



Association for the Scientific Study of Consciousness

9th Annual Meeting

June 24th to 27th, 2005
Pasadena, California



WELCOME

Welcome to the Ninth meeting of the Association for the Scientific Study of Consciousness.

The annual ASSC conferences provide a forum where the most recent developments in the scientific study of consciousness are presented and discussed. Following on the success of last year's member symposia, this year we sent out a call for proposals to the membership at large, for focussed symposia on relevant topics in consciousness research. This resulted in the pleasantly difficult task of selecting three proposals from the many received. The ones we chose introduce issues that have only been tangentially addressed at previous meetings. One symposium organized by Romi Nijhawan went on to spawn a satellite event devoted to problems of space and time in perception and action, which will be held on the Tuesday immediately following this meeting. We are very grateful to Romi for organizing this excellent addition to the program.

The Mind-Science Foundation (www.mindscience.org) has been active in supporting the establishment of a Science of Consciousness. They do so by virtue of an excellent and diverse range of scientific studies of consciousness via the auspices of the Tom Slick award. This year we invited a number of the recipients of this award to present their work in a special symposium.

Following on the success of last year's student night in Antwerp, a student committee was formed whose aim is to foster greater involvement of graduate students within the ASSC. A few of the initial fruits of this committee are evidenced at this meeting. A student social has been organized immediately after the poster session on Saturday (we thank Roberts and Company for generously sponsoring this event), and a new \$250 cash prize is being offered for the best student presentation to acknowledge and encourage new researchers.

The vast bulk of the program comes from member presentations. The sheer depth and quality of the proposals, evident in the abstracts in this book, is testimony to the vitality and breadth of this field.

This conference could not occur without the help of many individuals and institutions.

We would like to thank the Mind-Science Foundation and its Executive Director, Joseph Dial, for directly supporting this conference and making it possible to invite so many speakers from throughout the world.

Thanks to the California Institute of Technology for hosting this event.

Thanks for Moran Surf and Constanze Hofstoetter for setting up the web-portal at assc.caltech.edu/assc9, the database and dealing with the enormous amount of minor details that go into bringing more than 250 individuals from around the globe to one university.

Thanks to the Scientific Program Committee, composed of Ralph Adolphs, Tim Bayne, Christof Koch, David Leopold, Geraint Rees, Shinsuke Shimojo, Petra Stoerig and Patrick Wilken, which guided the content of ASSC9.

On behalf of the organizing committees and the ASSC Board,

Patrick Wilken, Magdeburg

and

Christof Koch, Pasadena

ASSC9 ORGANIZERS

Scientific Program Committee

- * Christof Koch, Caltech (Chair)
- * Ralph Adolphs, Caltech
- * Tim Bayne, Macquarie University
- * David Leopold, NIMH
- * Geraint Rees, University College London
- * Shinsuke Shimojo, Caltech
- * Petra Stoerig, Heinrich-Heine-University
- * Patrick Wilken, Otto von Guericke University

Local Organizing Committee

- * Christof Koch, Caltech (Chair)
- * Constanze Hofstoetter, Caltech
- * Moran Surf, Caltech
- * Patrick Wilken, Otto von Guericke University

SCHEDULE

Friday, June 24, 2005

9:30-12:30 MORNING TUTORIALS

- * Ralph Adolphs: Emotion, feeling and the brain.
- * Alex Maier & Melanie Wilke: Investigating neuronal correlates of conscious visual perception.
- * Thomas Metzinger & Stephan Schleim: Emerging ethical issues in consciousness research: From neuroethics to consciousness ethics.

12.30-14:00 LUNCH

14:00-17:00 AFTERNOON TUTORIALS

- * Bruno Breitmeyer & Vince di Lollo: Psychophysical methods for rendering stimuli invisible.
- * C. Richard Chapman: The feeling of hurt: A brain-body perspective on pain.
- * Robert Kentrige: Color and consciousness.
- * Walter Freeman: Temporal and spatial analysis of electroencephalographic signals.

17:30-17:45: WELCOME

17:45-18:45 PRESIDENTIAL ADDRESS

- * Stanislas Dehaene: Timing conscious access.

18:45-19:45: 2005 WILLIAM JAMES PRIZE SPEAKER

19:30 OPENING RECEPTION

Saturday, June 25, 2005

9:00-12:30 Plenary Symposium 1: 2004 TOM SLICK RESEARCH AWARD IN CONSCIOUSNESS

- * Susan Greenfield: The neuroscience of consciousness.
- * Christof Koch: Tracking the hemodynamic footsteps of awareness in visual cortex.

10:15-10:45 Coffee Break

- * Fred Gage: Experience-dependent modification of dentate gyrus through adult neurogenesis.
- * Allan Hobson: The brain basis of differences between the waking and dreaming states of consciousness.
- * Steven Laureys: Wakefulness without awareness: Lessons from Terri Schiavo and other victims of the vegetative state.

12:30-14:00 Lunch

14:00-16:00 CONCURRENT SESSIONS

1.1: NCC 1

- * Giedrius Buracas: Awareness as validation of prediction.
- * Toby Collins: An in vitro model for consciousness?
- * Lucia Melloni: Phase synchronization but not gamma oscillations correlates with conscious perception.
- * Kristy Sundberg: Neural mechanisms underlying a motion-dependent distortion of retinotopy in Area V4

1.2: PHILOSOPHY 1

- * Eric Schwitzgebel: Experience without attention?
- * Colin Klein: An imperative theory of pain.
- * Josh Weisberg: A limited defense of the ability hypothesis.
- * Brian Glenney: Consciousness and crossmodal integration.

1.3: IMPLICIT PROCESSING

- * Jonathan Smallwood: Reaction time and meta-awareness: your hands reveal what your mind doesn't know.

- * Arnaud Delorme: Neural dynamics of thought-full versus thought-free responses in orbitofrontal cortex.
- * Michael Snodgrass: On the fate of negative emotional stimuli: levels of (un)consciousness mediate vigilance vs. defense.
- * Ahmad Sohrabi: An fMRI study of conscious and unconscious priming in a line length comparison task: The role of conscious conflict monitoring and illusion.

16:00-16:30 Coffee Break

16:30-17:30 KEYNOTE LECTURE

- * Derek Denton: Primal emotion, instinct and the dawning of consciousness.

17:30-20:00 POSTER SESSION (see end of booklet)

20:00 GRADUATE STUDENT SOCIAL

Sunday, June 26

9:00-12:30 Plenary Symposium 2: VISUAL AFTEREFFECTS AND THE NEURAL CORRELATES OF CONSCIOUSNESS

- * Randolph Blake: Visual aftereffects and the neural correlates of consciousness.
- * Geoffrey Boynton: Perceptual deterioration.

10:30-11:00 Coffee Break

- * David Leopold: Visual aftereffects to simple and complex shapes.
- * Shinsuke Shimojo: Visibility, gaze specificity, and crossmodal synchrony assessed by aftereffect.

12:30-14:00 Lunch

14:00-16:00 CONCURRENT SESSIONS

2.1: ATTENTION

- * Ran Carmi: Attention deployment in a changing world - from amnesia to memory and back.
- * Nao Tsuchiya: Awareness and attention are different: Study of aftereffects produced by invisible stimulus.
- * Mark Stokes: Controlling the contents of visual consciousness: Mechanisms of competition and selection revealed by 'virtual lesions' of human parietal cortex.
- * Laurent Itti: Visual salience facilitates entry into conscious scene representation.

2.2: SELF

- * Tim Bayne: Consciousness and attention in the split-brain.
- * Roblin Meeks: You are not here: Locating the self in the brain.
- * Uriah Kriegel: No consciousness without self-consciousness: The empirical argument.
- * Henrik Ehrsson: Activity in the premotor cortex reflects the feeling of ownership of a limb.

2.3: TEMPORALITY

- * Gerrit Maus: Transient signals mask extrapolated position information of moving objects.
- * David Eagleman: Illusory reversals in the timing of actions and sensations: when can effect precede cause, and why?
- * Ryota Kanai: Visual motion dilates the time.
- * Rufin VanRullen: The temporal structure of visual perception: Insights from an illusion of reversed motion.

16:00-16:30 Coffee Break

16:30-17:30 KEYNOTE LECTURE

- * Jean-Pierre Changeux: Do mice have consciousness?

17:30-19:30 Plenary Symposium 3: PHILOSOPHY, PSYCHOPHYSICS AND NEUROSCIENCE OF SPACE AND TIME

- * Stanley Klein: Philosophy, physics and psychology in Libet's subjective time experiments

- * David Burr: Saccades cause relativistic misperception of time as well as space.
- * Romi Nijhawan: Motor space, visual space and the flash-lag effect.

20:30 CONFERENCE DINNER

Monday, June 27

9:00-10:00 KEYNOTE LECTURE

- * Giulio Tononi: An information integration theory of consciousness.

10:00-10:30 Coffee Break

10:30-12:30 Plenary Symposium 4: HYPNOSIS AND THE DIVISION OF CONSCIOUSNESS AND COGNITIVE CONTROL

- * Graham Jamieson: Hypnotic paradoxes of consciousness and control.
- * Richard Brown: Two levels of attention and awareness in the generation of hypnotic phenomena.
- * Zoltan Dienes: Cold control theory of hypnosis.

12:30-14:00 Lunch

14:00-16:00 CONCURRENT SESSIONS

3.1: CAPACITY LIMITS AND ATTENTION

- * Andreas Engel: Neural correlates of conscious perception in the attentional blink.
- * Nelson Cowan: What is the capacity limit of consciousness awareness?
- * Constanze Hofstoetter: Temporal aspects of change blindness and detection: stimulus- and response-locked EEG components of perceived and non-perceived changes.
- * Cédric Laloyaux: Change blindness and implicit change detection: New evidence.

3.2: PHILOSOPHY 2

- * Andrew Brook: The Representational basis of consciousness.
- * Marius Dumitru: The quale of a thought.
- * David Pitt: Meaning psychologism.
- * Brian Felsen: The conscious room.

3.3: NCC 2

- * Simone Wehling: Alteration of visual perception by direct influence from auditory cortex to visual cortex.
- * Joel Pearson: Suppressed patterns alter vision during binocular rivalry.
- * Olivia Carter: The brainstem and binocular rivalry: The role of serotonin in arousing perceptual switching.
- * Axel Kohler: Neural correlates of a motion illusion in primary visual cortex.

16:00-16:30 Coffee Break

16:30-17:30 KEYNOTE LECTURE

- * John Searle: Dualism reconsidered.

17:30-17:45 ANNOUNCEMENT OF STUDENT PRIZE

18:30 ASSC9 AFTER DRINKS

Tuesday, June 28

SATELLITE MEETING: PROBLEMS OF SPACE AND TIME IN PERCEPTION AND ACTION

8:55-9:00: Introduction

9:00-12:00 ORAL SESSION

- * John Schlag: What time is it?

- * Bruce Bridgeman: Space constancy: The gradual dissolution of perceptual compensation.
- * Stuart Anstis: Illusions of time, space and motion: Flash-lag meets chopsticks.
- * Bernard Baars: Parietal spatial cells have a contextual relationship to conscious visual features, objects and events.

10:40-11:00 Coffee

- * Alan Johnston: Spatially localized distortions of perceived duration.
- * Laurence Harris: A three-stage mechanism for simultaneity constancy.
- * Marcus Baldo: A unifying perspective for the flash-lag effect.

12:00-14:30 Lunch and SATELLITE POSTER SESSION (see end of booklet)

14:30-18:00 ORAL SESSION

- * Christof Koch: Attention-driven discrete sampling of motion perception.
- * Alva Noë: A puzzle about time and perception.
- * Romi Nijhawan: Flash-lag anisotropy for visual, motor and tactile movement.

15:45-16:30 Coffee

- * Dirk Jancke: Correlates of motion illusion in early visual cortex: voltage-sensitive dye imaging of cortical space in real-time.
- * Igor Aleksander: Necker flips in time as an indication of the mechanisms of visual consciousness.
- * Kielan Yarrow: Antedating of saccade targets.
- * Jamshid Ghajar: The attentional time frame of "now".

18:00-19:00 SPECIAL KEYNOTE

- * Richard Andersen: Cognitive neural prosthetics.

19:00-21:30: DINNER AT AVERY HOUSE (No Host)

CONFERENCE ABSTRACTS

Title:
Emotion, Feeling and the Brain

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Session:
Friday, June 24, 9:30-12:30: Morning Tutorial

Abstract:
Emotion and feeling figure prominently in everyday life, as well as in pathological states. Yet philosophical and psychological accounts have had difficulty providing explanations of these phenomena. In particular, they have had difficulty situating them within dominant accounts of representation and cognition. Recent findings from cognitive neuroscience provide a wealth of data that support a new view, according to which emotions and feelings represent the value of stimuli in a common currency of the survival and homeostasis-related states of our bodies. This new picture traces a common thread from writers such as William James to Antonio Damasio and Jesse Prinz. The tutorial will sandwich a review of the current state of the neuroscience between the theoretical questions and accounts.

Title:
Implicit Attitude Change: Can Do-It-Yourself Debiasing work?

Authors:

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Session:
Saturday, June 25, 17:30-20:00: Poster Session

Abstract:
Implicit attitudes, by their very nature, were once assumed to be unreceptive to change via consciously-based control strategies. Yet in recent years, evidence has built a strong case for various ways in which conscious thoughts and feelings can influence less conscious representations. In a series of studies, we explored the degree to which unconscious attitudes can come under conscious control with the help of mental concentration techniques. In Studies 1 and 2, we found that undergraduate participants were able to reduce pre-existing implicit biases after as little as a 10-minute period during which they concentrated on the positive aspects of a disfavored group or felt compassion toward that target group. Furthermore, in Study 2, we demonstrated a reversal such that participants could undo the effects of bias reduction by subsequently concentrating on the negative aspects of the target group. In Study 3, we created biased attitudes toward novel groups and were then able to both reverse and exacerbate that bias with the help of brief concentration tasks. The patterns obtained in Study 3 were strengthened when the data were selected for those participants who reported some experience with meditative practice. Based on such results, we sought experts in contemplative practice for Studies 4 and 5. In South India, we conducted studies with both novice and advanced yoga practitioners as well as transcendental meditators. Yoga practice, but not TM, was found to be successful at reducing even the strongest implicit attitudes (involving nationality, religion, and caste) after a mere 5 minutes of directed concentration. Such change stood in stark contrast to the data from Indian controls, who demonstrated reliably high levels of implicit

bias over several weeks of repeated testing. Interestingly, yoga practitioners and controls showed similar levels of bias at baseline, with yoga practitioners being able to reduce implicit bias when asked to employ mental control strategies.

Title:
Correlates of Motion Illusion in Early Visual Cortex: Voltage-Sensitive Dye Imaging of Cortical Space in Real-Time

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Session:
Tuesday, June 28, 14:30-19:00: Satellite Oral Session

Abstract:
Visual illusions reveal discrepancies between the outside physical world and inner re-presentations mediating subjective sensations. One example is the "line-motion illusion": After briefly presenting a small stationary spot of light, a long stationary bar is shown. Surprisingly, the bar is not perceived at once but appears to be drawn-out from the location of the preceding spot, thus evoking sensation of motion although in the outside world real motion has never occurred. We used optical imaging of voltage-sensitive dyes (VSDI) in area 18 of the anaesthetized cat in order to visualize cortical representations of either briefly flashed or moving stimuli. This new technique detects changes in membrane potentials of neural populations with high spatial and temporal resolutions, thus monitoring dynamic patterns of evoked activity across the cortical surface. We found that a flashed stimulus evoked low level subthreshold activity that spread out far beyond the retinotopic cortical location being stimulated. In contrast, high

suprathreshold activity stayed local, thus representing faithfully stimulus location in visual space. In the "line-motion" condition however, the subthreshold component was triggered by the bar stimulus leading to a propagating "wave front" of suprathreshold activity that moved at a constant speed away from the pre-cued location. Importantly, real moving stimuli resulted in almost identical activity patterns. We conclude that dependent on stimulus history, ongoing subthreshold activity can be boosted above threshold shaping the emergence of implicit stimulus properties correlating with perception.

