nonword, artificially generated fictional word, based on its proper probability even if they have never seen it before. In this study, it was investigated that the relationship between nonword reading task and probabilistic serial reaction time (SRT) task, eliminating influences of verbal related abilities measured by subordinate components of WAIS.

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# The Relationship of Two Numerical Magnitudes Influences Spatial Shifts of Attention

Kanji Tanaka, University of Tokyo & Japan Society for the Promotion of Science, Japan Fuminori Ono, University of Tokyo, Japan Katsumi Watanabe, University of Tokyo, Japan

# *July* 4<sup>th</sup>, 14:00-16:00: *Poster Session* 1.

Mental representations of numbers are associated with space. It is known that merely observing a single digit shifts attention covertly to the left or right, depending on the magnitude of the number. A small digit shifts attention to the left and a large digit shifts attention to the right. The present study examined how observing consecutively presented numbers would shifts visual attention. We adapted the Posner's cueing paradigm, used three numbers as central cues (1, 5, 9), and prepared 4 types of consecutive presentation of two digits (1-5, 5-1, 5-9, 9-5). The first digit was presented for 300 ms, followed by a 100-ms blank and the second digit for 300 ms. The target appeared either the left or right side of the central fixation 200, 400, or 600 ms after the second digit. Participants were asked to detect the target as quickly and accurately as possible. The results showed that the interval between the second digit and the target did not influence the detection time but observing the 1-5 and the 5-9 sequences caused shifts of spatial attention towards the right side. In other words, attention was shifted rightward after observing an increase in the magnitude of the numbers. These results suggest that the relative magnitude of consecutively presented numbers (or the direction of change; increase or decrease) may have influence on attentional shift.

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#### Effects of Bilingual Experiences on Numeral and Story-Telling Tasks: A Preliminary Neuroimaging (fNIRS) Study

Hideyuki Taura, Ritsumeikan University, Japan Amanda Taura, Setsunan University, Japan

July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

This study aims to explore how bilingual experiences, on the continuum of being monolingual to proficient bilingual, manifest an effect on brain activation. Cognitively demanding tasks (a storytelling task and a numeral

manipulation task) are administered to six Japanese-English bilingual high school students who greatly vary in their L2 (English) proficiency: three have been learning English in the formal classroom setting in Japan for only six months whereas the other three have acquired English during their prolonged sojourn in an English speaking country. Functional near-infrared spectroscopy (fNIRS) data in the subject's frontal lobe in terms of oxy-hemoglobin (Hb), deoxy-Hb, and the total-Hb are monitored on a 42-channeled imager (Shimadzu FOIRE-3000) while s/he is engaging in the tasks. The focus is placed on Broca's area and its right homologous region. Three kinds of data - behavioral data (the accuracy rate in the numeral task), the descriptive analysis on transcribed stories, and the fNIRS brain activation data - are incorporated to explore how bilingual experiences affect brain activation.

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#### A Unified Neuroanatomical Model of Time Perception.

Sundeep Teki, University College London, UK Manon Grube, Newcastle University, UK Timothy D. Griffiths, University College London & Newcastle University, UK

# July 3<sup>rd</sup>, 16:30-18:30: Concurrent Session 2.

Accurate perception of time is an integral aspect of sensory and motor processes such as the perception of speech and music and the execution of skilled movement. Neuropsychological studies of time perception in patient groups and functional neuroimaging studies of timing in normal participants suggest common neural substrates for perceptual and motor timing. A timing system is implicated in core regions of the motor network such as the cerebellum, inferior olive, basal ganglia, pre-supplementary, and supplementary motor area, pre-motor cortex as well as higher-level areas such as the prefrontal cortex. In this article, we assess how distinct parts of the timing system subserve different aspects of perceptual timing. We previously established brain bases for absolute, duration-based timing and relative, beat-based timing in the olivocerebellar and striato-thalamo-cortical circuits respectively (Teki et al., 2011). However, neurophysiological and neuroanatomical studies provide a basis to suggest that timing functions of these circuits may not be independent. Here, we propose a unified model of time perception based on coordinated activity in the core striatal and olivocerebellar networks that are interconnected with each other and the cerebral cortex through multiple synaptic pathways. Timing in this unified model is proposed to involve serial beat-based striatal activation followed by absolute olivocerebellar timing mechanisms (Teki et al., 2012).

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# Posthypnotic Manipulation of the Visuospatial Phenomenology of Colour Photisms Modulates Selective Attention in Synaesthesia

Devin Blair Terhune, University of Oxford, UK Roi Cohen Kadosh, University of Oxford, UK

# July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Individuals with grapheme-colour synaesthesia vary in the perceived visuo-spatial location of concurrent colour photisms with some experiencing photisms as mental images or representations (associators) and others experiencing them as percepts that are spatially proximal to inducer stimuli (projectors). Previous studies have suggested that this typological variability can account for individual differences in interference effects in stimulus and photism colour-naming variants of the synaesthesia Stroop task, but this has yet to be directly tested because the visuo-spatial location of colour photisms has not yet been subjected to experimental manipulation. In two experiments we induced synaesthesia in highly suggestible non-synaesthetes ('virtual' synaesthetes) and experimentally manipulated the visuo-spatial location of synaesthetic colour photisms using posthypnotic suggestion. In Experiment 1, congenital and virtual associator and projector synaesthetes completed stimulus and photism colour-naming variants of the synaesthesia Stroop task in a between-groups design. The visuo-spatial location of concurrent colour photisms modulated interference effects in both congenital and virtual synaesthetes, with projector synaesthetes displaying greater stimulus, but not photism, colour-naming interference effects than associator synaesthetes. We replicated these effects in Experiment 2 by manipulating the visuo-spatial location of colour photisms in the virtual synaesthetes in a within-groups design. Taken together, these results provide experimental evidence for a close coupling of visuo-spatial photism phenomenology and behavioural interference effects in grapheme-colour synaesthesia.

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#### Prestige Blindness: The Need for Vanished Objects to Re-Appear!

Robert Teszka, Brunel University, UK Daniel Narayn, Brunel University, UK Gustav Kuhn, Brunel University, UK

# *July* 4<sup>th</sup>, 14:00-16:00: *Poster Session* 1.

Magicians have perfected the art of manipulating our conscious perception and cognition, and it has been argued that many of the magicians' techniques provide valuable insights into the nature of human experience. A key rule of magic states that once an object disappears, it must re-appear later. The re-appearance of the object is thought to improve misdirection, as well as provide a more complete and fulfilled experience of the magic trick. In the first experiment, we empirically confirm that people strongly expect a coin that has disappeared to be returned to view, even though this defies the laws of physics and logic. In the second experiment, we demonstrate that expecting an object to re-appear influences conscious perception of that object. Change blindness research suggests that under certain circumstances people fail to notice an obvious change in their visual field. Participants were shown a video: either of a coin being vanished, and then a different coin being revealed under a salt shaker; or one where the coin is only obscured rather than vanished and then a different coin is revealed under the salt shaker. The results show that participants who saw the coin vanish, rather than merely occluded, were less likely to notice the discrepancy between the coins. Our results demonstrate that people have a strong expectation that objects which have vanished will reappear, and that this expectation influences conscious perception.

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# A Case of Unconscious Emotion?

Ralph R.J. Thompson, University of Bristol, UK Michael T. Mendl, University of Bristol, UK Elizabeth S. Paul, University of Bristol, UK

# *July* 4<sup>th</sup>, 14:00-16:00: *Poster Session* 1.

Although the idea of 'unconscious emotion' is established theoretically (Kihlstrom 2000) there is little experimental evidence for its existence. In order to demonstrate the existence of unconscious emotion empirically we must show behavioural, physiological or cognitive emotional effects in the absence of any change in felt affect. A single experiment (Winkleman and Berridge 2005) claims to have achieved this by demonstrating an emotional effect on appetite for, and valuation of, a novel drink (reported as a bias in interpretation of ambiguity) without changing subjective mood, but does not provide sufficient evidence alone.