Title:
A depictive extension to enactive theories of perceptual consciousness

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Session:
Saturday, June 25, 17:30-20:00: Poster Session

Abstract:
Enactive theories: what is missing? O'Regan and Noë's 2001 enactive approach to perceptual consciousness (mainly exercised by them in vision) shuns inner representation and solves puzzles in inattentional and change blindness. However it is lacking in respect of imaginational drive in the organism. It also leaves some doubt about the physical realisability of a scheme which consists in attending to the sensorimotor contingency which they maintain is the model of having

a phenomenological sensation. We show that by adding biologically plausible depictive machinery (Aleksander I.: *The World in my Mind, my Mind in the World*. Imprint Academic, Exeter, 2005) to the sensorimotor machine, the missing features are reinstated while the explanatory power of enactment is retained. The world is your model: false! Representation is avoided in the enactive approach through the assumption that any referential stimulus required by the organism is provided by the world. It has been pointed out elsewhere [2] that a part of our ability to act comes from the way we plan and envisage the outcome of our plans in the absence of a world stimulus. That is, we act on our imagination. This requires internal models in addition to the world. Semi-Formally: the enactive model S is a world available to the organism with $s(a)t$ an attended element of this world at time t . In the enactive model the rules of sensorimotor contingency ($R1, R2..$) map $Rj: s(a)t \rightarrow (m)t$ where $(m)t$ is a muscular action for which 'the world' delivers $s(a)(t+1)$. Given that the rules are appropriate, the organism will purposively explore S and, by attending to this process it builds a conscious awareness S' of S . Inattention and change blindness are explained in terms of the difference between S and S' . There is no explanation of 'attending to this process' and there is no action if S is not available. Semi-Formally: the depictive model In addition to the enactive model, the depictive model carries out integrative storage of $(m)t, s(a)(t+1)$ pairs thus reconstructing S' . The function of attention is then to create records S'' (neural recursive network learning) of S' into the states of an 'imagination' automaton, which in the absence of S can plan and generate patterns of $(m)t$. Then the attentional process and imaginative actions become functionally explicit without losing the concept of an effective sensorimotor activity. Of course S'' is faithful to S' according to recursive net storage parameters. Evidence in neurology The superior colliculus is a good example of an enactive system that has rules that work on an internal, unconscious map. (Move to contrasts, changes and motion). But this generates $(m)t, s(a)(t+1)$ pairs as input to locking cells that can internally construct S' and act on it. It is known that attention is required to turn this into more or less enduring memory. Ongoing ... With digital simulation we have pursued several models of visual awareness and planning that contain both enactive areas and imaginal ones. Simulations of these will be demonstrated. We are currently working with reversible

images (e.g. the Necker cube) to understand the breakpoint between imaginative and enactive mechanisms.

 Title:
 Emotions in volition: avoiding illusions

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Session:
 Saturday, June 25, 17:30-20:00: Poster Session

Abstract:
 Libet's discovery (Libet et al, 1983) of a neocortical 'readiness potential' associated with the spontaneous movement of a finger. As this happens approximately 350ms before the participant becomes conscious of willing the action, has led Wegner (2002) to develop an illusion-based hypothesis of volition founded on the existence of an unconscious cortical event which both controls a conscious sensation and the resulting action which the volitional organism mistakenly interprets as the action being caused by the sensation of volition. Here our addition to Libet and Wegner's reasoning is that choices in an act of volition involve emotional evaluation We have developed (in our Neural Representation Modelling language) a comprehensive mechanistic model which tests a non-illusory hypothesis which still accords with Libet's and respects a group of basic synthetic phenomenology (depictive) rules for conscious mechanisms (Aleksander and Dunmall, Jour. Conc. Studies, 2003 [A&D]). The hypothesis is developed as follows. For an organism with a 'brain' (real, virtual or constructed) to have a sensation of free will 1. There

exist areas of the 'brain' that support consciousness through having the depictive property (axioms 1 & 2 in [A&D]) 2. There exists in the 'brain' a depictive (sensation-generating) mechanism for cycling through the choices prompted by a perceived external event or an internally imagined event (Axioms 2,4 and 5 in [A&D]) 3. Cycling through the states in 2 includes memories of emotions associated with the choice states (Axioms 4 and 5 in [A&D]). 4. There exists in the brain a nondepictive evaluational mechanism (nonconscious therefore) that accumulates 'wantedness' values for the emotions associated with each choice. When wantedness exceeds some threshold the current conscious choice state is translated into action. 5. As part of the evaluational mechanism, there exists a random process which adds to the wantedness values helping to resolve situations of conflict or lack of emotional value. 6. Through the depiction of the freezing of the cycling mechanism due to a wantedness trigger, there exists in the organism the sensation that action flows from a choice among alternative actions. Conditions 1 and 2 are postulates that are fundamental to our approach. Denying 3 requires a denial that emotions are involved in making choices. Such a denial would contradict common experience. 4, 5 and 6 are then the basis of the main hypothesis presented here and the novel contributions of this paper. Our supporting model will be presented. Conclusion: It is here implied that the unconscious activity of emotional evaluation precedes the conscious activity in 6 which precedes action. This is a normal causal sequence. Interestingly, Libet's experiment does not (to any significant extent, anyway) involve emotions where the general case above, does. This merely leaves 5 entirely to the random process and measurement as the 'readiness potential', the rest of the sequence remaining consistent with the caused sensation and action.

Title:
Necker Flips in Time as an Indication of the Mechanisms of Visual Consciousness

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Session:

Tuesday, June 28, 14:30-19:00: Satellite Oral Session

Abstract:

The perceived reversals in time of the Necker cube image have drawn modelling attention for 170 years. These models favour specific research modalities: peripheral eye movement vs. central processes, sensory channel fatigue vs. cognitive hypothesis building, neural dynamics vs. programmed rules and specific vs. hybrid systems (Toppino et al. Phys. Bull. 130, 5, 2004). Here we argue that these models are limited by their theoretical orientation and then show that a general 'depictive' architecture developed to explain visual consciousness (Aleksander and Dumall, Proc R. Soc. Lond B 267, 2000) (Aleksander, The World in my Mind, Exeter: Imprint Academic, 2005) generates reversals as a direct product of striving to depict the egocentric coordinates of objects and features of objects located in the world. This architecture is depictive because it integrates visual and positional information gathered from the unconscious activity of motor mechanisms. It is the latter which becomes ambiguous in the case of observing the Necker image and, being unconscious, underpins much of the surprise felt due to Necker reversals and our limited ability to control them consciously. It will be argued that the timing of the reversals is a useful investigative tool. The general architecture will be demonstrated and experimental work in progress discussed. In sum, the thrust of this paper is that classical divisions of theoretical orientation do not serve the cause of explaining Necker reversals. We use a general dynamic system model to show how mechanisms that normally depict an out-there world are made unstable by the Necker image and engender the sensation of reversals in time.

Title:
Cognitive Neural Prosthetics

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Session:
Tuesday, June 28, 14:30-19:00: Satellite Oral Session

Abstract:
Neural prosthetics are being developed to assist paralyzed patients by enabling them to operate machines with recordings of their own neural activity. Recent studies show that high level cognitive variables can be decoded from cortical activity in healthy monkeys. The animals are trained to move a cursor on a computer screen using the decoded neural signals without their making any overt movements. The cognitive signals include the goal and trajectory of the cursor movement and the expected reward for the completion of each trial. The goal and trajectory signals potentially can be used by paralyzed patients to operate computers, robots and vehicles and the expected value signals to assess the patients preferences, mood, and motivations.

Title:
Illusions of time, space and motion: Flash-lag meets Chopsticks

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Session:
Tuesday, June 28, 9:00-12:00: Satellite Oral Session

Abstract:
In the 'chopstick illusion' (Anstis 1990, 2003) a vertical and a horizontal line overlapped to form a cross, and each line moved along a separate clockwise circular path in counterphase, without changing orientation. The intersection of the lines moved counterclockwise, but it was wrongly perceived as rotating clockwise. This chopstick illusion reveals how moving objects are parsed, based upon the intrinsic and extrinsic terminators of lines viewed through apertures. We conclude that intersections were not parsed as objects, but instead the motion of the terminators (tips) propagated along the lines and was blindly assigned to the intersection. In the similar 'sliding rings illusion', we found that observers could use their eyes to track intersections only when these appeared rigid and not when they appeared to slide. Conclusion: smooth pursuit eye movements are under top-down control and are compelled to rely upon perceptual interpretation of objects. In the 'flash-lag' effect, a static object that is briefly flashed up next to a moving object appears to lag behind the moving object (Nijhawan, TICS 2004). We superimposed a flashed spot on a chopsticks intersection that appeared to be moving clockwise along a circular path but was actually moving counterclockwise. We found that the flash appeared displaced clockwise. This was appropriate to the physical, not the subjective direction of rotation, indicating that the flash-lag and the chopstick illusions co-exist without interacting. Probably the flash-lag occurs early in the visual system, before motion signals are parsed into moving objects.

Title:
A brain interpretation of visual consciousness: The view from Global Workspace Theory

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Session:
Saturday, June 25, 17:30-20:00: Poster Session

Abstract:
Global Workspace Theory (GWT), developed by Baars (1983, 1988, 1997, 2003) has become one of the better-known theoretical views of consciousness, with brain models by Dehaene et al and large-scale computational models by Franklin's group. GWT has been applied to the Frame Problem, related to Fodor's cognitive modularity (Shanahan & Baars, 2004). It provides an interpretation of parietal and prefrontal hypometabolism in four unconscious states (Baars et al, 2004). GWT has much in common with Gerald Edelman's Neural Darwinism, Tononi's Complexity model, Walter Schneider neural net architecture and the neurodynamic views of ER John and WJ Freeman. This paper presents a new brain interpretation of GWT in terms of the integration of visual features into unified percepts that emerges by visual area IT/TE (Sheinberg & Logothetis, 1994), contextual constraints by unconscious dorsal stream cells to define multimodal egocentric, allocentric, and sensorimotor space, and subsequent "broadcasting" or distribution of the integrated visual content to other regions, including hippocampus and prefrontal cortex (Baars, 2003). The three basic constructs of GWT, the global workspace, specialized input processors, and unconscious contextual constraints on conscious contents, all receive natural brain interpretations. Distinctive GW inputs may exist for the major senses as well as "vague" conscious contents, such as the feeling of mental effort, which may emerge in prefrontal and cingulate cortices. Walter Freeman's recent findings suggests that global distribution and/or integration may occur in order-of-magnitude 10 Hz hemisphere-wide events. These may correspond

to the 10 Hz cognitive cycles proposed by Franklin. Because sensory consciousness appears to be phylogenetically as old as mammals, and because GWT is basically a simple architecture, there may be functionally redundant brain substrates of GW functions, perhaps associated with different levels of mammalian brains. As Edelman & Gally (2003) have pointed out, such "degeneracy" is a highly conserved property of biological systems. Price & Friston (2003) have also applied the principle of degeneracy to the search for fMRI correlates of cognitive functions. There is evidence that it applies to consciousness. For example, graded lesioning of the brainstem reticular formation does not abolish the conscious state, while rapid lesioning does, as first shown by Moruzzi & Magoun (1949) (E.R. John, personal communication). Functional redundancy of the brain substrate of consciousness makes hypothesis testing more challenging, but not impossible. It suggests that multiple convergent sources of evidence are required to establish the brain events that support consciousness.

Title:
Parietal spatial cells have a contextual relationship to conscious visual features, objects and events

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Session:
Tuesday, June 28, 9:00-12:00: Satellite Oral Session

Abstract:
Global Workspace Theory (GWT) suggests that consciousness involves widespread distribution of integrated contents to many parts of the

brain. It has become better known in recent years because widespread brain activation has been repeatedly observed for conscious but not unconscious events. A number of scientists have therefore advanced GWT-like hypotheses. Convergent ideas come from neuroscience and cognitive science. One point that is rarely understood, however, is the GWT notion of "unconscious contextual constraints on conscious experiences." Such contextual influences are known in every domain of human cognition. Brain evidence, however, is rarely interpreted to reflect contextual processes. The parietal cortex contains egocentric, allocentric, and sensorimotor regions that appear to be unconscious in and of themselves. However, they profoundly shape conscious visual events, the details of which are known to depend on the ventral visual "what" stream. Parietal influence on the conscious emergence of visual events therefore provides a compelling case for brain-based contextual knowledge. Damage to the right parietal cortex is associated with anosognosia, the inability of patients to understand their disorder. That is not the case for ventral stream lesions. GWT suggests that contextual lesions cannot be understood, because they involve knowledge that is unconscious, though it profoundly shapes conscious events. There should therefore be a class of contextual brain regions where lesions give rise to very different symptoms than in "object-like" regions. A great deal of our knowledge of space, time, and executive function appears to be contextual in just this sense.

Title:
Implicit knowledge and affect in intuitive problem solving

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Session:
Saturday, June 25, 17:30-20:00: Poster Session

Abstract:
Presented studies concern affective and cognitive mechanisms of intuition. Intuition is regarded as a process involved in problem solving and social judgment that lack consciously available premises of the solutions. In modified dyads of triads task participants were exposed to two sets of three words each and asked to give a single association to each set. If no answer was given subjects were asked to determine which of the two sets of words had any solution. Previous studies showed that participants who cannot give a correct solution to a triad are nevertheless able to accurately point to the triad that does have one and thus indicated the operation of intuitive processes that result in judgment of coherence. Manipulating the affective valence of the solution words enabled testing the role of affect in such intuitive information processing. Initial results showed the more positive affective words were the more likely participants were to accurately verbalize them thus indicating the facilitating role of positive affect in intuitive judgment. We also argue that implicit learning results in the knowledge base that automatically affects intuitive judgment and decision making. However, according to current research intuition might not only involve direct automatic influence of implicitly gained knowledge but also its unconscious manipulation and transfer (i.e. implicit thinking). These hypotheses were tested in transitive rules learning task in which participants were exposed to a series of octagram pairs. Each pair embedded two different rules of transforming one octagram into the other. After learning permitted transitions participants were asked to judge whether new pairs conformed to the rules. They were tested for their ability to (a) generalize learned transitions, and (b) use new combinations of these transitions to assess well-formedness of new octagram pairs. The results confirmed that learning transition rules was effective. However, participants did not show any ability to extend their implicit knowledge about permitted transitions through its unconscious manipulation. This suggests that intuition involves direct and automatic influence of implicitly acquired

knowledge but not "implicit thinking" as unconscious manipulation of that knowledge.

Title:

A unifying perspective for the flash-lag effect

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Session:

Tuesday, June 28, 9:00-12:00: Satellite Oral Session

Abstract:

In the flash-lag effect (FLE) a moving object is perceived ahead of a stationary stimulus flashed in spatial alignment. Over the last ten years, several explanations have been proposed in order to account for the FLE and its dependence on a variety of psychophysical attributes. Romi Nijhawan, who unearthed this perceptual effect, originally proposed a mechanism of perceptual extrapolation of motion in order to explain the phenomenon. Other accounts have come into view since then, such as those grounded on differential latencies, perceptual postdiction and attentional modulation. Here I offer a unifying perspective, according to which those previous seemingly conflicting explanations are seen, in fact, as complementary descriptions of the same phenomenon. Computational simulations of a simple artificial neural network were able to reproduce the standard FLE and several related manifestations, such as its modulation by stimulus luminance, trajectory, priming and spatial predictability. This model, open to a close scrutiny, allows us to look inside its physiological mechanisms

and merge those different accounts into a unified conceptual framework.

Title:

Conclusions about free will based on Libet's work have ignored crucial issues of causal sufficiency and necessity

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Session:

Saturday, June 25, 17:30-20:00: Poster Session

Abstract:

In 1983 Libet, et al. famously reported that the readiness potential (RP) for a hand motion begins well before the participant reports having decided to move. This has generally been taken to imply that the action is initiated by the brain activities generating the RP and that the conscious decision to move is a latecomer in the process and has no causal role. This account of the results of the experiment assumes that the RP is both necessary and sufficient to produce the action. In the entire two decades of argument on this point there appears to be no consideration of testing the causal sufficiency and necessity of the RP or other putative components of action. The most common interpretation is therefore but one of several stories that fit the results. Other possible interpretations of the findings have not even been tested empirically, much less disconfirmed. I will describe the basic findings, explain the gaps in hypothesis testing, and discuss methods for testing causal sufficiency and necessity in this paradigm. These tests may have been ignored because it is not obvious how to test the hypotheses they address. It is hoped that the audience will actively

engage the issue, criticize the methods proposed and suggest other approaches. While these tests apply to a rather constrained experimental paradigm, conclusions drawn from it have been vast, radical, and sometimes hysterical. Commentators have argued that Libet's findings demonstrate conscious inefficacy, undermining the imputation of a person's responsibility for action and challenging the basis for moral systems. Wide social acceptance of these conclusions has been predicted to lead to outcomes ranging from a fundamental change in jurisprudence to the collapse of civil society. It would seem prudent to check the empirical support for our conclusions before we announce that the sky is falling.

Title:
Intentionality naturalized

Author:
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Session:
Saturday, June 25, 17:30-20:00: Poster Session

Abstract:
My goal is to try to understand the intentionality of consciousness from a naturalistic perspective. Central to the project is to track the development of human understanding of mental phenomena. My basic methodological assumption is that embodied agents, through their sensory-motor, affective, and cognitive activities directed at objects, engage in intentional relations with these objects. Furthermore, I assume that intentional relations can be viewed from a first- and a third-person perspective. What is called primary consciousness is the first-person perspective of the agent engaged in a current intentional

relation. While primary consciousness posits an implicit "subject" or "self," it is primarily oriented toward its "object." Acts of primary consciousness have only ephemeral existence, but when such acts are reflected upon by the agent (or observer) reflexive or secondary conscious knowledge of oneself (or other) as an embodied agent engaged in an intentional relation is constituted. In such reflexive acts of secondary consciousness, an integration of a first- and third-person perspective on the agent, whether self or other, is achieved. I show how these ideas relate to the understanding of intentional relations of self and other in human development. At around 6 months the infant begins to understand actions directed at objects, both of self and of other. But this understanding is limited to the object-directedness of the action, not of the agent as an actor engaged in the action. Around 10 months, infants can join with others in object directed activities that are not merely actions but are also referential, or representational of the object. At this time, self and other are not represented as individual agents. Instead, an 'intention' shared between self and other is represented so as to have both a first-person (self) and third-person (other) aspect to the activity. Gradually toward 18 months the toddler begins to represent self and other as independent embodied agents with their own unique object directed intentional activities. This understanding requires the integration for a particular agent - whether of self or other - of first and third person aspects of the agent's intentional relations with an object, and yields a representation of the agent's intention as having both a subjective and objective side to it. But at this age and until around 4 years, the child is not yet able to represent intentional relations to non-current objects or to counterfactual objects. With this achievement at 4 years of age, the child is in a position to understand the representational nature of mental states in general, and of a mental agent extended through time, two necessary ingredients for the eventual understanding of intentionality in a philosophical sense.

Title:
Consciousness and attention in the split-brain

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Session:
Sunday, June 26, 14:00-16:00: Concurrent Session 2.2

Abstract:

It is often said that consciousness in the split-brain is split into two streams, one located in the right hemisphere and another in the left hemisphere. I call this the two-streams model of the split-brain. The two streams model can be developed in either phenomenal or functional terms. Phenomenally, the model holds that at any one point in time split-brain subjects have two states of consciousness that are not subsumed by a single global state of consciousness. Put in functional terms, the model holds that split-brain patients have two "regional" workspaces rather than a single global workspace. In this paper I put pressure on the two-streams model from two angles. First, I review findings that show that even patients with full commissurotomies are able to integrate many bilateral stimuli. Second, I review findings that suggest that selective attention remains unified in the split-brain. Given the intimate connections between selective attention and consciousness, it seems implausible to suppose that consciousness might be divided in the split-brain if selective attention remains unified. I conclude by sketching a single-stream model of consciousness in the split-brain according to which consciousness moves between hemispheres in response to task demands.

Title:
Is sensory-motor conceptual grounding sufficient to account for conscious experience?

Authors:

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Session:
Saturday, June 25, 17:30-20:00: Poster Session

Abstract:

Various authors have recently suggested that human cognition essentially involves internal simulation of the sensory-motor loop (Barsalou, 1999; Hesslow, 2002; Prinz, 2002). Hesslow explicitly claims that a complex enough simulation system will, in fact, be conscious. But why? As emphasised by Barsalou and Prinz, simulation architectures allow conceptual (rational, abstract) thought to be grounded in low level action and perception systems. Therefore, one way to claim consciousness for this type of architecture would be to refer to Global Workspace (GW) theory (Baars, 2002). As the relevant conceptual processing is high level and integrative, it will be conscious processing by definition according to GW theory. This definitional approach to consciousness is unsatisfying, but Baars' own account of his GW theory explicitly avoids the conceptual analysis needed to show that processing in integrative areas matches our pre-theoretic notion of consciousness. Hesslow himself argues that an internal re-creation of a sequence of quasi-perceptual states will necessarily result in the experience of an inner world. But Hesslow does not provide an argument as to why either simulated or actual perceptual states should be consciously experienced at all. In this paper I argue that neither the mere presence of information in high level brain areas, nor the mere re-creation of perceptual states in lower level brain areas is sufficient to account for conscious experience. However, I suggest that the real-time grounding of high level, conceptual processing in low level sensory-motor processing is sufficient to account for the supposedly non-naturalisable, subjective features of sensory qualia. I address the notions of privacy, subjectivity,

ineffability and intrinsicness and argue that all of these subjective features can be explained objectively in terms of Barsalovian grounded concepts.

Title:
Filling-in of the Perceived Void in the Flash-Lag Effect

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Session:
Tuesday, June 28, 12:00-14:30: Satellite Poster Session

Abstract:
The flash-lag effect (Nijhawan, 1994, *Nature*, 370, 256-257) is a perceptual illusion whereby a briefly flashed object is perceived as located behind a moving object with which it was aligned at the time of the flash. If the moving object is a ring, and the briefly flashed object a disc entirely filling the ring, the flashed object trails the moving object leaving an unfilled crescent shaped 'perceived void' inside the ring (Nijhawan, 2001, *Perception*, 30, 263-282). If the crescent-shaped perceived void (PV-crescent) is seen on an unchanging background, then its perceived color is that of the background. The present experiments examine the source of the color of the PV-crescent. The method used was to change the color of the background (either from red to green, or from green to red) at various SOAs with respect to the time of the flash. Previous work (Nijhawan et al., 2000, *ECVP*) reported that there exists a critical range of SOAs

during which the PV-crescent is seen neither as all red, nor as all green, but as consisting of inhomogeneous red/green regions, with a color border separating the two regions. In the current experiments five subjects pressed one of two keys (2AFC task) depending on whether the PV-crescent appeared more red or more green while the SOA between flash and background change ranged from -200 ms (background change before flash) to 300 ms (background change after flash) in 50 ms steps. In a second experiment four subjects from experiment 1 matched the relative proportions of red and green in the PV-crescent to red and green areas in a comparison rectangle. The results of experiment 1 indicate that subjects on average see the crescent as 50% green and 50% red at an SOA of about 70 ms. In experiment 2, subjects could easily estimate the percentage of red and green in the PV-crescent, which furthermore showed a systematic dependence on SOA predicted from experiment 1. It is well known that in determining the luminance or color of a region the visual system uses information from edges enclosing the region. The present experiments appear to show that this may not be a one-way street, and that the 'filling-in' process can also contribute to formation of edges. These experiments show that under appropriate conditions, the visual system can convert temporal information into spatial information.

Title:
Visual aftereffects and the neural correlates of consciousness

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Session:
Sunday, June 26, 9:00-12:30: Symposium 2

Abstract:

My presentation will describe and critique several strategies that have been employed to learn what types of visual adaptation transpire in the absence of visual awareness. These strategies exploit phenomena such as binocular rivalry and crowding to dissociate phenomenal perception from physical stimulation. After reviewing studies that have employed this strategy and summarizing conclusions that can be drawn from those studies, I will raise some questions about assumptions underlying the strategies, questions that may more sharply define the conditions under which adaptation reveals something about neural correlates of consciousness.

Title:

Plasticity of attentional effects: ERP differences induced by between-trial interference (Garner effect) and within trial interference (Stroop effect)

Authors:

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Session:

Saturday, June 25, 17:30-20:00: Poster Session

Abstract:

In visual perception, constituent features of objects interact unconsciously to form a representation of an object as a whole. When

one feature is the target in a classification task, and another is irrelevant, the latter can nevertheless interfere with the former. This interference can be used as a measure of perceptual integration. We distinguish between within-trial and between-trial interference. Within-trial interference results from incongruence between the relevant and the irrelevant feature ("Stroop effect"). Between-trial interference results from variation of the irrelevant feature across trials as opposed to a condition with the irrelevant feature held constant across trials ("Garner effect"). Several studies have dissociated these effects; and it was proposed that within-trial interference occurs at earlier points in time within the perceptual process than between-trial interference (van Leeuwen & Bakker, 1995). This was assumed on the basis of the notion that dynamic self-organization of brain activity proceeds from narrow to broad context domains. To our knowledge this is the first ERP study of both effects in a single sensory modality. We were able to demonstrate clear effects of within-trial and between-trial interference in the reaction time data and discernible effects of both types of interference on the ERP. First evaluation of the data showed adaptation of the between-trial effect across trials in both RT and ERP data. In contrast, no such adaptation was apparent for the within-trial interference. These first observations are currently validated and results will be presented at the meeting.

Title:

Studying pain processing using fMRI without requiring subjects' subjective report

Authors:

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Session:
Saturday, June 25, 17:30-20:00: Poster Session

Abstract:
Aim of Investigation: Disentangle neural responses related to sensory-discriminative and pain processing in healthy volunteers in the absence of subjective reports. Methods: Using a parametric event-related fMRI design we investigated BOLD responses to sensory-discriminative and pain components of laser stimuli in 12 volunteers. A thulium-YAG laser delivered stimuli of 4 different intensities to the left hand, ranging from warm to painful (300-600 mJ). Subjects rated their sensation on a 5-point scale during scanning. Data were analyzed using SPM2, with and without taking into account subjective reports. As described by Buchel et al (2002) we focused on 1) linear increases discriminating between low stimulus intensities in the innocuous range, indicative of sensory-discriminative processing and 2) an initial plateau followed by a linear increase only at higher, painful intensities. An additional analysis looked for neural responses to changes in laser stimulus intensities in the nonpainful (sensory-discriminative) and painful ranges. Results: Behavioral data showed linear correlations between subjective reports and laser energy. Brain areas responding to sensory-discriminative ratings encompassed primary sensory, posterior parietal, dorsolateral prefrontal, and medial frontal cortices and basal ganglia. Areas responding specifically to pain ratings included anterior cingulate, anterior insular, and orbitofrontal cortices and bilateral amygdala. Areas responding to laser energy increases in nonpainful (sensory-discriminative) and painful ranges included identical networks than those described above. Conclusions: Our data encourage the application of the described experimental setup using parametric single-trial thulium-YAG laser fMRI to dissociate neural responses related to sensory-discriminative and pain processing when verbal communication with subjects in the scanner is impossible (e.g. comatose or vegetative patients) or not desired.

Title:
Perceptual Deterioration

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Session:
Sunday, June 26, 9:00-12:30: Symposium 2

Abstract:
Previous work shows that repeated within-day testing on a texture discrimination task leads to a decrease in performance that is specific to the location of the target stimulus. In the present study we show that performance recovers with a change in the orientation of the target elements, even though subjects are unaware of this change. Also, preliminary fMRI measurements in V1 at the beginning and the end of a day of testing show a reduction in the stimulus-driven response to the target, but not in the effects of attention to the target. These results suggest that perceptual deterioration is the result of an unconscious reduction in the response to the target in the primary visual cortex, and not either to general fatigue, or in the ability to allocate attention to the target.

Title:
Psychophysical Methods for Rendering Stimuli Invisible

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Session:
Friday, June 24, 14:00-17:00: Afternoon Tutorial

Abstract:
In the past decade, psychophysical techniques that render stimuli invisible or inaccessible to conscious report have become increasingly important in the study of visual cognition and of neural correlates of conscious and unconscious vision. The aim of the proposed tutorial is to introduce researchers interested in the study of conscious and unconscious visual processing to several such psychophysical techniques and their associated phenomena. B. Breitmeyer covers: 1) Forward and backward masking by structure. 2) Forward and backward masking by noise. 3) Para- and metacontrast masking. 4) Applications to studies of unconscious and conscious processing of visual object attributes. 5) Double dissociation between neural processes contributing to a mask's effectiveness and to its visibility in relation to dual-channel theories. 6) Establishing the relation between metacontrast and binocular rivalry and the implications for our understanding of functional hierarchies of unconscious and conscious visual processing. V. Di Lollo covers: 1) Temporal integration in vision. Temporal integration is believed to be mediated by visible persistence (a brief period during which a stimulus remains visible after the physical display has been switched off). For example, all parts of a TV image appear to be simultaneously present on the screen, even though the physical display consists of a single point of light displayed successively and very briefly at every screen location. Several demonstrations will refute the belief that visible persistence is based on an iconic store that begins to decay when the stimulus is turned off. Instead, conscious awareness of a temporally-integrated display stems from ongoing neural processes time-locked to stimulus onset. 2) Pattern masking based on temporal integration. Demonstrations will illustrate the link between visible persistence and pattern masking. 3) Pattern unmasking by temporal segregation. Demonstrations will illustrate an ostensibly paradoxical effect in which increasing the

duration of a leading mask reduces the strength of masking of a trailing target. 4) Object Substitution: a new form of masking. Topics include: a) Procedural/methodological aspects of object-substitution masking, with demonstrations of the phenomenon; b) Theoretical accounts of these masking phenomena, based on interactions between cortical feedforward and reentrant processes that are deemed important for understanding the dynamics of unconscious and conscious information processing in the visual system; c) The link between object-substitution masking and the phenomenon known as the "attentional blink", in which conscious perception of the second of two rapidly sequential targets is impaired if it is presented within about 500 milliseconds of the first.

Title:
Contrast defined motion produces the motion aftereffect without awareness

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Session:
Saturday, June 25, 17:30-20:00: Poster Session

Abstract:
As opposed to first-order luminance defined motion, which involves early and automatic mechanisms, second-order (contrast defined) motion is thought to involve higher-order mechanisms, such as feature or attentive tracking. Consistent with this suggestion, many experiments have established that the second-order motion aftereffect (MAE) is modulated or even mediated by attention. However, there is

little research on the MAE in the absence of attention or awareness. If awareness of motion, mediated by high-level or topdown mechanisms, is necessary for the second-order MAE, then there should be no measurable MAE if the ability to detect directionality is impaired during adaptation. To eliminate the subject's ability to detect directionality of the adapting stimulus, a second-order drifting gabor was embedded in a dense array of additional gabors. Using this crowding technique, we found that the MAE was still present after adapting to second-order motion in the absence of awareness. The results suggest that the units that code second-order motion must be driven, at least in part, by a passive, bottom-up process.

Title:
Objective reality and slope perception in near and far space

Authors:
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Session:
Saturday, June 25, 17:30-20:00: Poster Session

Abstract:
People have the strong impression that they see the world as it is (naïve realism). There is evidence, however, that the environment affords not geometric reality, but a combination of the geometry of the environment and the motor effort required to interact with it. One particularly clear example of this combination is in estimates of the slopes of hills; cognitive measures greatly overestimate the slopes of real hills, while motor matching of the slope with a tilt board is fairly accurate (Proffitt, Creem, Bhalla). There is evidence from neurophysiology, however, that near space (within arm's reach) is

processed differently than more distant space. Many parietal neurons, for example, respond only to visual targets within reach, and will not respond to the same targets at greater distances. We tested whether motor and cognitive measures of slopes differed in near and far space. Subjects were led to a series of 4 campus slopes of 6 to 12 deg, where 15-meter segments were defined with traffic cones. Standing at the lower cone, subjects estimated the slope of the segment verbally in degrees, and also estimated the slope of the same hill within arm's reach. They also gave motoric matches of the slopes with a novel method - holding the elbow at the side, subjects raised their forearms to match the slope, and then were photographed from the side with a digital camera mounted on a leveled tripod. Arm angle was later measured with an objective algorithm in Adobe Photoshop. The order of the four measures was counterbalanced across subjects and across hills. Slopes were overestimated in the cognitive measure by 23 deg in the far space, while the motor measure was more accurate, both results replicating earlier work. In near space the motor measure gave similarly accurate results, but the cognitive measure now showed a slope closer to the true slope of the hill, not significantly different from the motor measure. Thus near space was judged accurately in both measures, implying that motor effort needed to climb the hill does not affect the cognitive measure in near space, where motor interactions can take place without locomotion. We will also discuss whether near and far space are qualitatively different, or whether total locomotory effort at various distances accounts for these results.