This study uses unpredictable (irregular) compared to predictable (regular) sound pulses to manipulate mood. Unpredictable auditory stimuli have previously been shown to be associated with increased amydala activation and anxiety-like behaviour, but participants state no preference for predictable over unpredictable sounds (Herry *et al.* 2007). Here these sounds were presented to participants while they performed an ambiguous facial emotion classification task (a test for emotional interpretive bias), and reported their emotional state on a 10–item visual-analogue scale.

Results indicate that female participants (but not males) showed an increased tendency to identify ambiguous faces as angry when listening to irregular (rather than regular) sound pulses, but showed no difference in anxiety between the two conditions. These results are consistent with those published by Herry *et al.* (2007) but provide additional evidence for the existence of 'unconscious emotion'.

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#### Adults with High Functioning Autism Do Not Make Sequence Knowledge More Explicit In a Motor Learning Task

Bert Timmermans, University Hospital of Cologne, Germany Antoine Pasquali, University of Tokyo, Japan Axel Cleeremans, Université Libre de Bruxelles, Belgium Kai Vogeley, University Hospital of Cologne & Research Centre Jülich

# July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

People with autism have been described as having difficulties with implicit social cognition, which in turn has led to the assumption that this might be related to basic problems with implicit learning. However, in contrast to earlier findings on, recent research (Barnes et al. 2008; Brown et al. 2010; Nemeth et al. 2010; Kourkoulou et al. 2011; Travers et al. 2010) shows that implicit learning is intact in people with autism, provided that (a) IQ is controlled for and (b) learning is absolutely implicit. However, whereas those studies have focused on tasks that were as implicit as possible, an important question remains: under less stringent implicit learning conditions, is there anything in autistic persons that increases their ability to render information explicit that to healthy controls

remains implicit? We tested 20 adults diagnosed with High Functioning Autism (HFA), and an IQ-matched control group in a Serial Reaction Time task, with a deterministic second-order conditional sequence. Besides an IQ-test, all participants had their Autism Quotient (AQ), Empathy Quotient (EQ), and Systemizing Quotient (SQ) scored. As expected, the HFA group are just as good at implicit sequence learning as controls, but more importantly, they do not automatically make sequence knowledge more explicit, a capacity which seems to correlate with IQ only.

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## Disturbances of Agency in Schizophrenia.

Georgina Torbet, Berlin School of Mind and Brain, Humboldt-Universität zu Berlin, Germany Benedikt Reuter, Humboldt-Universität zu Berlin, Germany Michael Pauen, Berlin School of Mind and Brain, Humboldt-Universität zu Berlin, Germany Norbert Kathmann, Humboldt-Universität zu Berlin, Germany

# July 4<sup>th</sup>, 11:00-13:00: Concurrent Session 3.

Disturbances of agency in schizophrenia are well-established in both clinical and experimental settings. Clinical reports and some experimental evidence suggest that people with schizophrenia experience a reduced sense of agency: they under-attribute agency to themselves and may believe that other people are controlling their actions or movements. A popular conception of schizophrenia, the comparator model, proposes that a mismatch arises between the predicted and actual sensory input which causes a reduced sense of agency. Other experiments, however, have found an enhanced sense of agency: people with schizophrenia over-attribute agency to themselves and are more likely to believe that they caused an event in the world.

In order to explain this apparent contradiction, we conceptualise the sense of agency as arising from two distinct components: a prior expectation which models the expected sensory input arising from a movement or action, and a retrospective evaluation of proprioceptive data to see if it accords with the prediction. If the predictive component is unreliable, as described in the comparator model, then it may be under-utilised in attributing agency. The abnormal integration of predictive and retrospective components could lead to over- or under-attribution of agency, dependent upon context. This would explain why schizophrenic subjects can show both enhanced and reduced agency in experimental settings.

We propose an innovative experiment using eye tracking in an intentional binding paradigm to investigate feelings of agency. Given findings of abnormal volitional saccades but unimpaired reflexive saccades in people with schizophrenia, there may be a link between the degree of volitionality of an action and its impairment. We predict that volitional eye movements will induce a small intentional binding effect, representing a low sense of agency, due to low reliance on predictive components in schizophrenia.

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# Transcranial Alternating Current Stimulation of 40Hz Influences Bistable Motion Perception by Interhemispheric Functional Decoupling

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# July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

Viewing ambiguous stimuli can alternate conscious perception spontaneously by switching between competing interpretations of physically unchanged stimulus information. It has been suggested that neurons dynamically change their pattern of synchronized oscillatory activity in the gamma band (30-80 Hz) during perceptual switches, which has also been supported by previous human electroencephalographic (EEG) studies demonstrating gamma band modulations during ambiguous perception. In the present study, 13 healthy participants watched a bistable motion quartet for 15 minutes in two different runs and indicated by button press whether they perceived horizontal or vertical motion. Simultaneously, they received either transcranial alternating current stimulation (tACS) in the gamma range (40Hz) over motion sensitive areas of both hemispheres, or no stimulation. Prior to and after each run, spontaneous 28 channel EEG was recorded in order to investigate interhemispheric coherence. In our paradigm, we expected that the switch between horizontal and vertical apparent motion was likely to involve a change in interhemispheric functional coupling. Indeed, we found an increase of interhemispheric gamma band coherence together with a decreased proportion of perceived horizontal motion. Thus, tACS allowed us to establish a causal role of gamma band coupling in bistable motion perception. Due to the fact that bilateral tACS induces sinusoidal currents with 180 degrees phase difference between hemispheres, the resulting interhemispheric functional decoupling lead to a relative decrease of horizontal motion perception. In summary,

these findings demonstrate a direct relationship between gamma band coupling and conscious perception including both behavioural and electrophysiological evidence.

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## Just a Heartbeat Away From One's Body: Interoceptive Sensitivity and Malleability of Self-Representations

Manos Tsakiris, University of London, UK

# July 5<sup>th</sup>, 11:00-13:00: Symposium 2.

Body-awareness relies on the representation of both interoceptive and exteroceptive percepts coming from one's body. However, the exact relationship and possible interaction of interoceptive and exteroceptive systems for body-awareness remain unknown. Based on recent models of self-awareness that consider the insula as a convergence zone linked to the representation of the bodily self, we examined the interaction between interoceptive and exteroceptive awareness of the body. Across three experiments, we combined measures of interoceptive sensitivity with experimental manipulations of body representations. Consistent results suggests that interoceptive sensitivity predicts the malleability of body representations, that is, people with low interoceptive sensitivity experience stronger illusions of embodiment ("rubber hand illusion") and identification ("enfacement illusion"). In one final experiment, we manipulated interoceptive sensitivity by mirror self-observation. Overall these findings suggest that interoceptive sensitivity modulates the integration of multisensory information and predicts the strength of self-representations.

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# Perceptual, Rather Than Physical, Disappearance of A Fixation Point Determines the Magnitude of the Gap Effect

Hiroshi Ueda, University of Tokyo & Japan Society for the Promotion of Science, Japan Kohske Takahashi, University of Tokyo, Tokyo, Japan Katsumi Watanabe, University of Tokyo, Tokyo, Japan

# July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

Saccadic latency and manual reaction time are shorter when a fixation point is removed just before the onset of a target than when the fixation point is remained (gap effect). The present study examined which of physical or perceptual disappearance of a fixation point would correlate better with the gap effect. In Experiment 1, we examined whether physical disappearance of a fixation point would always cause the gap effect. A fixation point was occluded by moving masks such that observers felt as if the fixation point persisted behind the occluding masks even though it physically disappeared. The results showed that the reaction time was slower when observers felt the fixation point. That is, the amodal maintenance of the fixation point reduced the gap effect. In Experiment 2, the fixation point remained physically but was removed from visual awareness by using continuous flash suppression. The results showed that the gap effect occurred only when observers noticed the disappearance of the fixation point, irrespective of the physical offset of the fixation point. Taken together, these results indicate that perceptual, but not physical, disappearance of a fixation point correlated more with the magnitude of the gap effect.

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#### Pre-Stimulus Activity Predicts Awareness In Visual Extinction.