Title:
Space Constancy: The Gradual Dissolution of Perceptual Compensation

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Session:

Tuesday, June 28, 9:00-12:00: Satellite Oral Session

Abstract:

The first theory of space constancy, the constancy of visual direction despite eye movements, dates from Helmholtz. It was based on quantitative subtraction of an efference copy signal from the corresponding shift of the retinal image, a compensation for image shifts. This theory remained dominant through quantitative experiments and mathematical theories until the 1970s, when it became clear that saccadic suppression of displacement, which contradicts the compensation theory, is too large to ignore. Further, work on extraretinal signals by the author and others showed that the efferent signals are too small and too slow to mediate complete compensation. Newer theories are based on the lack of a precise correlation of successive fixational images, and on ignoring extraretinal signals if a saccadic target is found after a saccade.

Title:

Consciousness as a learned phenomenon (a neural mechanism for inner speech, and hence consciousness)

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Session:

Saturday, June 25, 17:30-20:00: Poster Session

Abstract:

Primary consciousness (being aware and responsive), and secondary consciousness (an inner existence that includes imagery but is principally centered on being able to converse with oneself via inner speech) are two broad-brush divisions of the concept of consciousness. Primary consciousness, at least to some extent, is present in many lower animals. However, secondary consciousness appears to be much less prevalent, involving only humans and perhaps some higher mammals such as apes. The inner speech component of secondary consciousness is based, at least in humans, on the ability of language to label and project concepts onto the world. Language (and hence inner speech) is of such importance to secondary consciousness that without this mechanism there would be little to consciousness other than the simple or reactive behaviors of primary consciousness. One could suggest that any natural or artificial creature which is able to respond appropriately to its environment is experiencing primary consciousness, even though the degree of this awareness may vary considerably across the spectrum of existence. The relative importance of learning versus innateness in the makeup of that awareness may also vary considerably. However, the greater mystery of consciousness concerns the issue of how a physical object such as the brain can entertain thoughts and images separate from the external world? Any neural model hoping to explain consciousness will need to provide an explanation and a mechanism for these two general components. While some form of neural model with appropriate feed-forward stimulus-response mechanisms, perhaps with some degree of feedback to allow for adaptation and learning, would seem to capture the essence of primary consciousness, the neural mechanism of inner speech and imagery presents a more difficult problem. An investigation of possible neural mechanisms for this inner existence might then contribute to the understanding of consciousness. A model of cognition is proposed that postulates four learning processes to account for cognition and consciousness. The first is the acquisition of perceptual attractors linking sensory inputs with behavioral output responses, and includes both innate behaviors and the learning of sensory temporal sequences. The second process involves an active association between sensory outputs of a creature and resultant behaviors in others of the same (or different) species. While perceptual conceptualization does not involve language per se, the labeling of perceptual attractors does allow for the formation of richer behaviors.

The learning of language is the third process, in which sequences of verbal utterances (or visual displays in the case of signing) are learned and associated with more complex behaviors. The utterances form temporal sequences that allow alternate perceptual means of inducing behaviors in ourselves and others. The internalization of speech to provide for inner speech is the final process within the proposed neural model.

Title:
The representational basis of consciousness

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Session:
Monday, June 27, 14:00-16:00: Concurrent Session 3.2

Abstract:
Everyone agrees, no matter what their point of view on consciousness, that consciousness at least has a representational base. However, there have been relatively few well-worked-out attempts to say what this base might be like. The two best developed are perhaps the higher-order thought (HOT) and the transparency approaches. As we argue, both are lacking. Starting from the notion of a self-presenting representation, we develop an alternative view. In our view, a representation, a completely normal representation, is the representational base not just of consciousness of its object (if it has one), but also of itself and of oneself as its subject. We then sketch how a unified picture of consciousness can be built on this base, one

that might open the way to clearer and better articulated research on consciousness.

Title:
What is a brain state?

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Session:
Saturday, June 25, 17:30-20:00: Poster Session

Abstract:
Philosophers have been talking about brain states for well over 50 years and as of yet no one has articulated a theoretical account of what one is. Having such a viable theoretical notion is of utmost importance if, like me, one happens to be an identity theorist but it is equally important for cognitive scientists in general. Any way you slice it, the brain is intimately connected with mentality and knowing what a brain state is and how to individuate them is vitally important if we are to understand one in terms of the other no matter whether we do that by correlation, supervenience, causation, or identity. Thomas Polger, who is also an identity theorist, has recently made much of this and has argued that we still do not know how to individuate brain states. In fact he goes on to make the stronger claim that "we don't really even have a clue what such things are" (Polger 2004). He is not alone in this claim, which I take to evince the consensus among philosophers so, for instance, we see Bechtel and Mundale say "the notion of a brain state is a philosopher's fiction; a notion closer to what a neuroscientist would use is activity in the same part or conglomerate of parts" (Bechtel and Mundale 1999). Polger's

arguments are instructive in that by examining them we simultaneously see what a brain state would have to be and that we have just such a notion in current neuroscience. After examining Polger's claims I argue, via the work of Wolf Singer, Gyorgy Buzaki, Pare and Llinas, D. Kahn, and others, that a specific brain state is 'synchronized neural activity in a specific frequency', while the overall state of the brain is 'synchronized neural activity in a specific frequency, gated and modulated in a particular way'.

Title:

Two levels of attention and awareness in the generation of hypnotic phenomena

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Session:

Monday, June 27, 10:30-12:30: Symposium 4

Abstract:

In this presentation, a novel account of suggestion and hypnosis based on contemporary models of consciousness and behavioral control will be presented. According to this account, the alterations in experience associated with hypnosis demonstrate how the attentional systems responsible for self-awareness and willed behaviour are reliant on earlier attentional mechanisms that determine the contents of consciousness and trigger automatic behaviors. By this view, suggested phenomena are produced when high-level attentional systems receive a distorted interpretation of current sensory input, due to the selection of inappropriate (or "rogue") representations by low-level attention.

The model demonstrates the value of distinguishing between different levels of attention and awareness for understanding hypnosis, and how hypnosis itself can contribute to our understanding of consciousness.

Title:

Resetting the Internal Timer

Author:

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Session:

Tuesday, June 28, 12:00-14:30: Satellite Poster Session

Abstract:

Our subjective perception of time relies on neural mechanisms capable of estimating absolute time. In contrast to a simple spatial discrimination (e.g. orientation), virtually nothing is known about the neural mechanisms underlying a simple temporal task, such as, interval discrimination. Two models that have been proposed include the Internal Clock and State-Dependent Network models. The former proposes that events from a neural oscillator(s) are 'counted' by a neural-integrator, which can be read-out to obtain an estimate of absolute time. Whereas the Internal Clock model relies on specialized circuits dedicated to timing, the State-Dependent Network model assumes that neural circuits composed of excitatory and inhibitory neurons are inherently able to decode a temporal interval. Specifically, the recent temporal stimulus history can be encoded in the state of a network either by ongoing activity, or time-dependent properties such as short-term synaptic plasticity. Time can be read-out because the activity patterns produced by a stimulus will be a function of both the

stimulus and the time-dependent state of the network. We have tested differential predictions of these models using a Reset Task. Subjects are asked to perform both a simple two tone (2T) interval discrimination task, as well as to judge the interval between the 2nd and 3rd tone of a three tone (3T) stimulus. In this task the second tone could be the stop signal of a 2T stimulus or the start signal of a 3T stimulus. The task provides a means to examine whether the neural timer can be rapidly reset, and how temporal patterns are encoded. Psychophysical results show that for a 100 ms target interval performance is consistent with the prediction of the State-Dependent Network model, whereas performance on a 1000 ms interval is consistent with internal clock models. Together these results suggest that on short-time scales temporal patterns are timed not by their components but as a single temporal object, and that decoding these temporal patterns need not rely on specialized neural circuits dedicated to temporal processing. In contrast, the estimation of longer intervals relies on neural mechanisms that can independently time embedded intervals and perform the necessary 'temporal arithmetic' to determine the absolute interval of the components.

 Title:
 Awareness as validation of prediction

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Session:
 Saturday, June 25, 14:00-16:00: Concurrent Session 1.1

Abstract:

It has been suggested as early as in 1970-ties that perception is an active, predictive process (Neisser, U, 1974). Indeed, the familiar surroundings we live in are highly predictable, and our brains over time build a rather detailed, invariant, model of these surroundings. Thus, perceptual results $p(t+1)$ of various actions performed in familiar environment can be predicted from information about current percept $p(t)$ and intended action a . Thus, mechanistically, $p(t+1) = Fa[p(t)]$, where Fa is an operator of transformation that depends on the (cognitive or motor) action performed. For example, in familiar environment (certain elements of) perceptual outcome of a saccadic eye movement can be readily predicted from current percept and the intended end-point of the saccade; similarly, familiar circumstances can lead to successful prediction of content of an intended utterance by a colleague etc. Even though such predictive perceptual phenomena have received little attention, their pervasiveness in perception is suggested by ubiquitous phenomena related to violations of predictions/expectations. Thus, unexpected (unpredicted) flashes of light initiate orienting response, unexpected auditory stimuli result in the mismatch negativity (e.g. Naataanen R, 2001), violations of semantic or syntactic rules in sentences ending with incongruent word produce the N400 (e.g. Gunter et al., 1994), etc. We propose that perceptual awareness is a consequence of the predictive perceptual process and is a result of matching predicted percepts and actual sensory (perceptual) data. Thus, predictions (predicted models) that are supported (validated) by sensory data (or previously validated percepts at the lower description level) become the content of awareness; conversely, models that are not supported by the "data" collapse thus eliciting an orienting mismatch response. The proposed predictive perceptual mechanism is different from recent models of predictive coding (e.g. Rao & Ballard, 1999) in that, unlike the latter, our model postulates (cognitive and motor) actions (intentions to act) of an observer as an integral part of prediction process, and conscious perception. Next, we propose that prediction is driven by focus of attention, so that only attended aspects of a scene lead to predictions. Since the scope of predictions does not have to coincide with scope of attention, unattended content can also enter awareness. Finally, we discuss a neuroanatomically and neurophysiologically plausible

mechanism of thalamo-cortical circuitry that might support the process of prediction validation that leads to conscious perception.

Title:

Saccades cause relativistic misperception of time as well as space

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Session:

Sunday, June 26, 17:30-19:30: Symposium 3

Abstract:

There is now considerable evidence that space is deformed when stimuli are flashed shortly before or after the onset of a saccadic eye movement (Ross, Morrone & Burr *Nature* 384, 598-601, 1997). New experiments show that not only is space grossly misperceived by saccades, but so too is time: the apparent temporal separation of two briefly-flashed bars is halved when they are presented near saccadic onset and perceived temporal order is consistently reversed. Taken together, the spatial and temporal phenomena accompanying saccades strongly suggest that vision may be subject to relativistic effects, similar to physical relativistic effects that occur at speeds approaching the speed of light. In many visual areas, neural receptive fields shift perisaccadically to offset the effect of saccades. This dynamic coordinate transformation is rapid, approaching the physical limit of neural information transfer, hence producing relativistic consequences in both space and time. Transient stimuli captured during the dynamic coordinate transformation will be measured against spatial and temporal scales that are dilated by the Lorentz transform, and will

therefore appear compressed in one spatial dimension and in time. Similar mechanisms may explain smaller temporal and spatial misjudgements

Title:

Attention deployment in a changing world - from amnesia to memory and back

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Session:

Sunday, June 26, 14:00-16:00: Concurrent Session 2.1

Abstract:

Paying attention to the right thing at the right time underlies the ability of humans and other animals to learn, perceive, and interact with their environment. What kinds of memories survive visual disruptions, such as due to rapid gaze shifts (saccades) that typically occur several times each second (Findlay & Walker 1999)? According to "the world as an outside memory" theory (O'Regan 1992; Rensink 2000), humans exploit the stability of the world to access external information on demand, leading to conscious perceptions that are seemingly rich and continuous in the absence of detailed internal representations lasting beyond a single fixation. An alternative theory (Land & Farnsworth 1997; Chun and Nakayama 2000) postulates that recent attention targets give rise to detailed memory traces of both visual and semantic information spanning multiple saccades. Here we resolve this apparent discrepancy by showing that the impact of memory on attention deployment critically depends on the availability of semantically persistent context. We asked human observers to inspect MTV-style

video clips, in which unpredictable scene changes occur every 1-3 seconds, and quantified the ability of a memory-free model of attention deployment (Itti & Koch 2000; Itti in press) to predict saccade targets. Scene changes triggered memory-free influences on attention deployment that overwhelmed previous influences within less than 250 ms. These initial sharp increases in the impact of memory-free influences were followed by gradual decreases for up to 2.5 seconds, reflecting slower increases in competing memory-dependent influences (Henderson and Hollingworth 1999; Wolfe et al. 2000; Henderson 2003). Contrary to predictions made by "the world as an outside memory" theory, our results indicate that when semantically persistent context is available, detailed visual memories lasting well beyond the duration of a single fixation play an important role in guiding attention.

Title:

The brainstem and binocular rivalry: The role of serotonin in arousing perceptual switching

Authors:

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Session:

Monday, June 27, 14:00-16:00: Concurrent Session 3.3

Abstract:

Binocular rivalry refers to the phenomenon of repeated perceptual alternations that occur when two different images are simultaneously presented to the two eyes. To explore the role of serotonin (5-HT) in binocular rivalry, this study investigated the effects of the hallucinogenic 5-HT_{1A}&2A receptor agonist psilocybin, alone and after pretreatment with the selective 5-HT_{2A} antagonist ketanserin. Ten healthy human subjects were tested eleven times over a nine hour period under each of the four drug conditions: placebo; psilocybin (215µg/kg); ketanserin (50mg); psilocybin plus ketanserin. Psilocybin alone and in combination with ketanserin significantly reduced the rate of binocular rivalry switching and increased the proportion of time subjects reported experiencing the transitional/mixed percept. The finding that pretreatment with ketanserin did not attenuate psilocybin's effect on binocular rivalry rate suggests that this effect is not mediated via the 5-HT_{2A} receptor, instead suggesting a possible involvement of the 5-HT_{1A} receptor. The altered states of consciousness rating scale (5D-ASC) and the adjective mood rating scale (AMRS) were used to assess changes in subjective experience. While the majority of "hallucinogenic" effects of psilocybin were blocked by ketanserin pretreatment, the measures relating to general states of arousal and vigilance remained elevated. Since activation of presynaptic 5-HT_{1A} receptors is associated with a reduction of 5-HT release from the raphe nuclei in the brainstem, a region known to influence general levels of arousal, our findings implicate possible brainstem involvement in modulating the rate of perceptual switching and add further weight to increasing links between rivalry and processes of attention.

Title:

Perceiving-the-present and a general theory of illusions of projected size, speed, luminance contrast, and distance

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Session:

Tuesday, June 28, 12:00-14:30: Satellite Poster Session

Abstract:

Perceiving-the-present is the theoretical framework positing that the function of the visual system is to generate percepts representative not of the scene that generated the proximal stimulus, but of the scene that will be present at the time the percept actually occurs about 100 msec later, thereby compensating for the neural delay. To achieve this, the visual system must utilize ecological regularities to "guess" what is about to happen in the next moment. One of the most common kinds of ecological regularity is forward movement, and this research demonstrates that the visual system responds with appropriate latency-correction mechanisms when cues suggest forward movement. On the basis of this it is possible to predict a pattern of illusions over two dozen classes of stimuli.

Title:

Do mice have consciousness?