Maren Urner, University College London, UK Margarita Sarri, University College London, UK Tom Manly, MRC Cognition and Brain Sciences Unit Cambridge, UK Jessica Grahn, University of Western Ontario, Canada Geraint Rees, University College London, UK

# July 3<sup>rd</sup>, 16:30-18:30: Concurrent Session 2.

Patients with visual extinction following right-hemisphere damage sometimes see and sometimes miss left visual events under identical bilateral visual stimulation conditions. Awareness of the left visual event leads to increased neural activity in bilateral parietal and frontal regions. However, it is unknown why patients see or miss the left visual event. Previous neuroimaging studies have shown that pre-stimulus activity biases perceptual decisions. More precisely, fluctuations in visual perception have been attributed to shifts in the ongoing fluctuations of neuronal activity in task relevant brain regions. We used fMRI to investigate whether pre-stimulus activity in stimulus-responsive brain areas predicts perception in visual extinction. A patient with unilateral right parietal

damage and visual extinction was scanned three times to measure baseline activity in stimulus-responsive cortical areas during an extinction paradigm. This allowed comparison of pre-stimulus activity on physically identical bilateral trials that sometimes lead to visual extinction. We found significantly increased activity prior to stimulus presentation in three areas that were also activated by passive visual stimulation; right calcarine sulcus, right inferior occipital gyrus and right superior parietal lobule. Prestimulus activity was also observed in a region in left medial temporal cortex that did not respond to passive visual stimulation. All four regions also showed higher neural activity in response to the stimulus for perceived trials. Thus, we provide evidence for the idea that ongoing neural fluctuations in an occipital-parietal network of stimulus responsive areas prior to stimulus onset not only bias, but predict awareness for subsequently presented stimuli in visual extinction.

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#### Perception of Numbers, a Case of Cognitive Penetration?

#### Arstila Valtteri, University of Turku, Finland

# July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

Whether perceptual experiences can be penetrated by cognitive states or not has been the topic of a longstanding debate. For example, while it has been suggested that our perceptions of bistable figures sometimes illustrate cognitive penetrability, this idea has also been objected by maintaining that the differences in the perceptual experiences mirror differences in spatial attention. Other possible candidates of cognitive penetration in turn have been refuted based on the claim that in those cases perceptual experiences are not altered by cognitive states. Instead, the only thing that changes is the judgment of the content of perceptual experiences. In short, all suggested candidates of cognitive penetration can also be explained with reference to non-cognitive factors and the issue of cognitive penetrability remains unresolved. In this talk, I present a new candidate for a case of cognitive penetration that is based on the studies concerning common mechanisms of magnitude representation. For the case at hand, the most important results of these studies are those in which Arabic numerals (that is, conventional symbols) of large numbers are perceived to last longer and be physically larger than Arabic numerals of small numbers. Given that these results are unlikely to be due to attentional effects, and that there are reasons to regard the effects perceptual, the candidate is immune to the mentioned alternative interpretations that rely on non-cognitive factors. Therefore, without further counterarguments, the perception of numbers is likely to be an example of cognitive penetration.

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#### The Evolution of Masked Priming Effects Using the Incremental Priming Technique.

Eva Van den Bussche, Vrije Universiteit Brussel, Belgium Astrid Vermeiren, Université Libre de Bruxelles, Belgium

# July 3<sup>rd</sup>, 16:30-18:30: Concurrent Session 2.

We aimed to sketch the time-course of masked priming effects using the incremental priming technique (Jacobs, Grainger, & Ferrand, 1995). With this technique, the prime duration is gradually increased, which provides two baseline conditions to measure priming: (1) the "traditional" between-conditions baseline where RTs on congruent trials are compared to RTs on incongruent trials; (2) the within-condition baseline where RTs to trials with different prime durations are compared to RTs on the shortest duration.

Thirty-one participants were asked to categorize targets as smaller or larger than 5. These targets were preceded by masked primes which could be congruent or incongruent with the target. Each participant received various trial blocks where the prime duration sequentially increased starting from 5ms to 90ms in steps of 5ms.

The results showed that congruent primes facilitated target processing relative to the traditionally used incongruent condition (between-condition baseline). With respect to the within-condition baseline, incongruent trials produced massive inhibition of RTs, especially for short durations.

Congruent primes did not produce facilitation, but only a small inhibition for short durations. With regards to the visibility of the masked primes, a significant cubic trend emerged indicated by an S-shaped curve: visibility began at chance level until a prime duration of 30ms, and then steeply increases until a duration of 70ms, where a ceiling effect is reached.

This study shows that masked priming effects are inhibitory in nature: for short prime durations both congruent and incongruent primes trigger inhibition of responses to the target as compared to a within-condition baseline.

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# Integration Theories of Consciousness and the Unity of the Self- A Proposal for Mutual Exchange between Research Programs.

# Robert Van Gulick, Syracuse University, USA

# July 4<sup>th</sup>, 11:00-13:00: Concurrent Session 3.

Many current theories/models of consciousness appeal to some form of integration as a key factor. They involve integrating information, functions or subsystems into a larger coherent whole. Global workspace theories (Barrs, Dehaene), Tononi's information measure  $\phi$ , local recurrence theories (Lamme), and global recurrence theories (Edelman, Llinas) all explain consciousness at least partly as involving a high degree of integration. The relevant integrations occur at sub-personal levels of computational, neural or representational processing, which leaves some gap in moving from them to the level of subjective experience and more phenomenally based theories. Some recent personal-level theories have explored the link between phenomenal consciousness and implicit self-awareness including reflexive models (Kriegel) and theories focused on the unity of the self (Bayne). They appeal to distinctively phenomenal forms of integration to account for subjective unity. These two current discussions make little contact, but each has the potential to enhance the other. I show a number of specific ways in which combining integration models with theories about the unity of the self deepens and clarifies both including:

- Why the integration involved in generating consciousness must give rise to the perspective of a self (or subject) and how it might do so.
- Ways in which the content of information is transformed by its integration into a unified personal level system.
- Ways in which integration gives rises to enhanced self-understanding .Collaborative interchange between the two discussions should be encouraged, and a specific model is offered for doing so the Higher-Order Global States (HOGS) model.

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# Perceptual Closure in Grapheme-Colour Synaesthesia.

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Michael Wibral, Johann Wolfgang Goethe University, Germany
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Lucia Melloni, Max Planck Institute for Brain Research, Germany & Columbia University, USA

# July 4<sup>th</sup>, 11:00-13:00: Concurrent Session 3.

In people with grapheme-colour synaesthesia, letters and numbers evoke the percept of colour. It is proposed that synaesthesia involves hyper-binding mechanisms for colour and graphemes. It is at present unclear whether this hyper-binding of colour and graphemes can alter the threshold of conscious perception in synaesthetes. At the neural level, binding processes are associated with increased synchronization between different features, which is reflected by gamma oscillations. Here we used magnetoencephalograhy during a visual closure task in synaesthetes to investigate the impact of the interplay between colour and graphemes on the threshold of awareness, and its neural manifestation in terms of gamma oscillations. Seventeen synaesthetes and 17 controls were presented with synaesthesia-inducing stimuli (letters and numbers) and with neutral stimuli that did not induce synaesthesia (symbols). Stimuli were embedded in a coloured noise background, which was congruent with the synaesthetic colour or neutral (symbols). The amount of noise was parametrically varied and the visibility threshold of the stimuli was determined by subjective visibility ratings of the embedded grapheme. As expected, both groups showed similar visibility thresholds in the neutral condition, but synaesthetes showed a lower threshold in the letter condition (perceived more stimuli than controls). We suggest synaesthetic hyper-binding aids synaesthetes during closure. Preliminary MEG analyses showed strong induced gamma band activity (50-70 Hz) over occipital sensors for both conditions and groups. However, only synaesthetes showed a difference in gamma power between letters and symbols, suggesting a relationship between synaesthesia and induced gamma. We suggest that altered gamma activity reflects hyperbinding.

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#### GABA Concentrations Predict Individual Differenced In Bistable Perception.

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July 6<sup>th</sup>, 11:00-13:00: Concurrent Session 4.

GABA is the major inhibitory neurotransmitter in the brain. We investigated the role of GABA in visual awareness using Magnetic Resonance Spectroscopy (MRS). This is a non-invasive methodology that allows the direct

detection of endogenous GABA in the human brain in vivo. Small differences in GABA concentrations that occur naturally may help to explain basic differences in behavior. We used MRS to measure the GABA concentration of 23 healthy male participants in two brain regions involved in visual awareness: occipital cortex (OC) and dorsolateral prefrontal cortex (DLPFC). Participants experienced three bistable visual illusions: binocular rivalry (BR), motion induced blindness (MiB) and 3D structure from motion (SFM). The individual GABA concentration in OC predicted longer perceptual state durations for all three illusions. There was no evidence for such a correlation for DLPFC. These results are consistent with models of bistable perception, in which perceptual alternations result from mutual inhibition between competing neuronal populations in visual cortex.

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#### Visual Rivalry In The Fly Brain Reveals A Dissociation Between Salience And Time.

# Bruno van Swinderen, The University of Queensland, Brisbane, Australia

## July 6<sup>th</sup>, 11:00-13:00: Concurrent Session 4.

There is increasing evidence that even simple creatures such as flies display selective attention, although parallel processing of simultaneous cues remains difficult to demonstrate in such tiny brains. Local field potential (LFP) activity in the fly brain is associated with stimulus selection and suppression, much like in other animals, suggesting that similar processes may be working to control attention in vastly different brains. To investigate selective attention to competing visual cues, I recorded brain activity from behaving flies while applying a method used in human attention and rivalry studies: competing visual flicker, or frequency tags. Behavioral fixation in a closed-loop flight arena increased the response to visual flicker in the fly brain, and visual salience modulated responses to competing tags in a center-surround rivalry scenario. Visual rivalry dynamics were dependent on the rate of stimulus presentation rather than absolute time, suggesting that attention-like switching in the fly brain is tuned to motility or optic flow.

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# Visual Sensory Memory Contains Phenomenal Rather Than Unconscious Representations.

Annelinde Vandenbroucke, University of Amsterdam, the Netherlands Ilja Sligte, University of Amsterdam, the Netherlands Johannes Fahrenfort, University of Amsterdam, the Netherlands Klaudia Ambroziak, University of Amsterdam, the Netherlands Victor Lamme, University of Amsterdam, the Netherlands

# July 3<sup>rd</sup>, 14:00-16:00: Concurrent Session 1.

Over the last years, a debate has surged about the nature of sensory memory representations. Some scholars suggest that visual sensory memory, as measured in iconic memory tasks, reflects unconscious processing (Cohen & Dennett, 2011, Kouider et al., 2010, Philips, 2011). Others propose that these brief forms of visual memory result from conscious processing, just like visual working memory does (Block, 2011; Crick & Koch, 1990; Lamme, 2010). Here, we attempt to resolve this issue by investigating the perceptual characteristics of visual sensory memory. To examine the perceptual nature of sensory memory, we embedded Kanizsa figures as objects in a Change Detection task. The Kanizsa illusion is a prime example of the way our brain translates meaningless fragmented input into coherent and bound objects, thereby adding a perceptual quality to the physical input. Indeed, the perception of the illusion has been shown to depend on conscious processing of its inducer elements (Harris et al., 2011). In this study we show that memory capacity benefits from figural information induced by the Kanizsa illusion. Moreover, this benefit was larger for sensory memory than for working memory. In a second experiment, we established that this larger benefit depended critically on the illusion, not on the stimulus configuration. This shows that sensory memory depends on phenomenal rather than unconscious representations, suggesting that it has a genuinely perceptual nature.

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# Loss of Self-Referential Stimuli Discrimination during Propofol-Induced Loss of Consciousness

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# July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Introduction: We investigated if the differential activation between various stimuli (here subjects' own names versus other names) would be more impaired than non-specific auditory activation during propofol-induced unconsciousness. Methods: We presented subjects' own names as well as familiar names to 12 participants using a simultaneous EEG-3T fMRI block design during normal wakefulness, propofol-induced sedation (Ramsay 3), unconsciousness (Ramsay 5), and recovery. fMRI activation and EEG event-related spectral perturbation analyses were performed in SPM8. Results were thresholded at family-wise-error corrected p<0.05. Results: During wakefulness, both names activated temporal, inferior frontal and middle frontal gyri. The presentation of own name additionally activated medial prefrontal (MPFC) cortex. Self-related brain activations in response to own name disappeared during propofol-induced unconsciousness, while temporal cortices activation was preserved for both stimuli. The self-related MPFC activation in response to own name versus other names was correlated to the level of consciousness. A differential EEG beta band synchronization at 150 msec latency for own name versus other names was present during wakefulness. This differential stimulus-induced oscillatory activity was also correlated with the level of consciousness across sedation stages. Conclusions: Our results suggest that propofolinduced anesthesia is associated with preserved activation of associative auditory cortices, but a loss of discrimination of self-related versus non-self stimuli. They stress the importance of functional specialization of brain activity – in particular the integrity of external versus internal awareness systems in the generation of normal conscious perception. The presence of preserved differential information processing could be mediated by differences in cortical beta frequency synchronisation.

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#### Consciousness as an Answer to Pervasive Intentionality.

## Paul F.M.J. Verschure, ICREA & Universitat Pompeu Fabra, Barcelona, Spain

#### July 4<sup>th</sup>, 11:00-13:00: Concurrent Session 3.

This paper proposes that consciousness is evolution's answer to the fundamental problem of survival in a world that is filled with intentional agents, or the Pervasive Intentionality hypothesis (PI). Already in the interaction with the physical world it is fundamentally impossible to univocally assess the causes of the deluge of sense data that an agent receives. This problem is aggravated by the fact that most sources of data are other agents that operate on the basis of hidden internal states such as motivations, emotions and goals. As a result the ability to generate action in real-time and thus survival on the basis of sense data alone is compromised. I propose that consciousness is the solution to this problem by realizing a virtualization of sense data merging it with hypothesized intentional states of self and of other agentsThe model of consciousness proposed here is based on the, so called, Grounded Enactive, Predictive Experience model (GEPE): the experiencing physically instantiated self, the sensori-motor coupling of the agent to the world, the amplifying role of sensori-motor predictions, the co-existence of high levels of differentiation with high levels of integration and the dependence on highly parallel, distributed and implicit states with metastable, continuous and unified explicit factors. By merging this framework with the well established robot-based biomimetic Distributed Adaptive Control architecture (DAC) applied to the humanoid iCub robot, I will show how this proposal can be transferred to real-world artefacts and that in turn this translation is a necessary step in realizing and validating theories of consciousness.

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## Hearing (Rivaling) Lips and Seeing Voices: How Audiovisual Congruence Modulates Perceptual Stabilization

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# July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

In binocular rivalry (BR), sensory input remains the same yet subjective experience fluctuates irremediably between two mutually exclusive representations. We investigated the perceptual stabilization effect of an additional sound on the BR dynamics. Previous studies reported conflicting evidence that we attribute to differences in how the sound matched with the visual percepts. We used speech stimuli known to involve robust

audiovisual interactions at several cortical levels. We measured how a voice saying /aba/ influences the perception of rivaling faces saying /aba/ and /aga/, either viewing passively or trying to promote one percept. Real, perceived or irrelevant congruence and incongruence were distinguished comparing McGurk sensitive and insensitive subjects. First, adding the voice /aba/ stabilized both real and perceived congruent lips percept, indicating that perceived congruence is enough, but had the opposite effect when irrelevant or incongruent. Second, real congruence of the added voice improved volitional control more than perceived one, suggesting a graded contribution to the top-down sensitivity control involved in selective attention. Third, for McGurk insensitive subjects to who vision contributes little to speech perception, adding the voice /aba/ cancelled the limited volition observed without sound. In conclusion, congruent sound amplifies considerably attentional control over the perceptual outcome selection; however, differences in stabilization according to AV congruency suggest there are at least two distinct processes at stake. Based on BR properties, recent models of selective attention and speech perception, we propose a unified functional model that accounts for our findings.