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Session:

Sunday, June 26, 16:30-17:30: Keynote

Abstract:

The issue is to what extent the mouse is a useful animal model to investigate consciousness. The theoretical framework is that of the neuronal workspace which distinguishes two main computational spaces: a global « conscious » workspace composed of distributed and heavily interconnected neurons with long-range axons, and a set of « encapsulated » and automatic perceptual, motor, memory, attentional and reward processors (rev. Dehaene & Changeux, 2004). Simulations with these formal architectures account for the access to consciousness taking place in the Stroop task, the attentional blink or inattentional blindness. Among specific aspects of the network architecture, it was proposed a neuromodulatory control of network activation which, together with the reward processors, give access to pharmacological and molecular approaches. The mouse brain possesses a rather small prefrontal cortex, thus placing evident limits on its neuronal workspace. Yet, the mouse model offers important facilities for molecular investigations. We have selected nicotinic receptors as targets of the neuromodulator acetylcholine known to control working memory, attention, sleep and wakefulness (see Perry & Perry, 2004). At least ten neuronal nAChR subunits (a2-a10, b2-b4) have been identified in the vertebrate brain which assemble to form a variety of pentameric oligomers possessing different physiological and pharmacological properties and distribution patterns in the central nervous system. Mice lacking the b2, a4 and a6 subunits were generated by homologous recombination (Champtiaux & Changeux, 2002). An automated method to quantify mouse behaviour revealed in the b2-/- mice selective deficits in executive functions such as exploratory behaviour, with normal automatic navigatory behaviour (Granon et al., 2003). We have developed a new strategy based upon the observation that a given nAChR, subunit such as b2, can be efficiently re-expressed stereo-selectively on a b2 knock-out background using a lentiviral vector (Maskos et al., 2005). Specific restoration of fully functional high-affinity nAChRs in the Ventral Tegmental Area (VTA) demonstrate that these receptors are sufficient to recover slow exploratory behaviour together with nicotine self-administration. These data highlight the important role of endogenous cholinergic regulation of the dopaminergic system in higher cognitive

function. Furthermore, the method offers the versatility required to differentially analyse the contribution of defined neuronal circuits in the regulation of the underlying states of consciousness.

Title:

The Feeling of Hurt: A Brain-Body Perspective on Pain

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Session:

Friday, June 24, 14:00-17:00: Afternoon Tutorial

Abstract:

It is impossible to reconcile the classical notion that pain is a primitive sensation with clinical observations of people suffering physical trauma or those who live with disabling chronic pain. Pain can fail to occur with tissue injury, persist indefinitely in the absence of tissue injury, and it is often difficult or impossible to relieve. Uncontrolled chronic pain is a major and costly social problem because it causes extensive presenteeism (nonproductive presence in the workplace), disability and suicide. Whether acute or chronic, pain is complex, highly individual, and sensitive to social and cultural context. Accordingly, the field of pain research is interdisciplinary, ranging from molecular mechanisms on the one hand to epidemiology and anthropology on the other. Because pain as we conventionally define it is an unpleasant subjective bodily awareness associated with, or normally attributed to, tissue injury, the mind-body dichotomy impedes both the progress of science and the efficacy of clinical care for patients with pain. Researchers studying neurophysiological

mechanisms have targeted the sensory processes of transduction, transmission and modulation of neural signals generated by tissue injury. Although essential and valuable, this line of inquiry has proven only partially successful in accounting for clinical pain states and guiding treatment. Parallel research on behavioral aspects of pain have revealed that pain is not purely sensory; it has an intrinsic affective dimension as well. Moreover, the complaint of pain and related behavior including disability depends heavily on past experience and learning, the sense of self, beliefs and attitudes, social context and culture. Between these separate domains of inquiry lies a third, underdeveloped area: somatic awareness. Why pain "hurts," why it has negative motivational qualities, why fatigue, dysphoria and sometimes nausea accompanies it, and why prolonged unrelieved pain causes the state we know as sickness are fundamental questions. This much is clear: a) nontrivial pain as phenomenal bodily awareness never exists alone but always in the company of other negative affects, bodily sensations and negative motivational states, and b) nociception (the detection and transmission of tissue damage) never has solely sensory consequences. Pathways of nociceptive transmission extend to many areas of the limbic (emotional) brain, activate defense mechanisms that have cognitive-emotional aspects, provoke neuroendocrine stress responses at the level of the hypothalamo-pituitary-adrenocortical axis and stimulate the immune system. An emerging but extensive literature indicates that hormones, cytokines, peptides and other neurotransmitters along with autonomic activity comprise a common chemical language that coordinates the global interaction of these systems. This process lends itself to description in the complex adaptation systems framework. In short, nociception triggers a complex, multi-factorial response that determines not only the phenomenal reality of pain but also the constellation of negative affective, motivational and cognitive symptoms that accompany it. The organizing theme for this tutorial will be self-organization and dynamic equilibrium: the nested processes of adaptation, allostasis and homeostasis as they relate to tissue injury and pain. The presentation will review the basic neurophysiological mechanisms of pain, psychological aspects of pain, and problematic pathological pain states including phantom limb pain. It will draw upon neuroimaging studies of brain activity during pain as well as animal and clinical research. Discussion of mechanisms will include the impact of

nociception on the central nervous system including limbic structures, the hypothalamo-pituitary-adrenocortical axis, and the immune system including the cytokine-mediated sickness response. Finally, the presentation will explore the emergence of pain as phenomenal reality in a complex adaptive systems framework.

Title:
An in vitro model for consciousness?

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Session:
Saturday, June 25, 14:00-16:00: Concurrent Session 1.1

Abstract:
Analgesics and anaesthetics have diverse synaptic actions that nonetheless have a common inhibitory action on net neuronal discharge. Why therefore do these two classes of compounds have fundamentally different effects, one blocking pain and the other consciousness? Beyond the isolated synapse, little is known of the higher order mechanisms that are sensitive specifically to anaesthetics, causing the defining loss of consciousness. Here we show for the first time that, irrespective of their effects at the synaptic level, the dynamics of a higher order of brain organization (transient neuronal assemblies) are modified in real-time by diverse anaesthetics but not by analgesics. These findings might suggest a novel in vitro approach for gaining insights into the neuronal mechanisms underlying consciousness.

Title:
What is the capacity limit of consciousness awareness?

Authors:
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Session:
Monday, June 27, 14:00-16:00: Concurrent Session 3.1

Abstract:
To understand consciousness, one must describe its limits. George Miller (1956) famously discussed a short-term memory limit of about seven items. However, that limit is not fundamental. It depends on two things: (1) how items are grouped together, and (2) whether they all enter consciousness at once. For example, the string of letters "IBMFBI CIA" can be grouped into three acronyms (IBM, FBI, CIA). Moreover, successful recall need not depend on every element being consciously held concurrently. Accordingly, we describe recent experiments to examine the relation between consciousness and short-term storage. Cowan (2001) suggested that, in some test circumstances, items cannot be grouped together because they are presented too quickly or with multiple concurrent items, or because they are not readily rehearsable. In such cases, every item presented remains a separate chunk in memory. A survey of many such procedures produced convergent results: 3 to 4 items could be retained in awareness at once. Subsequent research (e.g., Cowan, Chen, & Rouders, 2004) extended this conclusion. Instead of preventing the formation of new chunks, we taught new chunks (pairings between words), which were used within lists to be recalled. Teaching new pairings increased the average size of chunks recalled but did not

increase the estimated number of chunks recalled per list (about 3.5). Researchers have described mechanisms of short-term memory that operate apart from the focus of attention and consciousness, such as phonological rehearsal (e.g., Baddeley, 1986). However, we maintain that when these mechanisms are curtailed, 3 to 4 chunks are still held in the focus of attention as a capacity-limited, short-term storage device. We show this with several procedures. Diverting attention away from the set to be remembered during a retention interval decreases memory performance, unlike control interference tasks that require little attention (e.g., articulation). We have conducted studies of memory for arrays of differently-colored squares, each of which has to be retained briefly to be compared to a second array (Morey & Cowan, 2004; in press), and memory for lists of quickly-spoken digits that stop at an unpredictable point, whereupon digits from the end of the list have to be transferred to the focus of attention for recall. In both procedures, dissimilar interfering tasks degrade memory only if they appear to require attention. Two different attention-demanding memory tasks presented at once (color and tone arrays) show a tradeoff. The focus of attention thus functions as short-term memory storage linked to consciousness.

Title:
Timing conscious access

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Session:
Friday, June 24, 17:30-18:30: Presidential Address

Abstract:

Past work from my laboratory has examined how the processing of subliminal stimuli differs from that of consciously seen stimuli. Our newer work focuses on the dynamics of these processes. According to the global neuronal workspace theory, while several subliminal chains of processing can proceed in parallel, recurrent interactions between neurons with long-distance connections should lead to a non-linear divergence specifically associated with access to consciousness. The model predicts a sudden all-or-none surge of activation if a threshold for sustained activity is exceeded. Claire Sergent and I tested this view using high-density recordings of event-related potentials during an attentional blink task. Our design allows us to trace the fate of a blinked or seen word. The results indicate a fast, all-or-none divergence around 300 milliseconds after stimulus presentation, which leads to waves of anterior temporal, prefrontal and parietal activation uniquely associated with conscious access. They also indicate that, in parallel, the processing of a non-conscious stimulus can proceed for a prolonged duration (>400 ms). The latter result is confirmed by a recent study of intracranial recordings in the amygdala, with Lionel Naccache and Raphaël Gaillard, where subliminal semantic signals of emotional word meaning are shown to reach the amygdala at latencies over 700 milliseconds. We conclude that both non-conscious and conscious processing can elicit late patterns of brain activity -- but that conscious access is characterized by a non-linear transition involving the joint activation of multiple distant sites including prefrontal cortex.

Title:
Primal Emotion, Instinct and the Dawning of Consciousness

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Session:
Saturday, June 25, 16:30-17:30: Keynote

Abstract:
Consciousness has emerged during the course of evolution because its advent gave great survival advantage. It has been honed on the anvil of natural selection. This talk considers the issue of its first emergence. For an animal to be able to form images in the mind, and to choose an apt option for action in the light of appraisal of its immediate situation and its memory of past experience has great advantage. It may be much better than responding reflexly - that is, with an inflexible pattern which does not adapt according to the particular circumstances. It may make the difference between surviving or being killed. Survival allows it to hand on to its descendants the particular genetic structure which coded for the neuronal organization which subserved the propensity for conscious analysis of situations. Higher in the phylogenetic scale, we know that we are conscious because, amongst other things, we can distinguish between what thinking is going on in our own head, what we might wish to do, and what information is coming from the outside world. It is proposed that the imperious states of arousal and compelling intentions to act which characterize the primal emotions were the origins of consciousness. The term "primal" or primordial emotion is being used for the subjective element of genetically programmed behaviour which subserves control of the vegetative systems of the body. The great Harvard psychologist, William James stated the inexorable binding of emotion and instinct, it being a genetically determined structural relation. He says ..."In speaking of instincts, it has been impossible to keep them separate from the emotional excitements which go with them." Further"That every object which excites an instinct excites an emotion." Primal emotions could signal that the very existence of the organism was threatened. Examples of primal emotion include thirst arising from desiccation of the organism, breathlessness or "hunger for air" which occurs with choking, hunger, pain, hunger for specific minerals, impediment of visceral function, sexual arousal and

orgasm, compulsion to sleep, and avoidance of body core temperature change. Emotions which may be overwhelming and commandeer the whole stream of consciousness are choreographed from the lower or basal areas of the brain. The initiating signals frequently come from sensors monitoring and reacting to the physiochemical composition of the blood reaching the base of the brain - "interoceptors", in contrast to the "exteroceptors" - eyes, ears and nose - the distance receptors. The interoceptors are the operative elements of the vegetative systems which regulate and maintain the constancy of the internal environment of all the cells of the body. As a consequence of the gradual evolutionary development rostrally of the structure of the brain, it is plausible that these hard wired systems of complex reflexes in the hypothalamus, midbrain and hind brain melded via pathways with the giant relay system of the thalamus. Thereupon they connected with the earliest cortical elements which had evolved. These cortical structures, the so-called 3 and 5 layered allocortex and transitional cortex, including the cingulate, parahippocampal and insula regions, subserve the primal emotions and early origin of consciousness. Neuroimaging of the primal emotions reveals a functional organization in which the evolutionary ancient areas of the brain play a dominant role.

Title:
Velmans and Peirce on the scientific study of consciousness: So close yet so far

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Session:
Saturday, June 25, 17:30-20:00: Poster Session

Abstract:

Ironically, in his *Understanding Consciousness* (2000) and in subsequent articles in the *Journal of Consciousness Studies*, Max Velmans argues that while taking phenomenal experience at face value, it is the scientific study of consciousness itself (like the Libet experiments, and experiments on focal attention) that forces us to conclude that we will never understand what it is that constitutes consciousness. According to Velmans, 'there is one thing [the universe] that can be known in many [or at least two complementary] ways' (2000, 233). More to the point, Velmans proposes a double aspect theory of mind. He states that in the human case, 'minds viewed from the outside seem to take the form of brains [...] viewed from the perspective of those who embody them, [...] of conscious experience'. Next he defends a panpsychist view: with the birth of the universe consciousness emerged as well (2000, 275). Remarkably, in the work of C.S. Peirce (1891, 1892) we already encounter the same strand of thought based on the same idea: if we take phenomenal experience seriously, as well as the scientific study of consciousness (Peirce talks about the study of 'protoplasm that feels'), we cannot but conclude that matter and consciousness are two aspects of mind (hence Peirce's idealism). Apart from this similarity between Velmans' and Peirce's scientific approach to consciousness I would like to argue that both Velmans and Peirce, although they are close, get it wrong: there is no need for a speculative metaphysics in order to fuse phenomenal experience and the science of consciousness. However, where Velmans lacks the right philosophical framework for a true scientific understanding of consciousness, Peirce's pragmatism does at least offer the elements that point out a road to such understanding. The classic papers by Peirce introducing the method of belief fixation (1877) and pragmatic maxim (1878) offer the right framework in which consciousness can be studied scientifically - notwithstanding contemporary philosophers of mind who claim otherwise.

Title:

Neural dynamics of thought-full versus thought-free responses in orbitofrontal cortex

Authors:

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Session:

Saturday, June 25, 14:00-16:00: Concurrent Session 1.3

Abstract:

According to Wundt (1913, *Grundriss der Psychologie*) impulsive responses are triggered without the subject thinking about it. Indeed, it has been shown that complex tasks involving written language or category discrimination can be performed unconsciously (Dehaene et al, *Nature*, 1998, 395, 597-600; Fabre-Thorpe et al., *J Cog Neuroscience*, 2001, 13, 171-80). On the other hand, before slower non-impulsive responses, subjects might likely base their behavioral decisions on their more fully conscious experience. We studied the neural correlate of faster (thought-less) responses versus slower thoughtful responses in a visual selective attention paradigm. Following visual target stimuli presented infrequently at a covertly attended location, faster thumb button responses tended to follow a larger far-frontal evoked positivity (P3f or P2a) in the average event-related potential (ERP) (Makeig et al., *J Neurosci*, 1999, 19, 2665-80). Closer study of these data revealed a linear relationship ($r=0.96$, $p<10^{-11}$) between median RT and the upslope to the P3f peak. This result is compatible with a model in which the behavioral response is triggered when the area under the ERP, beginning at a relatively fixed latency near 200 ms, reaches a threshold. Consistent with this hypothesis, the area under the P3f was not correlated with response time. We then attempted to determine how this effect was related to the EEG activity in single trials. Interestingly, spectral decomposition of the EEG signal revealed that a 1.5-cycle theta (4.5 Hz) burst preceded and was weakly phase-locked to the button press. We found that the amplitude

of this theta wave, as well as its phase, covaried significantly with response time ($p < 10^{-33}$), a higher theta-power wavelet tending to immediately precede fast responses. We also observed that this effect persisted even after regressing out the average response-locked P3f peak out of every trial. On the other hand, regressing the theta wavelet out of every trial removed the P3f and its relation to RT. Thus it seems that wavelet analysis in the theta band better characterizes the event-related brain dynamics in this case than ERP analysis. Finally, independent component analysis identified inferior frontal processes with similar theta dynamics in most subjects. Comparable components from two 256-channel recording sessions localized to orbitofrontal cortex. Overall, slower responders produced less P3f/theta activation, possibly reflecting these subjects' inability to respond reflexively, in line with Wundt's hypothesis. The orbitofrontal theta response complex may index inferior frontal processing of early limbic signals to facilitate or inhibit reflexive responses in speeded response tasks.