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#### Electrophysiological Study of Intention-To-Act Opposed To Intention-In-Action

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### July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Most neurophysiological studies investigating intention focus on intention in immediate relation to motoric action and the related electrophysiological signals. The relation between subjective reports and electrophysiological signals are however controversial, as it is unclear to what extend the signals are associated with the intention itself or merely unconscious motor initiation. The present study presents an experiment that aims to separate intention and motor initiation, by looking at the neural correlates of intention-to-act, versus intention-in-action. The experiment used a clock-paradigm similar to Libet (1985). The subjects had to form an intention to press a key and then delay the action until the clock had completed one full rotation. This was compared to pressing the key immediately when they had the intention. In this manner the intention was separated from the actual movement, but the content of the intention remained the same. Neuroelectrophysiological activity was measured using multichannel EEG. In addition to comparing the ERPs of the different conditions data was analyzed using SPM in order to get a picture of the overall pattern of activity. The results showed that when forming the intention to press the key distinct of the action. This indicates that motor- and pre-motor areas are involved in planning of a motoric action as well as executing the action. To ask whether motor-cortical signals precede intention or not might therefore not be valid, as intention itself could arise from these signals.

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#### Merleau-Ponty's Reflection on Nature as the Inversion of the Philosophy of Consciousness

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# July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Husserl's theory of consciousness that considers intentionality as an essential feature of Noesis has much influence on the history of philosophy in 20th century. Speaking for Merleau-Ponty, his early phenomenological reduction to the embodied suject and body schema doesnot clearly thematize the descriptive significance and the exact scope of the perceived, which actually makes him prisoner of Husserlian theory. However, on his way to the philosophy of nature, he overthrows the initial phenomenological movement which neutralizes nature and the perception of nature to reveal the transcendental consciousness, and shifts to a new understanding of conciousness by making the concept of nature as the object of a separate reflection.

In Merleau-Ponty's research into nature, he no longer starts from consciousness as Husserl, but considers the problem of the relationship between the perceived world and the nature as the commencement. His reflection on "nature and logos" reveals the "ineinander" of animality and humanity as well as the most recent emergence of the symbolism on the level of the human body, which shows that natural being has already in itself included the generativity of meaning. Hence, there is no destructive break between the subject and object in natural being-which is the ultimate philosophical point shown to us and tentatively demonstrated by the inquiry of nature. Therefore, it is indeed by the research into nature that the transition towards ontology comes about, which then enables the fundamental inversion of philosophy of consciousness.

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#### **Objects in the Brain**

Katja Weibert, Heinrich-Heine-University, Germany Tessa van Leeuwen, Radboud University, Nijmegen, The Netherlands Petra Stoerig, Heinrich-Heine-University, Germany

# July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

Neuropsychology and neuroimaging applied to uncover the neural underpinnings of object categorization showed that ventral stream visual cortex as well as mediotemporal and frontal cortex may be differentially engaged by artefactual vs. natural object categories. As few of the studies used an explicit categorization task, we here studied 25 healthy subjects who categorized objects in a semantic oddball paradigm while undergoing fMRI at 3T. Stimuli were colour photographs of Bathroom, Food, and Kitchen objects; all object types were familiar and in the same manipulable size range (e.g. hairbrush, chocolate, plate). Conjointly, objects activated the ventral stream areas as well as inferior to middle frontal gyri bilaterally, showing that our categories did not differentially affect frontal regions, possibly because their visuomotor contingencies were roughly equal. Next, we investigated which brain areas were differentially engaged by different categories. Contrasting Bath and Kitchen with Food items vielded the strongest effect in the right cuneus; this may reflect their needing more detailed analysis for discrimination than did food items. The reverse contrast activated the left middle occipital gyrus, probably corresponding to a region of the lateral occipital cortex known to specialize in object processing. Contrasting Kitchen vs. Bathroom produced a cluster in the right parahippocampal gyrus (peak voxel at pFWE-corr. <0.05), suggesting categorization involving object location retrieval. In sum, presenting objects equated for mean size, manipulability, and familiarity in a categorization task, we found category-specific activation of occipito-temporal brain regions indicating that object categorization invoked visual and memory-related processing differentially.

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#### Neural Correlates of Implicit Approach Bias for Alcohol Stimuli in Detoxified Alcohol-Dependent Patients

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# July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

Behavioural studies have shown an automatic approach bias for alcohol stimuli in alcohol-dependent patients: the tendency to faster approach than avoid alcohol stimuli, without being consciously aware of it (Wiers et al, 2011). Although this is a well-studies psychological phenomenon, relatively little is known about the brain processes underlying automatic action tendencies in addiction. According to the dual process model of addiction, exposure to alcohol stimuli increases activity in brain areas associated with the impulsive system (e.g. ventral striatum, orbitofrontal cortex (OFC)), whereas an inhibitory system (e.g. dorsolateral prefrontal cortex (dIPFC)), that normally controls automatic responses mediated by the impulsive system, is generally less activated in patients (Bechara et al, 2005). Whether these antagonistic processes underlie the approach bias in alcohol-dependent patients as yet remains unknown.

In this still ongoing study, BOLD responses were measured while performing an implicit approach avoidance joystick task (AAT) in a Siemens 3T MRI scanner. Participants were instructed to push or pull pictures according to picture format (landscape/portrait), with picture content changing from alcoholic to non-alcoholic beverages. Approach bias scores were calculated by median scores of pushing alcohol pictures minus pulling alcohol (see Wiers et al, 2010). Preliminary results of n = 9 male patients and 8 age-, gender- and education matched healthy control participants, reveal patients' approach bias for alcohol pictures to be significantly larger (M = 0,048 ms, SE = 0,01) compared to control subjects (M = -0,002 ms, SE = 0,02, t(15) = 2,274, P < 0,05, r = 0.51). As hypothesised, patients showed greater left ventral striatal activity while approaching versus avoiding alcohol pictures (MNI [x, y, z = [-15, -10, 10], t = 4,70, p < 0,001). A second region in the left insula (MNI [x, y, z] = [-39, -4, 10], t = 4,98, p < 0,001). 0,001), a key region in representing affective states, showed stronger approach-related activity in alcoholic patients compared to controls.

Our preliminary data suggest that an overactive impulsive system might lead to the automatic bias to approach alcohol-related stimuli, possibly making patients vulnerable for relapse after abstinence. Since it is possible to overcome the approach bias by a training version of the AAT, which has been shown to be clinically effective (Wiers et al, 2011), future studies should focus on whether and how training influences addictive brain states.

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#### **Could A Performance Influence Subjective Availability Of Stimuli?**

Michał Wierzchoń, Jagiellonian University, Poland Borysław Paulewicz, Warsaw School of Social Science and Humanities, Faculty in Katowice, Poland Dariusz Asanowicz, Jagiellonian University, Poland Axel Cleeremans, Université Libre de Bruxelles, Belgium

# July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

Different measures of consciousness often yield different conclusions about the extent to which awareness relates to performance. Following theories of embodied mind, awareness may be influenced by the execution of responses in the performance tests. We aimed to investigate this hypothesis and compare the relations between the awareness and performance with four different subjective measures of availability in the context of a simple discrimination task (SDT).

In each trial of SDT, participants (N=151) were asked to discriminate whether a male or a female face was presented and then to express their awareness by means of one of four different scales: (1) confidence rating (CR), (2) post-decision wagering (PDW), (3) feeling of warmth (FOW) and (4) perceptual awareness scale (PAS). The presentation time in SDT followed the psychophysical method of limits. To estimate the influence of SDT reactions on subjective availability, awareness ratings were collected either after or before the decisions (the order factor).

All scales were found to be sensitive to awareness, i.e. discrimination accuracy correlated with awareness ratings. However, for every scale the correlations were stronger for ratings that were made after the decision. Furthermore, the accuracy for the lowest ratings differed between the scales for longer presentation times.

We discuss the differences between the scales ratings and the influence of the order factor in the framework of graded access account, comparing the results with our previous findings on awareness measures in a memory task.