Title:

The audibility of changes in non-perceived pitches: A paradoxical property of auditory memory

Authors:

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Session:

Saturday, June 25, 17:30-20:00: Poster Session

Abstract:

A sum of pure tones with synchronous onsets and offsets is normally heard as a single sound. Even when the components of such a "chord"

are widely spaced in frequency and have no harmonic relationships, they are difficult to hear out individually. Indeed, if the chord is followed after a short delay by a probe tone which is either identical to one component of the chord or halfway in frequency between two components, it is generally difficult to say if the probe was present in the chord or absent from it. Surprisingly, however, if the probe is slightly higher or lower in frequency than a randomly selected component of the chord, many listeners are sensitive to this relation and can make accurate "up" vs. "down" judgments. In our initial investigation of this phenomenon (Demany and Ramos, *Journal of the Acoustical Society of America*, 2005, 117, 833-841), the chords used consisted of only five tones, irregularly spaced in frequency. In new experiments, we used 300-ms chords of 10 tones, with frequencies changing at random from trial to trial but always 5.5 semitones apart. On each trial run in the "up/down" task, the probe was 1 semitone above or below a randomly selected component of the chord. In experiment 1 (five participants), there was a 500-ms silent delay between the chord and the probe. Performance was good in the up/down task (mean $d' = 1.56$) although it did not exceed the chance level in the present/absent task (mean $d' = 0.07$). In experiment 2 (three participants; up/down task only), there was a 1-s interval between the chord and the probe, and this interval sometimes included a 300-ms "distractor" (which had to be ignored). The distractor was either a loud burst of pink noise or a soft tone with a randomly selected frequency. Both types of distractors disrupted performance (d'), but the tonal distractors were significantly more deleterious. An opposite trend should have been observed if the deleterious effect of a distractor was due to spectral interference in the auditory filters responding to the tone to be memorized. Therefore, it appears that a tone which was not consciously perceived can nonetheless be memorized for at least 1 s in a "non-spectral" type of auditory memory. Its pitch trace will remain unconscious, but can give rise to a conscious percept of directional change if a slightly different tone is subsequently heard.

Can the importance of stimuli and place of presentation influence change blindness effect?

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Session:
Saturday, June 25, 17:30-20:00: Poster Session

Abstract:
We concerned if the adaptive role of stimuli and place of presentation could spontaneously influence the focus of our attention and modify change blindness effect. The importance, the place and time of changes were manipulated on the picture presenting a girl sitting in a room and talking on the phone with a blue curtain and a small picture of another girl in the background or with fruits in front of her. The colour of a curtain (low importance, perypheric), of an apple (low importance, central), or facial expression from neutral to happy and back to neutral (high importance, central vs perypheric) were changing. Changes occurred progressively during either 60 or 100 seconds time of picture presentation. We assumed that change blindness effect in case of adaptively important stimuli (i.e. expression on human face) would decrease in comparison to low-important stimuli, (i.e. the colour of a curtain and apple). We also expected that in opposition to non-important stimuli, there would be no differences in change blindness effect between central and marginal changes. The strongest change blindness effect was expected in case of low importance changes presented perypherically (the curtain's colour) and the weakest change blindness effect in case of high importance changes presented centrally (the expression of main character). We obtained strong change blindness effect for central vs perypheric presentations both in short and long time condition and slight effect of importance of stimuli, but only in 60 seconds condition. The results

suggest that adaptive role of stimuli can influence change blindness effect, but first of all there's strong effect of place of changes.

Title:
Cold control theory of hypnosis

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Session:
Monday, June 27, 10:30-12:30: Symposium 4

Abstract:
We argue for the theoretical possibility of unconscious executive control using the hierarchy of explicit knowledge developed in Dienes and Perner (1999) and the Higher Order Thought (HOT) theory of Rosenthal (2002). Then we elaborate the cold control theory of hypnosis, according to which hypnotic response involves executive control without conscious intentions. Cold control theory allows an account of why some hypnotic tasks are more difficult than others, of individual differences in hypnotisability, and of the effects of expectation in hypnosis.

Title:
Evolutionary epiphenomenal qualia

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Session:

Saturday, June 25, 17:30-20:00: Poster Session

Abstract:

Since consciousness is both homogeneous and heterogeneous it is unlikely that every type of experience presents the experiencing organism with evolutionary advantages. This is even the case in subtypes like experiences of beauty. It is plausible that experiences of beauty evoked by the physical appearances of some conspecifics might have been selected for, while those evoked by architecture or art were not. Some philosophers claim on a priori grounds that consciousness cannot be functionally analyzed (e.g. Chalmers, Kim), which leads to a further claim that evolution cannot have selected experiences. (Chalmers 1996) I will first show that experiences of beauty evoked by faces of conspecifics do serve an evolutionary function. Hence, the a priori arguments have been refuted. Such experiences are what I call evolution's shorthand, since they provide a quick and reliable (though non-veridical - e.g. Uma Thurman is not represented as fertile, but as beautiful) route to information about the environment that is essential to the individual's survival and the reproduction of his or her genes. My second point is that we need an explanation of those experiences that cannot be functionally analyzed within an evolutionary context. The hypothesis is that we are able to use our ability to experience beauty in other contexts than that of our natural environment. This ability itself might be viewed as an evolutionary advantage itself, though in the case of the Rothko painting it results in experiences of beauty that do not provide us with any evolutionary advantage at all. To show that this actually happens we can look at experiences of beauty evoked by landscapes. Small children prefer the savanna landscape. (Balling & Falk 1982) The evolutionary shorthand theory says that this is a quick and reliable

manner to see whether the landscape provides enough food, water and shelter to survive. As we age, we also experience the landscape in which we grew up as beautiful. This learned experience of beauty shows that cultural aspects of our environment can become triggers of experiences of beauty and I suggest that this ability itself might present the experiencing organism with an evolutionary advantage. However, this mechanism can easily result in representing aspects of the environment as beautiful, while this experience is no shorthand for any evolutionary relevant information whatsoever. As long as this does not harm the experiencing organism, these evolutionary byproduct will continue to exist, for the mechanism behind it is evolutionary advantageous.

Title:

Time and the observer redux

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Session:

Saturday, June 25, 17:30-20:00: Poster Session

Abstract:

Daniel Dennett (1991; Dennett and Kinsbourne 1992, hereafter D & K) had the right idea when he used the vehicle/content distinction to separate time of representing from time represented. The time a representation occurs in the brain (say, 10:37 January 24, 2005) is not the same as the time represented by the representation (10:35 January 24, 2005 or last week or next June). But Dennett drew the wrong conclusion. He thought that the separation of represented time

(content) from the time of its vehicle meant that conscious content floats free, anchored only by subjective report. After all, what could fix the contents of consciousness other than the subject herself? And since subjects tend to continually revise their experiential reports, there can be no fact of the matter about the exact contents of conscious states. I believe this conclusion overlooks an alternative anchor for conscious contents. If conscious states have the function of representing the present moment, conscious contents are determined according to which elements best represent 'now.' Though the demonstrative function threatens to collapse the hard-won distinction between vehicle and content, I argue the contrary: the demonstrative reveals the essential functional relation between content and object as distinct from the vehicle of representation. (For example, "I now prepare the abstract for ASSC9.") In my view, the content of conscious states is 'now' where 'now' refers to a state of the world at a moment just past the time that the conscious state occurs. In conclusion I consider the ways this theory both reinforces and undermines Daniel Wegner's (2002; forthcoming; Wegner and Wheatley 1999) claim that conscious will is illusory.

Title:
The time is 'now'

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Session:
Tuesday, June 28, 12:00-14:30: Satellite Poster Session

Abstract:

The role of time in consciousness is under-theorized in contemporary analytic philosophy. In our debates over terminology we have lost sight of William James' original insights into the relation between consciousness and what he called 'the specious present'. By re-examining the role of the spatio-temporal present in determining conscious states, I believe the prospects for a definition and correlate of consciousness are vastly improved. As a representationalist, I hold that mental phenomena can be fully accounted for in representational terms. My claim is that consciousness is constituted by representations of the world at the present moment, where 'world' includes both mental and physical states of affairs. This view is not essentially higher-order; although higher-order states are sometimes conscious, a higher-order state is not necessary for a mental state to be conscious. The crucial component that unites states in consciousness is the function of representing the world at the present moment. If we take representations of the world at the present moment as our operational definition of conscious states, we can then ask what brain systems could support such representations. The answer yields interesting points of contact between conscious representations and a collection of current neurological theories of consciousness.

Title:
The quale of a thought

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Session:
Monday, June 27, 14:00-16:00: Concurrent Session 3.2

Abstract:

Much philosophical work has focused on what is called the consciousnessintentionality interface. Propositional attitudes, paradigmatic intentional states, are regularly regarded as types of states that do not necessitate a what-it's like-experience associated with them. Tokening a propositional attitude is to be seen as an essentially mechanical, syntactic process. Thought per se is not a phenomenal going-on. There is no such a thing as the quale of a thought. Rational transition from a state to another is considered to be taking place at an infrastructural, subpersonal level of the cognitive system, and using introspection as a tool so as to elucidate the nature of the process is a mistake, since the real mechanics doing the work is hidden from such view. I want to argue that there is such a thing as the quale of a thought, that necessarily any ratiocinative process involves at least an initial conscious stage of tokening it, and that tracing the dynamics of a tagged ratiocinative process shows how it changes the initial quale by feedforward and feedback loops in which it propagates its meaning to other parts of the semantic web of mentality. We could consider three main stages: an initial, proto-quale one, a subsequent automatizing one, and a latter qualo-holistic one. One interesting connection here is that between meaning and the quale. The classical Fregean rejection of psychologism and stress on the publicity of meaning amounts to rejection of random idiosyncratic associations made by a cognitive agent as playing any role in the meaning of a linguistic item, broadly defined. My contention is that a subset of these associations is actually pivotal for the fixing of the meaning of the item. In my opinion, the full-fledged tokening of a thought is imbued with semanticity and holistic localisation, both in the production, and comprehension stage of a cognitive interchange. Merely concatenating concepts in a compositional fashion, without semantic localization of the product as a whole in a web of knowledge allowing one to draw inferences and integrate them into coherent gestalts does not do justice to the indispensable semantic imbrications. The idea of phenomenal experience should cover not only perceptual modality-based inner events, but also conceptual activity. This should lead to the identification of a common pattern of individuating features of subjectivity (mainly perspectivity, holistic inferential potential), which seems to shed doubts on the conceivability of a zombie-like cognitive system exhibiting ratiocinations, but lacking phenomenality.

Title:

Illusory reversals in the timing of actions and sensations: when can effect precede cause, and why?

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Session:

Sunday, June 26, 14:00-16:00: Concurrent Session 2.3

Tuesday, June 28, 12:00-14:30: Satellite Poster Session

Abstract:

Traditional psychophysical studies deliver stimuli to a subject at a time of the experimenter's choosing, not the subject's. But different results emerge when a participant's motor act is involved - especially as regards the perception of time. We here report a novel illusion: temporal order judgments of action and sensation can become reversed. When a fixed delay was consistently injected between a participant's keypress and a subsequent flash, adaptation to this delay induced a reversal of action and sensation: flashes appearing at delays shorter than the injected delay were perceived as occurring before the keypress. On trials when participants experienced these illusory reversals, fMRI BOLD activation increased primarily in dorsal anterior cingulate gyrus (dACC) as compared to trials in which the participants perceived the veridical timing. As an executive region known to monitor response conflict, this illusion-mediated dACC activation suggests the novel possibility of conflict between two timing representations in the brain - one which adapts to the delay between

action and effect, and one which does not. We suggest the illusion reflects a recalibration of motor-sensory timing which results from a neural prior expectation that sensory consequences should follow motor acts without delay. Our psychophysical data can be captured by a model involving neural pooling and opponent-processing. This model suggests that the temporal recalibration illusion described above is a temporal analogue to the motion aftereffect, and offers a unified explanation for both. We thus make the novel suggestion that a single neural circuit can underlie judgments of both time and space, allowing analogous illusions in both domains. This could implicate a single genetic program that can unpack a module that usefully deals with time or space, depending on the neural neighborhood in which it finds itself. In summary, we have described a novel temporal illusion and proposed a framework in which the perceived times of motor and sensory events shift with respect to each other in response to a delay between actions and sensory feedback, bringing actions and events appearing at consistent delays closer in perceived time and, within a certain range, reversing their order.

Title:

Activity in the premotor cortex reflects the feeling of ownership of a limb

Authors:

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Session:

Sunday, June 26, 14:00-16:00: Concurrent Session 2.2

Abstract:

When we touch or look at our hands we immediately feel that they are part of our own body. This feeling of ownership of our limbs is a fundamental aspect of self-consciousness. We have studied the neuronal counterparts of this experience. A perceptual illusion was used to manipulate feelings of ownership of a rubber hand presented visually in front of healthy subjects while brain activity was measured using functional magnetic resonance imaging. The neural activity in the premotor cortex reflected the feeling of ownership of the seen hand. From work in non-human primates we know that the premotor cortex receives both visual and somatic information and we argue that it is the correlation between these two sources of information that underlies changes in body ownership. In a second experiment we demonstrate that the premotor activity does not simply reflect the dominant role of vision or a visual representation. We designed a somatic version of the 'rubber hand illusion' where we manipulated the feeling of ownership of a rubber hand which the blindfolded participants were touching. The activity in the premotor cortices reflected the feeling ownership also in this case. Taken together these findings suggest that multisensory integration in the premotor cortex provides a mechanism for bodily ownership.

Title:

Neural correlates of conscious perception in the attentional blink

Authors:

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Session:
Monday, June 27, 14:00-16:00: Concurrent Session 3.1

Abstract:

If two target stimuli are presented sequentially in a rapid stream of distractors, the second target is frequently missed during a critical time interval of approximately 200-400ms. This phenomenon known as the "attentional blink" provides the opportunity to compare brain activation evoked by identical stimuli that in one case reach awareness and in the other case fail to evoke a conscious percept. The aim of the present study was to investigate neural correlates of these two possible outcomes. Previous studies have suggested that a second target stimulus (T2) presented during the attentional blink period, i.e., about 300 ms after onset of the first target (T1), does not activate working memory. To further investigate this hypothesis, we conducted an event-related potential (ERP) study where ERPs for detected and missed task T2 stimuli were compared. Targets that were detected during the attentional blink period elicited a P3 ERP, whereas missed targets did not evoke a P3. This finding suggests that, despite impaired performance during the attentional blink, some targets do reach working memory. To further evaluate the electrophysiological correlates of detected versus missed T2 trials, a second study was conducted with a focus on evoked versus induced EEG gamma-band activity. Analysis of these data suggests that correlates of the attentional blink phenomenon can also be found at the level of induced oscillatory activity. In a third study, we attempted to identify brain regions involved in controlling access for awareness in the attentional blink. To this end, an event-related fMRI study was carried out, comparing activation patterns for detected versus missed T2 targets. We observed an increase in activation for detected as compared to missed targets in left lateral frontal, superior frontal and inferior frontal regions. In addition, bilateral inferior parietal areas were also more active for detected targets. In contrast, in lateral

occipital and fusiform regions activation was increased when the target was missed. The same decrease was observed in regions associated with emotional and predominantly automatic processing. The results indicate that visual awareness in the attentional blink is accompanied by a complex pattern of differential activations in a widely distributed network. While activations in occipitotemporal regions might mainly reflect duration of attentive search, the frontoparietal areas seem to be involved in a network controlling visual awareness.