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# Towards A Self-Representational Account of the Diachronic Unity of Consciousness

Wanja Wiese, Johannes Gutenberg University Mainz, Germany Thomas Metzinger, Johannes Gutenberg University Mainz & Frankfurt Institute for Advanced Studies, Germany

# July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

A sketch of a representational account of the diachronic unity of consciousness in three steps. *First step:* What is the diachronic unity of consciousness? We approach this question by positing three constraints aimed at capturing the way most subjects of experience would describe the continuity of their conscious experience. *Second Step*: What necessary conditions must a self-representational account fulfill in order to explain the features described by these constraints? We argue that a self-representing process must be what we call a *self-embedding*. What we take to be crucial here is that there must be a difference between the grain sizes at which contents are represented and self-represented by this process. *Third Step:* How can a representational system become a self-representational system fulfilling the conditions stated in the second step? We posit a new theoretical principle, the *Principle of Globalization by Representational Fusion*. If representational vehicle with a new content that can be regarded as a *global* self-representation of the whole system. We do not claim that only a self-representational account could explain the diachronic unity of consciousness. Rather, we wish to show that it is a viable option that can shed more light on the temporal structure of consciousness than phenomenological descriptions alone. Ideally, this analysis could also be a starting point for developing non-representational characterizations of what we describe as a *self-embedding* process.

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#### Confuse Your Illusion: Feedback To Early Visual Cortex Contributes To Perceptual Completion.

Martijn E. Wokke, University of Amsterdam, the Netherlands Annelinde R.E. Vandenbroucke, University of Amsterdam, the Netherlands H. Steven Scholte, University of Amsterdam, the Netherlands Victor A.F. Lamme, University of Amsterdam, the Netherlands

# July 4<sup>th</sup>, 11:00-13:00: Concurrent Session 3.

A striking example of the constructive nature of visual perception is how our visual system completes contours of occluded objects. To date, it still remains unclear whether perceptual completion emerges during early stages of visual processing or if higher-level mechanisms are necessary. To find out at what level of the visual hierarchy perceptual completion emerges, we used transcranial magnetic stimulation to disrupt signaling in areas V1/V2 and

in the lateral occipital area (LO) at different moments in time while participants performed a Kanizsa-type illusory figure discrimination task. Results show that both areas V1/V2 and higher-level visual area LO are critically involved in perceptual completion. Interestingly, the involvement of these areas seems to arise in an inverse hierarchal fashion, where the critical time window of areas V1/V2 follows that of LO. These results are in line with the growing amount of evidence that feedback to V1/V2 contributes to perceptual completion. Furthermore, our findings suggest that TMS did not so much disrupted processing of the physical stimulus characteristics present in the scene but rather seemed to interfere with mechanisms responsible for creating a conscious experience of the illusory figure.

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#### Is Consciousness Graded, Dichotomous, Or Both?

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# July 4<sup>th</sup>, 11:00-13:00: Concurrent Session 3.

This study aims to shed light on an ongoing debate in the visual awareness literature: is our conscious experience graded or binary? The Recurrent Processing Hypothesis assumes a graded transition (i.e., a linear relationship between stimulus duration and visibility). The Global Workspace Theory assumes an all-or-none transition (i.e., a non-linear enhancement of visibility once stimulus duration is sufficient). Here we intend to integrate the two theories and their supporting evidence, by controlling for the "level of processing" of the presented stimuli, a factor that was overlooked so far. To this end, we used a masked priming paradigm. Participants expressed either low-level judgements (color naming) or high-level judgements (number categorization) on the very same colored number stimuli. These were presented for 10 ms up to 80 ms. On every trial, participants were also asked to assess the subjective visibility of the stimulus in four steps, by means of the Perceptual Awareness Scale (ranging from "not seen" over "weak glimpse" and "almost clear image" to "clear image"). Non-linear models were fitted to the accuracy and the visibility data, respectively. We predicted and observed a graded access to consciousness in the low-level task, but a dichotomous access in the high-level task. This suggests that the Recurrent Processing Hypothesis and the Global Workspace Theory can be integrated if the level of processing is taken into account. We speculate that a more graded local workspace is sufficient for conscious access in low-level tasks, whereas in highlevel tasks this requires an all-or-none global workspace.

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#### Dreaming, Embodiment, and the Phenomenology of Presence: Limitations and Conceptual Clarifications for **Virtual Reality Research**

Jennifer M. Windt, Johannes Gutenberg University, Germany

# July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Dreams are often described as a form of virtual reality because they give rise to the experience of presence of a virtual self in a virtual world. As such, they offer an important contrast condition for the subjective experience of presence in standard wake states, but also for virtual reality (VR) research, which depends on the experimental induction of presence. An important limitation of VR research, however, is that while virtual environments can induce a sense of self-location and even of self-identification with a virtual body, the ongoing flow of bodily experience remains firmly anchored in the participant's physical body. Consequently, VR research introduces a confound between two different types of embodiment, namely phenomenal and functional embodiment. By contrast, in dreams, the phenomenology of embodiment arises in a state of near-complete functional disembodiment, because the subjectively experienced dream body is only weakly constrained, if at all, by realbody inputs. In some dreams, self-location even arises in a state of phenomenal disembodiment, in which the dreamer experiences herself as located in the dream world whilst lacking bodily experience altogether. These dreams afford an example of pure presence, namely the experience of self-location within a spatiotemporal reference frame, thus extending the scope of findings from VR research. Consequently, dreams afford a unique opportunity for studying the relationship between phenomenal and functional (dis-)embodiment, and presence, suggesting that neither the simulation of realistic sensorimotor contingencies, as sometimes suggested in VR research, nor the experience of phenomenal embodiment are necessary for the emergence of presence.

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### Can Voluntary Saccadic Eye Movements Cause Compression Of Time?

Yoshiko Yabe, Kochi University of Technology, Japan Hiroaki Shigemasu, Kochi University of Technology, Japan

# *July* 4<sup>th</sup>, 14:00-16:00: *Poster Session* 1.

We investigated whether perceived duration is compressed by the execution of a voluntary saccade. To this end, we presented two brief bars that marked intervals between 40 and 160ms and asked participants to judge their order during automatic saccade, voluntary saccade, or fixation. As Morrone et al. (2005) reported, we found a compression of perceived duration during automatic saccade. However, we did not find such compressions during voluntary saccade as well as during fixation. We also recorded eye movements and found that the bars presented especially just before or after (50 - 120ms) automatic saccades were seen in reversed order. Our results suggest that the neural mechanisms underlying the automaticity of saccadic eye movements and the compression and the reversal of time perception are interrelated.

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#### Disturbance of Self as Compensation for Adaptive Behavior

Yuichi Yamashita, RIKEN Brain Science Institute, Japan Jun Tani, RIKEN Brain Science Institute, Japan

# July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Orderly communication in hierarchically-organized neural systems is essential for flexible and adaptive human behavior, while disturbances in network interactions resulting in imbalanced cognitive signaling may account for psychiatric symptoms such as disturbance of self, a core symptom of schizophrenia. In this study, we hypothesize that disturbance of self may arise from impairment of the forward model originating in functional disconnection in hierarchical networks. To test this hypothesis, we monitored the goal-oriented behavior of a humanoid robot driven by a hierarchical neural network. The result demonstrates that, in normal condition, not only top-down forward dynamics, but also bottom-up modulation processes driven by prediction error are essential mechanisms for flexible adaptation to unpredictable changes in environment. In the simulation of disconnection deficits hypothesized in schizophrenia, mild perturbations in connectivity resulted in the spontaneous appearance of uncompensated prediction errors and altered interactions within the network without any external changes in behavior. Based on this finding, we propose that despite no external sensory perturbation, such covert fictive prediction error signals could signal equivalently to normally-generated prediction error signals and, in principle, be indistinguishable by the patient to prediction errors generated from real external sensory stimuli. The results raise the possibility that uncompensated prediction error signals may induce the fictive sensations and agency that patients' actions are affected by some outside force, termed a disturbance of self. Our results demonstrate that covert altered subjective experiences in schizophrenia can be understood as maladaptive processes induced by disconnection between levels responsible for goal-oriented behavior in hierarchical networks.

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#### **Causal Status of Essential Thoughts for Perception**

# Yuan-chieh Yang, National Yang-Ming University, Taiwan

# July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

In this paper, I will discuss the causal status of the essential thought for perception and whether we can give a functional characterization to it. What I term the essential thought for perception is one's thought identifying a particular subject who has a certain mental state or a certain body/physical condition and this thought is essential for one to be aware of one's own perceptual states or to take actions. For example, John Perry (1979) has argued that an "I"-thought, a thought having the first-person pronoun in its content, is essential for one's actions. Furthermore, by showing the separable relationship between one's introspected perceptual state and mental ownership, some empirical studies, such as thought identifying a different subject from the subject having the thought can be the essential thought. Instead, one's thought identifying a different subject for perception, Mellor (1988) has tried to give functional characterization to "I"-thoughts. He thinks that the causal contiguity can determine the subject of that belief without assuming any internal representation of the self. However, the empirical cases show a recognizing process about mental ownership which Mellor denies. Therefore, I will refute Mellor's argument and argue that although the essential thought for perception has a causal impact on perceptual states; it cannot be given a functional characterization. Finally, I will introduce the level/order distinction to explain the causal status of essential thoughts for perceptual states; it cannot be given a functional characterization. Finally, I will introduce the level/order distinction to explain the causal status of essential thoughts for perceptual states; it cannot be given a functional characterization. Finally, I will introduce the level/order distinction to explain the causal status of essential thoughts for perception.

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#### **Emotion and Time Perception**

#### Leung Ka Yeung, National Yang Ming University, Taiwan

# July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

It is common for us to feel time goes by quickly when we are happy, and time seems to drag when we are not happy. However, why the time is more frequently perceived in negative emotions? In this paper, I'm going to find out the reason. First, I will point out that the relation between different kinds of emotion and the time perception is not clear. Although the anterior insular cortex (AIC) and the anterior cingulate cortex (ACC) are the common activated regions shared by the experience of emotion and time perception, the activation of AIC and ACC cannot figure out how emotions affect the time perception. To explain how different kinds of emotion affect time perception, I think the role of cognitive demands and the attention is very important. It is because many studies show that the time perception cannot be isolated from cognitive demands. Besides, the attention is always driven by positive and negative emotions. And, the emotional systems evaluate the stimuli according to cognitive demands. When we are engaged in positive emotions, the reward system of emotion drives the attention to a permanent target. Attention to the temporal demand decreases and time is not perceived frequently. When we are engaged in negative emotions, the warning system of emotion drives the attention instinctually to cognitive controls. Our attention then focus on the reaction of our own with the environment, attention on temporal demand increases and time is perceived more frequently.

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#### Saccadic Eye Movement in Blindsight

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#### Shiori Amemiya, University of Tokyo, Japan

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## July 4<sup>th</sup>, 14:00-16:00: Poster Session 1.

We have previously shown that monkeys with a unilateral lesion in the primary visual cortex (V1) exhibited similar behaviors to human blindsight and that the V1 lesion affected not only vision but also saccadic eye movements (Yoshida et. al. 2008). Here we examined whether this is true for a human blindsight subject. The subject (male, in twenties) has damage in the right V1 but, in a key press task, he can discriminate the position of a moving gabor patch in his affected hemifield, in a 2afc condition (>90% correct). According to his report, he has no awareness of the shape and texture of the stimulus. Then the subject was tested with the visually guided saccade task in which he made a saccade to the same stimulus as that used in the key press task. The performance of localization was also good (>90% correct) but the end points of saccades tended to fall short of the actual stimulus position. Such tendency was not found in the saccades to the normal hemifield and in those of age-matched control subjects (n=4). The subject was also tested with a memory-guided saccade task in which the subject memorized the position of the stimulus for 2 seconds before making saccades. The performance was higher than the chance level (>90% correct), which is consistent with our previous finding that the blindsight monkeys maintain short-term spatial memory (Takaura et. al. 2011). These results support the view that blindsight in human and monkey share the same neuronal mechanism.

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#### Smelling Phenomenal: Rethinking the Distinction between Access and Phenomenal Consciousness.

#### Benjamin D. Young, City University of New York, USA

# July 6<sup>th</sup>, 11:00-13:00: Concurrent Session 4.

Olfaction suggests a new treatment of phenomenal-consciousness and awareness that questions the viability of Block's distinction between access and phenomenal consciousness. Block (1995) argues that the concept of consciousness is not a cluster concept containing different kinds of relevantly similar concepts but a mongrel containing different kinds of states, such as access-consciousness and phenomenal-consciousness (1993, 1995, 2001, 2007, 2008, 2009, 2011). However, the difference between these kinds of consciousness has been challenged as conceptually ambiguous (Rosenthal, 2002, 2007, 2009, and 2010) and incapable of scientific investigation (Kouider et al., 2012). Furthermore, empirical evidence shows that olfactory phenomenal-consciousness is necessarily constitutive of conscious awareness, thereby falsifying Block's claimed double dissociation of phenomenal and access consciousness. Evidence that olfactory sensory states have a qualitatively character in the absence of awareness derives from research on blind smell (Schwartz, 1994, 2000; Sobel, 1999), mate selection (Beauchamp et al., 1985; Jacob et al., 2002; Ober, et al., 1997; Wedekind et al., 1995; Yamazaki et al., 1979; Yamaguchi et al., 1981; Ehman, et al., 2001), the selection of social preference for social interaction and acquaintances (Herz &

Schooler,2002; Jacob et al.,2002; Li et al.,2007), as well as the role of olfactory deficits in causing affective disorders (Deems, et al.,1991; Miwa et al.,2001). Furthermore, evidence that olfactory awareness is always phenomenally conscious derives from the sniffing (Bensafi et al., 2003) and cortical activation patterns (Bensafi et al., 2007; Rinck et al., 2009) during olfactory imagery experiments (Algom & Cain, 1991; Stevenson et al., 2005). Olfactory consciousness provides a new treatment of Block's distinction that is conceptually unambiguous and scientifically verifiable

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# A Formalized Naturalization of Intentionality in the Sense of 'Aboutness'

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# July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Intentionality is considered to be a central component of consciousness. One core component of intentionality is the capacity of a physical signal to be 'about' (i.e., to represent) a different physical signal with the non-physical property that the signal's content may be 'wrong'. Here, I present a formalized framework which specifies how the content of a representation can be naturalistically determined and how normativity (i.e., the correctness of content) can be defined without leaving the realm of physical descriptions.

The core component of the framework is to consider the fitness of an organism, not only in general terms, but in terms of how well different physically equally possible combinations of system input and responses fit to each other. Foe instance, the possible combinations between environmental states of predator or food with possible responses hiding or eating are all physically possible but differ in their fitness value.

Using a control theoretic formulation of the problem, it is possible to formally define indicative and imperative content. In qualitative terms, determining the content of a signal requires observing the system response *r* to a specific state of the environment, *alpha*. Signals within the organism caused by state *alpha* then can be assigned that state of the world *alpha*\* as content, for which *r* would have been optimal. The signals content *alpha*\* then can be identical to the world's state *alpha*, but it can also differ. The presented framework grounds the usage of representations in empirical theories on a naturalistic foundation.

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# **Unconscious Activation of Task-Sets without Conscious Preparation**

Fanzhi Anita Zhou, University of Cambridge, UK Greg Davis, University of Cambridge, UK

# *July* 4<sup>th</sup>, 14:00-16:00: *Poster Session* 1.

Converging evidence from unconscious priming studies has challenged the view that conscious processes play any major role in human choices. However, one major limitation in these studies is that the associations between unconscious prime stimuli and tasks had been consciously and voluntarily set up by either explicit task instructions or prior conscious learning. Therefore, a set of three experiments involving a gambling task was conducted to establish clear influences of unconscious stimuli in strategic choice behaviours. A learning phase in which associations between two arbitrary shapes and two tasks was established unconsciously without participants ever consciously seeing such stimuli or being explicitly aware of the associations between them and the tasks. In a later test phase, these shapes were presented unconsciously to assess their influence in participants' task performances. It was found that an unconscious prime stimulus could increase number of sensible bets when it was previously associated with calculating risks. Such finding demonstrated that choice behaviours could be affected by unconsciously perceived stimuli even when participants were not voluntarily set up to respond to them. The later two experiments in the set assessed whether conscious perception of prime stimuli might prevent unconscious control of strategic choices, in which four conscious trials were added to the test phase prior to unconscious test trials. In these four additional conscious trials, stimuli presented as unconscious primes were presented consciously. It was found that even minimal conscious perception of unconscious prime stimuli could eliminate their unconscious influences.