Title:
Implications of NCC theory for the evaluation of nonhuman consciousness

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Session:
Saturday, June 25, 17:30-20:00: Poster Session

Abstract:

There's something strikingly primitive about even the best discussions of nonhuman consciousness. Approaches based on philosophical or psychological theories of consciousness rarely provide any compelling empirical criteria for line-drawing, or at least none that go very far beyond what intuition already tells us. On the other hand, approaches based on neuroscience invite charges of neural chauvinism - both for excluding nonbiological consciousnesses and for potentially including biological entities that probably shouldn't qualify (e.g. flies, who as we saw last year exhibit synchronized oscillations modulated by selective attention). As a consequence, most ASSC types - at least, those I've talked to - seem to have adopted a policy of open-minded agnosticism,

on which a few hypothetical tests may be proposed but the basic assumption is that we just don't know enough to draw any dividing lines with confidence. This approach may be epistemologically virtuous, but there's a problem: the world is full of nonhuman organisms, and our current assumptions about how we should treat them are based almost entirely on prescientific theories and intuitions. If consciousness is at least part of what determines an entity's moral status, and if we now know a lot more about consciousness than we did a few decades ago, then it seems that we should at least be making the attempt to bring that knowledge to bear on our decisions about how animals should be treated. I believe that our current knowledge can justify drawing at least three "natural" (i.e. vague but not arbitrary) boundary lines, lines that mark morally significant differences in type and degree of consciousness. In this presentation, I will focus on the most basic and inclusive of these: conscious awareness of bodily sensations. This ability arguably stands as a necessary condition for an organism to be able to experience suffering in response to bodily damage, as opposed to merely detecting or registering such damage. Depending on your moral theory, this may or may not be enough to give an organism "rights" or formal moral properties, but I'm more interested in what it implies for decisions at the practical level - e.g. regarding the treatment of experimental and food animals, the moral status of impaired humans, and the proper scope of vegetarianism. The primary purpose of this presentation will be to show how our current "best guess" NCC theory (I'll focus on the Crick and Koch version) can justify the use of anatomical evidence in drawing this line in a particular place, and can do so without falling prey to chauvinism or historical conservatism.

Title:

The Conscious Room: a reflection on the function of poetry as metaphor for the nature of conscious experience and the emergence of the self; and a prolegomena to a system of notation of phenomenological accounts

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Session:

Monday, June 27, 14:00-16:00: Concurrent Session 3.2

Abstract:

Working in collaboration with other philosophers and artists, I have produced a work that uses visual, musical, and written forms to mirror the pandemonium of activity in the brain, in which different layers of activation operate simultaneously--and often 'at odds' with one another. After performing a piece of my work Strangers' Gallery, I will discuss it as a rendering of how the clamor of competing voices, within the parliamentary chamber of the mind, can yield the experience of consciousness. The artwork illustrates the problems David Chalmers lists in giving a "first-person perspective" report on mental states. I hope to show how one can create a shorthand of notation while avoiding two pitfalls that Chalmers notes as obstacles in developing "methodologies for investigating first-person data and of formalisms for expressing them": the fact that verbal productions are linear, and slow. Perhaps, then, the piece can serve to provide what is "missing" to fill in the gaps, which Chalmers sees as being an important function of novelists and artists. I will also show how, through a new system of notation, "tagging" procedures as activated or tabled can illustrate Daniel Dennett's "Cerebral celebrity" ("Fame in the Brain") amplification of the Multiple Drafts Model of consciousness. By taking into account emergent developments that can lead to "strikingly different sequels" with losing competitors "unable to recruit enough specialist attention to achieve self-sustaining reverberation," an artwork can be "pushed" to illustrate the "multitrack" nature of the "processes of interpretation and elaboration of sensory inputs." Finally, I hope that the discussion will show how that fragmented, abstract forms can be used to refer to simultaneous events that occur in the brain over very small time frames, and that flexibly varying the depth of polyphonic structures can illustrate the ebb and flow of activation, attention, and simultaneity in multiple streams of consciousness. At philosophy

conferences, many pay homage to poetry through its uses as entertainment (TSC's notorious "poetry slams"), "filling in the gaps" (Chalmers), or meditative activity (Susan Blackmore's calls to "quiet the mind"). Here, however, in addition to the work's function as metaphor, I will provide a glossary of some of the techniques and shorthand I have used to notate and illustrate the "stream" in the work and will discuss its creation. In the end, if this interpretation of my work proves as unreliable as a laboratory subject's first-person phenomenal reports, it remains my hope to have created a work that will delight and inform the scientific and artistic community.

Title:

Self-awareness in autism: First vs. third person evidence

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Session:

Saturday, June 25, 17:30-20:00: Poster Session

Abstract:

In this paper, we will review and discuss evidence about the development of self-awareness—understood as the ability to take oneself as the object of one's own thought. We begin by reviewing research on typical development, including recent neuroscientific findings that relate to the development of self-awareness. However, our paper will focus on the atypical development of self-awareness in autism, because autism is often defined as denoting a lack of self-awareness. We will discuss our own recent case study of a thirteen-

year old autistic boy (Vuletic, Ferrari, & Mihail, 2005). Our study makes use of both first and third person data by considering many different sorts of evidence about self-awareness, including both biographical and scientific. Biographical perspectives include those of his family (through interviews with his grandparents and his parents), his school (through his teacher's report card and an interview with his Teaching Assistant) and his own (through formal and informal interviews with him, his autobiographical writings, personal documents and pictures of artifacts). Scientific perspectives include a psychiatric assessment (in which he is first diagnosed with mild autism and then with Asperger's syndrome), a psychological assessment using the WISC-III, assessment of self-concept using interviews and questionnaires, and a Neurologic evaluation. Our case study and autobiographies written by people with autism all show that scientific claims that autistic individuals lack self-awareness—based on third-person evidence—are deceptive. When autobiographical and other first-person data are considered, we show that this child has a rich and varied self-awareness, as well as insight into the concerns and minds of others. We also examine self-awareness in autobiographies written by people with autism. These texts show that scientific claims about severe impairment of self-awareness in autistic individuals are not seen when autobiographical documents are taken as evidence. Finally, we will discuss the implications of these divergent findings for education of children with autism, and consider why self-awareness might play a crucial role in determining the life outcomes of autistic individuals.

Title:

Unnoticed unwanted thoughts: What you don't (meta)-know can hurt you

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Session:
Saturday, June 25, 17:30-20:00: Poster Session

Abstract:
Research on unwanted thoughts and attempts to suppress them has generally assumed that these undesired thoughts can be either conscious or unconscious, and has posited that some interplay between unconscious and conscious thoughts is responsible for the difficulty people have in suppressing unwanted thoughts. This dichotomy ignores the possibility suggested by work on “meta-consciousness” (the awareness of the contents of conscious thought) that some of our thoughts may be conscious without our being aware that we are having them. The present research investigates the possibility that some unwanted thoughts may be consciously experienced without meta-awareness of the thought using a combination of probe-reported and self-reported unwanted thoughts. Participants were asked not to think about a previous romantic relationship while reading and while sitting quietly with no other task. Participants were told to report each time that they noticed that they were thinking about the relationship and some participants were periodically probed and asked whether or not they were currently thinking about the past relationship without having realized it. The data showed that participants were sometimes experiencing thoughts of their previous relationship without being aware of it, and that such unnoticed thoughts may in fact be fairly common. Furthermore, the data reveal that such unnoticed unwanted thoughts may interfere with comprehension and/or memory to a greater degree than do unwanted thoughts which are noticed. These data suggest that meta-consciousness may affect not only the nature of our conscious experience, but the manner in which our experiences are processed.

Title:
Understanding qualitative experiences: Can fish experience pain?

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Session:
Saturday, June 25, 17:30-20:00: Poster Session

Abstract:
Are fish able to experience pain? This question cannot be answered if we adopt the view that a scientific description of a cognitive system cannot account for the relation between the described physical process and the qualitative aspect of experience. My thesis is that the reason for this lack of understanding is not that our experiences fall beyond the scope of the scientific method, but that we adopted certain presuppositions concerning science and experience. Therefore, my first objective is to uncover the presuppositions that underlie the explanatory gap and subsequently argue that this gap could be dissolved if we were to adopt John Dewey's pragmatic stance towards science and experience. Finally, I will illustrate the merits of the pragmatic way of thinking by offering a method by which we can answer questions such as 'can fish experience pain?'. The first presupposition is a particular notion of experience that is sturdily embedded in our philosophic tradition: experience is an internal phenomenon. The philosophical problems arise when the method of science is injected with a particular ontology (materialism / physicalism), consequently demarcating the scientific method. This second presupposition concerning science is usually fuelled by the success of contemporary science (in particular physics). A result of adopting both presuppositions is that we are unable to explain the relation between physical processes and experiences by using the method of science. However it is possible to dissolve the explanatory gap by redefining experience and science. We do not experience objects or events in isolation, but only in connection with, what Dewey calls, a contextual situation. From this vantage point, an

experience is no longer conceived as an internal phenomenon, but an experience has to be equated with a meaningful situation. The adjective 'meaningful' indicates that the objects or events which constitute a particular situation only make sense insofar as they are the result of prior inquiry. The onset of inquiry is the moment when the interaction with the world around us is somehow disturbed; when this particular situation becomes indeterminate with respect to the potential consequences of our actions. The only method, according to Dewey, to transform an indeterminate situation into a stable and secure situation is therefore to change the environing conditions until a particular end-in-view is reached; the experimental method of inquiry. To conclude, if we adopt Dewey's pragmatic view on experience and science, the explanatory gap will never arise. The results of scientific research will only enrich our qualitative experiences with meaning, thereby explaining and elucidating these experiences instead of transforming them into bare unexplainable facts.

Title:

Temporal and Spatial Analysis of Electroencephalographic Signals

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Session:

Friday, June 24, 14:00-17:00: Afternoon Tutorial

Abstract:

Consciousness for most of us is realized in a rapid sequence of thoughts, feelings, perceptions and mental images, since few of us are Zen masters. Instead of seeking measures of the state or level of consciousness in subjects, as in evaluating surgical anesthesia or

sleepiness, I propose to make images of the neural activity patterns in subjects who give verbal, instrumental or behavioral feedback on their mental states. Making such images is a challenging task that can be addressed with recent advances in EEG analysis. The objective of this tutorial is to describe these advanced methods of analysis of single and multichannel electroencephalographic (EEG) recordings. These new algorithms can be applied in any clinical facility with standard equipment at no great expense. They have applications to the study of intention, attention, expectancy, sensory processing, formation of meaning, learning, habituation, sensitization, epilepsy, etc. In the first part of the tutorial I will review conventional as well as advanced methods of analysis of EEG in time series and in the temporal frequency domain. One of the most distinctive features of EEGs is the appearance of oscillations in different frequency bands, which reflect the synchronized activity of large groups of neurons. Brain oscillations are correlated with different brain processes and behaviors. Their power is usually quantified by means of the Fourier Transform. This is the most useful tool for analysis of EEGs, but it assumes linearity and stationarity of the signal, and it does not give time information. It is therefore not appropriate when frequency patterns change rapidly over time. For these cases, "time-frequency" representations such as the one given by the Short Time Fourier Transform are more suitable. In particular, I will describe a relatively new time-frequency decomposition, namely, the Wavelet Transform, and stress its advantages in the analysis of EEG data. I will also describe reformulation of the output of the 1-D FFT by display in log-log coordinates. This display is useful to distinguish among various noise spectra and the 1/f scaling that distinguishes EEGs from muscle potentials [electromyograms, EMGs]. As a complement to the Fourier Transform I will introduce the Hilbert Transform, which is needed to get high temporal resolution in order to document rapid changes in frequency and discontinuities in phase. I will include discussion of the criteria for the temporal and spatial filtering that are necessary for effective use of the Hilbert transform. In the second part I will review recent advances in EEG spatial pattern imaging, with emphasis on techniques for analysis of multichannel scalp recordings from normal human volunteers. Brain processes involving large neuronal assemblies and/or interactions between distant sites are assayed by comparisons between pairs of EEG recordings and among multiple

signals. I will describe recently proposed measures of synchronization and compare them to conventional approaches. I will introduce a form of nonstationarity in cortical dynamics, in which cortical states occur as brief stable EEG amplitude patterns, like frames in a movie film (cinematographic). Each window is bracketed by widespread yet simultaneous discontinuities in beta and gamma phase that recur at rates in the alpha and theta ranges. I will compare two main uses of EEG (localization of modular signals vs. measurement of global spatial patterns) and describe the diametrically opposed methods that these two goals require. I will show the advantages of spatial analysis with 1-D arrays preparatory to 2-D recording. I will use the application of the 1-D FFT to EEGs from curvilinear scalp electrode arrays to exemplify temporal and spatial sampling, aliasing, the Nyquist frequencies, and the spectral features caused by the impedance barriers of the scalp and skull as well as by the sulci and gyri of cortex. I will review the subdivision of temporal EEG spectra into the classical ranges by use of temporal and spatial band pass filters, and introduce the subdivision of spatial EEG spectra. I will conclude with a brief description of some unsolved problems in correlation of EEG and behavior

Title:

The nature of semantic abilities in a split brain patient

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Session:

Saturday, June 25, 17:30-20:00: Poster Session

Abstract:

We ran an experiment exploring the abilities and the nature of semantic networks in the Right Hemisphere of a split brain patient. Our experiment concerns pictorial priming of semantic conceptual networks. As a control condition, normal participants were shown a picture for 3 seconds followed by a subliminal picture (shown initially for 10 ms.). Their task was to repeat the presentation of the subliminal picture till they could accurately name the object. Each time the subliminal picture was repeated it was shown for a longer duration (in increments of 10 ms.). There were three conditions of picture pairs: a) same, b) different but semantically related and, c) different with no semantic relation. An example of the second type is hammer/nails, and an example of the third type is lemon/tank. Results show that normal participants are fastest at condition (a) (repetition priming) and slowest at condition (c), implying that they are primed by semantically related pictures in condition (b). This paradigm is adapted for split brain patients on a split screen testing both hemispheres simultaneously. We hypothesize that the RH will not be primed by semantic relations because it does not have the same linguistic and hence, semantic abilities that the LH has; the RH will not be aided by semantic cues so conditions (b) and (c) will have similar reaction times. Additionally, the RH should have the same reaction time as the LH for repetition priming. This experiment is designed to explore semantic abilities through pictorial priming in the RH. The question that is being tested empirically in this experiment is whether semantic relations can be computed in a non-linguistic hemisphere. This is important since it probes the issue of the fundamental units of semantics in relation to language and nonconceptual abilities.

Title:

Experience-Dependent Modification of Dentate Gyrus Through Adult Neurogenesis: Critical Periods for Immature Neurons

Authors:

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Session:
Saturday, June 25, 9:00-12:30: Symposium 1

Abstract:

New neurons are continuously incorporated into existing neural circuits in adult dentate gyrus. It has been known that the amount of neurogenesis is affected by animal's experience. However, important questions related to this experience-dependent regulation remains answered: for example, 1) whether and when a critical period for experience-dependent regulation of neurogenesis exists, 2) whether animal's experience also modulate any functional measures of new neuron activity. To address these questions, C57/Bl6 mice was exposed to enriched environment for 1 week at different times (1st-4th week) after BrdU injection. At 6 weeks, we briefly re-exposed the mice to the same enriched environment and sacrificed the mice. Using triple-immunostaining for BrdU, NeuN and c-fos, we examined the number of new neurons (BrdU+, NeuN+) and activated new neurons (BrdU+, NeuN+, c-fos+). We found that both the numbers of new neurons and activated new neurons are increased in mice exposed to enriched environment at the 1st, 2nd (maximum) and 3rd week, but not the 4th week, suggesting the existence of a critical period for experience-dependent regulation of survival and responsiveness of new neurons within 3 weeks after neuronal birth with a maximum in the second week. Further, we compared the proportion of activated neurons between new and total population and found that significantly more new neurons are activated in mice exposed to enriched environment at the 2nd week after neuronal birth, suggesting that the responsiveness of individual new neurons is modulated by animal's experience. Thus, an animal's experience within a critical period during maturation of newly born neurons in the adult dentate gyrus, determines the properties of new neurons and their contribution to dentate functions at later time. This experience-dependent long-lasting

modification in the dentate circuit is likely to be critical for functions of adult neurogenesis such as learning and memory.

Title:
Being ahead to know now: Anticipatory timing in the production of attention

Authors:
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Session:
Saturday, June 25, 17:30-20:00: Poster Session

Abstract:
Organisms must interact with a world that has already happened due to inherent physiological delays in sensory processing. The mammalian brain has evolved the ability to anticipate forthcoming events, allowing for more efficient motor and cognitive processing. We hypothesize that one aspect of attention involves the integration of anticipated sensory processing with actual sensory input. Moreover, attention is crucially dependent on a specific time frame for anticipating sensory stimuli (i.e. when a stimulus event is expected to occur). The optimal attentional time frame is constrained by the limits of internal processes that are involved in anticipating events over specific temporal windows. Disruption of attention (i.e. distractibility, increased performance variability) occurs when stimuli occur beyond

these temporal windows or when the neural network supporting anticipatory timing is dysfunctional. Disturbance of anticipatory timing could affect learning, memory encoding, knowing and self-attributed actions. We hypothesize that these behaviors are compromised in traumatic brain injury (TBI), aging and certain neurological and psychiatric conditions, in part because of deficits in anticipatory timing. In the case of mild TBI, there is no neurobiological explanation for the symptoms: deficits in attention, diminished self-awareness, fatigue, irritability, poor concentration and failed interpersonal interactions. The above hypotheses are presently undergoing investigation in mild TBI patients in a collaborative consortium of investigators. Behavioral, electrophysiological and anatomical evidence will be reviewed with respect to these ideas.