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# A Cortico-Thalamic Model of Consciousness Bias

## **Riccardo Zucca**, Universitat Pompeu Fabra, Spain **Paul Verschure**, Universitat Pompeu Fabra, ICREA, Spain

# July 5<sup>th</sup>, 14:00-16:00: Poster Session 2.

Our brain largely relies on implicit forms of information processing as it generates the stream of consciousness and guides our actions in the world. Conscious and unconscious factors are closely coupled and can be seen as complementary since unconscious processing can be sensitive to regularities within signals prior to conscious awareness, suggesting that the content of consciousness can be biased by unconscious factors. In the context of the Distributed Adaptive Control (DAC) framework, we previously developed different probabilistic models of perception and attention that include bottom-up and modulatory top-down effects in defining an anticipatory gate to restrict the prediction of future stimuli. We hypothesize that the injection of unconscious information at the border of this anticipatory gate could lead to a re-organization of perception and cognition by modifying sensory expectations. A plausible neuronal substrate for this top-down attentional mechanism is the loop involving prefrontal cortical areas and the thalamus (given the widespread projections to the inhibitory thalamic reticular nuclei) suggesting a modulatory role of the PFC at an early stage of sensory processing through the thalamus. The thalamus is also responsible for many aspects of behaviour, from consciousness to perception, learning and cognition and has a profound influence on cortical states. Here, building on an initial model of thalamo-cortical dysrhytmia we propose a neuronal model based on the anatomical and physiological properties of the corticothalamic loop where the violation of expectation caused by stimulating the border of the anticipatory gate can induce changes in the specific sensory nuclei of the thalamus that are then reflected in sensory processing streams that in turn feed higher cortical areas.

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# **Associated Events**



# June 30th 2012 at the Brighton Corn Exchange

**State of Mind** is a one-day public Expo interactively showcasing the latest developments in the new science of consciousness. Taking place just before the academic meeting of the association for the scientific study of consciousness (ASSC16), the Expo will form a key part of a citywide celebration of consciousness science, all compered by Sussex University's Sackler Centre for Consciousness Science.

The Expo, hosted in central Brighton at the magnificent Corn Exchange complex, will feature an interactive showcase of new technologies that exploit and explore many aspects of consciousness, perception, and human experience. Exhibits will have a strong interactive component allowing you to be immersed in, and to learn about, different aspects of your own conscious experience and their biological basis. There will also be plentiful opportunities to talk with the scientists, technologists, and artists investigating consciousness from their many differing perspectives.

State of Mind will have a strong focus on the core theme of consciousness science, with exhibits covering topics such as: introspection, mind-bending visual illusions, striking scientific images of the brain, sensory substitution devices, impossible objects, myths, morphs and memes, virtual-reality environments, bio-feedback, eye-tracking, and much, much more.

Come and join in with a citywide celebration of consciousness science.

Everyone is welcome as long as they keep an open mind.

For more information visit <u>http://www.consciousnessexpo.co.uk/</u>





# Consciousness Salon – Exploring Hypnosis

# **Peter Naish**

# July 4th 2012 at the Latest Music Bar

It was not long ago that science was skeptical about hypnosis - it simply wasn't "real". However, recent research suggests that hypnosis actually produces changes in the brain; there is a reality that begins to explain why it has therapeutic value (and potential dangers). Hypnosis has always been fascinating to the general public; now the scientists are fascinated too, because it seems to help with unravelling that most fascinating topic of all - the nature of consciousness.

Peter Naish will set recent intriguing findings in context, and consider why some people are more



hypnotisable than others. Are they in some sense "more conscious" - or are they more vulnerable?

Peter Naish has long had an interest in hypnosis, and in a varied career, including research in academia, for the Home Office and for the Ministry of Defence, he has taken every opportunity either to research or to use hypnosis. He has discussed the subject on numerous TV and radio programmes, at home and abroad, given lectures on it at science festivals and serves as an expert witness in court cases involving hypnosis. He is currently Chair of Council of the British Society of Clinical and Academic Hypnosis, and is the President of the Section for Hypnosis and Psychosomatic Medicine, at the Royal Society of Medicine, of which he is a Fellow.

# Satellite Symposium

# Neuropsychiatry and Consciousness: Bringing Consciousness Science to the Clinic

# Saturday 7th July 2012

# Organizers:

- Dr Nick Medford (Brighton and Sussex Medical School),
- Ms Hazelle Woodhurst

**Venue:** Michael Chowen Lecture Theatre, (BSMS) Brighton & Sussex Medical School - Teaching Building (No **46** on map at bottom of page).

**Registration:** £30 for the full day - Note there is a capacity limit of 140 people.

# NOTE: Registration for this event is separate to general ASSC 16 registration.

**Summary:** Psychiatric disorders entail disturbances of first-person experience, such as altered mood or anomalous perceptions. To what extent can they be considered consciousness disorders? And what can theoretical approaches to consciousness gain from considering the mental and biological disturbances that are seen in clinical neurology? The disturbances that arise in neuropsychiatric disorders can provide clues to the underlying structure of conscious awareness itself. In this satellite symposium, a range of medical neuroscientists will address these issues, covering such topics as disturbances of volition, anomalies of self-representation, and the interaction of body and brain. Recommended for clinicians interested in consciousness science, and for consciousness scientists wishing to learn more about the functions and dysfunctions of consciousness.

# Program

9.15-9.30 Welcome and Introduction - Dr Nick Medford, Prof Hugo Critchley

9.30-10.30 Keynote lecture: 'The neuropsychiatry of core and extended consciousness' - Prof Adam Zeman

10.30-11.10 'Self-representation, neurovisceral phenotypes and anxiety' - Prof Hugo Critchley

11.10-11.30 Coffee

11.30-12.10 'Premonitory urges and sensory tics: is Tourette syndrome a pathology of consciousness?' - Dr Andrea Cavanna

12.10-12.50 'Psychogenic movement disorders: why and how' - Dr Valerie Voon

12.50-14.00 Lunch

14.00-14.40 'Selves unreal and divided: dissociation and psychosis'- Dr Nick Medford

14.40-15.20 'Body perception illusions in epilepsy'- Dr Lukas Heydrich
15.20-15.40 Coffee

15.40-16.20 'Hypnosis, Consciousness, and Dissociation'- Dr Quinton Deeley

16.20-17.00 'The role of the body in emotional experience'- Dr Neil Harrison

**Venue:** Michael Chowen Lecture Theatre, (BSMS) Brighton & Sussex Medical School - Teaching Building (No. **46)** on University of Sussex campus map. See link below.

## Travel:

If travelling from overseas or within the UK to the University of Sussex, Brighton and Sussex Medical School (BSMS)

http://www.sussex.ac.uk/aboutus/findus

# By Train:

If arriving by Train into Brighton please take a connecting train to Falmer Station for the University.

- Falmer Station: <u>http://www.nationalrail.co.uk/stations/FMR.html</u>
- National Rail Enquiries <u>http://www.nationalrail.co.uk/</u>

#### By Car

• Should you prefer to come by car, the closest car park to the Medical school is car park 3 in Biology Road, which is parallel to the BSMS Teaching Building. The medical school has long white steps at the front leading up to its entrance and will be signposted outside for the satellite symposium.

#### Ву Тахі

• Taxis are available at both Brighton and Lewes train stations and at many places in the centre of Brighton. It is about four miles (six kilometres) from central Brighton to the University. (There is no taxi service at Falmer station itself.)

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