Title:
The attentional time frame of "now"

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Session:
Tuesday, June 28, 14:30-19:00: Satellite Oral Session

Abstract:
In 1890, William James defined the present moment as: "the prototype of all conceived times is the specious present, the short duration of which we are immediately and incessantly sensible." Results from time perception experiments show that the perceived duration of the present moment is around 2.5 seconds (ranging from 0.5 to 3 seconds) (Poppel). While intuitively accepted, the underlying neural dynamics

of this phenomenon are unknown. I propose that this time range is an attentional time frame that is constrained by the temporal properties of sensory signaling used in event anticipation. This time frame is dependent on brain stem-cerebellar timing networks involved in learning and attention. I will discuss experiments in tactile (finger tapping) and visual (saccadic and smooth pursuit eye movements) domains that support motor anticipation and attention during this specific time frame. The empirical findings are relevant to understanding self-attributed actions and meaning arising from the temporal construction of the present moment.

Title:
It is not so bad to feel sad: How mood moderates the use of implicitly acquired knowledge

Authors:
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Session:
Saturday, June 25, 17:30-20:00: Poster Session

Abstract:
The presented study explores the cognitive and emotional basis of intuitive decision making by the interplay between mood and implicit learning. Intuition is defined as a perception of coherence amongst information which results from the automatic influence of implicitly acquired knowledge. This influence is nevertheless moderated by the person's affective state, as predicted by Schwarz's cognitive tuning model. The study employed standard artificial grammar learning procedure in which participants were first asked to memorize a series

of letter strings generated based on a finite-state grammar (e.g. .XTRLTRJ) and then tested for acquired knowledge in a simple classification task. The latter task required deciding about the grammatical status of new letter string exemplars and indicating the confidence in each decision. Participants' mood was manipulated by asking them to report either a happy or a sad autobiographical event before the testing phase. In order to maintain induced mood participants were also asked to review their reports in the middle of testing phase. Results showed that mood manipulation was successful. Participants previously exposed to grammatical strings (i.e. experimental group) were more accurate, but not confident, in classification decisions than those previously exposed to random letter strings (i.e. control group). Second, sad participants were on average more accurate in the second part of the testing phase than happy participants. A logistic regression analysis revealed that there were more accurate sad participants than happy ones. However, sad participants in experimental group were not more confident than happy participants. The reverse pattern of confidence ratings was detected in control group - happy participants were more confident than sad ones. This indicates that negative mood seem to facilitate the use of implicit knowledge in intuitive decision making. At the same time, positive mood guides confidence judgments but only in the absence of the relevant implicitly acquired knowledge. Limitations and future directions will be further discussed.

Title:
Consciousness and crossmodal integration

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Session:
Saturday, June 25, 14:00-16:00: Concurrent Session 1.2

Abstract:
How does our disparately sensed experience of the world get integrated into a unified conscious experience? Historically, this issue was considered from the vantage point of a thought experiment known as Molyneux's question; whether a man born blind could recognize tactually familiar shapes by sight alone if he were made to see. I will argue that answering 'yes' or 'no' to Molyneux's question can determine whether crossmodal integration is an instinctive or a learned process, but cannot explain how this integration occurs. This is evident from the disparity of philosophical explanations and research in cognitive science that have given the more plausible 'yes' answer to Molyneux's question. I discuss the explanations given by Leibniz (1704) and supported by Amir Amedi (2002), Gareth Evans (1978) supported by Andrew Meltzoff (1993), John Campbell (1996) supported by Alvaro Pascual-Leone (2001), and Jesse Prinz (2002) supported by Laurence Barsalou (1993). These explanations of crossmodal integration are also explanations of one aspect of the unity of our conscious experience; that our multisensed interaction with the world is an experience of only one world and not broken up into a visual world, a tactile world, etc. Determining the correct explanation of crossmodal integration will then lead to an explanation of this aspect of unified consciousness.

Title:
Perceptual Simulation: The problems of perceptual content and perceptual experience

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Session:

Saturday, June 25, 17:30-20:00: Poster Session

Abstract:

The analogy between visual perception and mental visual imagery is well established. What is less clear is what kind of perceptual representations images should be identified with and what kind of content - if any - they have. Therefore, my concern is the imagery debate and how the analogy of perception and imagery relates to the debate about the representational content of perceptual representations and perceptual experience. Do the perceptual experiences and their simulated pardon - perceptual simulations - have identical content, or the same kind of content? The specific question I am interested in is: what is the best answer for a proponent of mental pictures? What are minimal constraints for a promising account? The options available seemed to be that they have no content by themselves (NoCont), that they have nonconceptual content, partly or even entirely (PaNoCo or EnNoCo) or that they have conceptual content (CoCo). The argument I present is a conditional argument. First, images are identified with perceptual representations. Second, I argue that the analogy needs to be understood at least as presupposing that both kinds of contents are type-identical. Third, if we also want to classify both images and perceptual representations as having the same sort of nonconceptual content, we need an argument for both kinds of representations being nonconceptual. Whether perceptual representations are nonconceptual is highly controversial. I show, that the arguments in favor of nonconceptualism seem at best hard to transfer to imagery. This is not surprising at all. For it is grounded in the difference of both capacities that make use of these representations. But it means that there is a gap that needs to be filled even for advocates of PaNoCo regarding perceptual states. Furthermore, I argue that nonconceptualism regarding images is not convincing. I argue that the minimal condition for a pictorialist should be a position between (NoCo) and (CoCo). Images have to have conceptual content to an important degree. Thus I argue for a revised version of PaNoCo as a minimal constraint for an explanatory pictorialist view. If images and perceptual representation have the

same special kind of content, entirely nonconceptual content is the wrong candidate. My aim is to broker a reconciliation. On the one hand, an adequate theory of images must have sufficient expressive power to accommodate the role imagery plays as a cognitive capacity. On the other hand, the perception analogy constrains appropriate accounts but is at the same time the source of many misunderstandings. A promising reconciliation demands at least the concession, that images as well as perceptual states have (at least) a partly conceptual content.

Title:

The Neuroscience of Consciousness

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Session:

Saturday, June 25, 9:00-12:30: Symposium 1

Abstract:

Despite the attempts of physicists and mathematicians to model consciousness in artificial systems, there is a need to understand consciousness in a way that caters for the diverse range of chemicals operating in the brain; how else might one explain the various mood modifying and consciousness changing effects of specific drugs? We also need to account for disorders such as depression and schizophrenia, and explain how they could arise from the neurochemical context of the holistic brain. In this talk we shall develop a way of describing consciousness, that on the one hand caters for different momentary states of the physical brain, whilst at the same time respects the subjective phenomenology that is all too often

ignored by scientists. We shall explore a list of properties that would be required of the physical brain, to cater for the subjectivity of consciousness. It might then be possible to test this 'Rosetta Stone' model, in various scenarios of everyday life, and see how such scenarios might be interpreted in terms of functioning of the physical brain.

Title:

The interference of action in the flash-lag effect

Authors:

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Session:

Saturday, June 25, 17:30-20:00: Poster Session

Abstract:

In the present work, we assessed the modulatory effect of action on a perceptual task involving visual localization in space-time: the Flash-Lag Effect (FLE). In the FLE, a flashing object appears to lag behind a moving object when both happen to be physically aligned to each other. METHODS: Eighteen participants were assembled in nine pairs. Each pair of volunteers was simultaneously submitted to a psychophysical task in which they had to report the position of a vertical bar, moving horizontally from left to right on a projection screen, in relation to a vertical stationary slit located on its path. The stimulus used as the temporal marker for the spatial judgment was an abrupt-onset dot superimposed to the moving bar. The initial task of one member of the pair (active) was to control the time onset of the dot by pressing a designated key in a joystick. His/her task, on every

trial, was to produce a spatial alignment between the moving bar and the stationary slit at the moment of appearance of the dot. At the end of each trial, both observers (active and passive) had to decide among three possible perceptual outcomes: moving bar "behind", "aligned with" or "ahead of" the stationary slit at the moment the dot was caused to appear. The procedure was terminated after sixty trials. Therefore, both participants (active and passive) had to judge, throughout the experimental session, the space-time features of the very same set of visual stimuli. RESULTS: Our analysis showed that the passive observers, as expected, systematically perceived the moving bar as being ahead of the alignment position (27.6 ± 7.1 ms; $p < 0.001$) when the dot was physically presented in alignment with the slit (the FLE). The active observers, however, showed only a marginal FLE (13.8 ± 10.0 ms; $p = 0.08$). Most importantly, a significant difference was found when the magnitudes of the localization errors for both groups were compared to each other ($p < 0.05$). CONCLUSION: The active control of the abrupt-onset stimulus presentation reduced the perceptual magnitude of the FLE. This result shows a clear interference of action planning and/or execution in a spatiotemporal localization task.

Title:

Libet's backward time, quantum information and the "knowledge argument"

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Session:

Saturday, June 25, 17:30-20:00: Poster Session

Abstract:

Libet's experiments forced his conclusion that the brain refers subjective experience "backward in time". Timing of conscious experience is generally perplexing. Different aspects of a unified conscious percept, e.g. shape, motion, color and meaning of an object are processed in different brain regions at different times, separated by ~80 msec per feature. Brain activities correlating with apparently conscious perception of stimuli in speech, vision etc. occur after seemingly conscious voluntary response to those stimuli have occurred. In the "color Phi" and "cutaneous rabbit" anomalies, the brain apparently fills in information yet to be perceived. Accordingly, many scientists and philosophers (e.g. Daniel Dennett) conclude that unified consciousness and volitional actions are constructed after unbound/unconscious perceptions and responses occur: we only remember unified, bound perceptions and conscious control of our actions. But this can't account for Libet's (e.g. medial lemniscus) findings. An alternative explanation was raised by Penrose in 1989: particular quantum state reductions in the brain are essential to consciousness and send subconscious quantum information "backward in time", e.g. to the evoked potential. The very nature of time in physics is unclear, but several approaches show backward time effects: (1) Wheeler-Feynman: electromagnetic phenomena have negative time vectors, but a coherent absorber (i.e. a quantum system) is required to detect them. (2) Aharonov: quantum state reductions send quantum information vectors both forward and backward in classical time. (3) Schumacher and Penrose (separately): backward referral of quantum information accounts for instantaneous effects in quantum entanglement. Backward time information/action flow threatens causal paradox (e.g. going back in time to kill your ancestor, preventing your birth). But quantum information is a misnomer (Penrose calls it quanglement), as signaling/conveyance of classical information is prohibited. Quantum information/quanglement can merely modify classical information. One possible modification is becoming conscious/gain qualia. Libet's backward time, temporal binding, color Phi/cutaneous rabbit, volitional choices may be viewed as brain activity/information becoming conscious/gaining qualia because of modification by quantum information/quanglement. In Jackson's version of the "knowledge argument", Mary the neuroscientist knows

everything about color vision but lacks color vision herself. She then gains color vision. Has she gained knowledge/classical information? No, she has gained qualia which could be quantum information ("quanglement") modifying nonconscious visual perceptions (previously modified by only black and white qualia). Despite backward referral there is no possible causal paradox. Qualia may be quantum information/quanglement modifying nonconscious brain activity resulting in conscious experience.

Title:

Multimodal apparent motion

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Session:

Tuesday, June 28, 12:00-14:30: Satellite Poster Session

Abstract:

The perception of motion requires both the perception of space and time to be integrated in order to assess the speed and direction of a moving object. Korte's 1915 laws of motion suggest that we have a preferred speed for visual motion, extending over a substantial range. Within the context of these laws, we looked at the preferred speed for visual, tactile and multimodal motion. We presented subjects with unimodal and bimodal stimulus pairs of lights and touches (produced by mini solenoids) with a range of stimulus onset asynchronies (SOAs). Based on subjects' forced-choice decisions between all combinations of SOAs, we determined the SOAs that evoked the most convincing unimodal and bimodal apparent motion. In another experiment, subjects made forced-choice decisions about the perceived direction

of apparent motion. Psychometric functions provided the SOAs for apparent motion's lower threshold. We looked at how the optimal and threshold SOAs for apparent motion varied with distance between the pairs, and with duration and intensity of the stimuli. The task of determining direction and choosing the most convincing apparent motion implicitly requires judgments about space and time, for example which stimulus came on first. By comparing the effects of distance, duration and intensity of bimodal and unimodal motion we have determined differences between unimodal and bimodal perceptions of space and time. These data will be discussed in the context of emerging research revealing cross-modal influences on unimodal apparent motion perception.

Title:

A three-stage mechanism for simultaneity constancy

Authors:

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Session:

Tuesday, June 28, 9:00-12:00: Satellite Oral Session

Abstract:

Different sensory systems take different amounts of time to process different stimuli. Under certain conditions, and for particular types of stimuli, we and others have demonstrated simultaneity constancy. Simultaneity constancy is the perception that the different components of an event are simultaneous despite variations in physical and sensory processing times. How might this be achieved? Bottom-up schemes include adjusting the overall processing times for each sense modality,

or adjusting the perceived timing of particular stimuli that are expected to occur together. Reaction times, however, did not show such adjustments, nor did reaction times vary in response to an adaptation which shifted the relative timing of stimuli regarded as simultaneous, nor did they show an enhancement to double stimuli. These lack of changes support a top-down model. A top-down approach might involve, after identifying a particular multimodal event, retrospectively adjusting the perceived relative timing of its components. We postulate that the brain first identifies multimodal stimuli as occurring close enough together in space and time to belong to the same event. Unless this is true simultaneity is not perceived. Second the brain applies some fixed rules to the perception of the relative times of the stimuli. For example, the perceived relative timing of lights and sounds are shifted closer together if they occur close enough in time and in the right order. Thirdly specific adjustments based on experience with similar multimodal pairs can then be applied. We present experiments that support each of these three stages of a simultaneity constancy mechanism.

Title:

The specific role of the left prefrontal cortex in sentence processing

Authors:

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Session:

Saturday, June 25, 17:30-20:00: Poster Session

Abstract:

Introduction. Language comprehension involves access to and recognition of a vast array of figurative expressions. Some cases of idioms are truly fixed while others are more malleable (productive) and allow a literal as well as a figurative interpretation. In particular productive forms are ideal for studying conscious perception of linguistic information, because they are comparable to bistable visual percepts. However, the cognitive processes and cortical circuitries of idiom processing are not well understood. A widely accepted view in neuroscience is that damage to the right hemisphere, but not to the linguistically dominant left hemisphere, degrades idiom comprehension. However, recent TMS experiments point to the left hemisphere as the site of idiom comprehension. Which cortical regions employ access and recognition of idioms, is yet to be determined. Specific Aims. The goal of our research is to reveal the neural substrate that is specifically involved in idiom processing. Our model predicts that comprehension of figurative expressions requires additional cognitive resources compared to literal speech. These additional resources are related to our assumption that the selection of a figurative reading involves the recognition of an idiom key and the suppression of literal meanings. We predict that comprehension of idioms implies to some extent controlled-conscious processing to rehearse, suppress the literal, and interpret the figurative meaning. Therefore, our hypothesis is that the right and left inferior frontal gyri are stronger activated for both literally/figuratively interpretable (productive) and non-literally interpretable (opaque) idioms than for literal phrases. Methods. We used an m-sequence-based, rapid event-related fMRI technique (TR=1.5sec) to measure in 10 healthy speakers region-specific blood-oxygen level dependent (BOLD) signals during spoken sentence comprehension (n=200). The sentence corpus was classified according to their degree of figurativeness, rated by 24 subjects on a 7-point scale. Results and Conclusions. We did not find a specific right-hemispheric involvement in idiom comprehension compared to literal processing. However, the left prefrontal cortex was activated more strongly during comprehension of opaque idioms as compared to productive figurative expressions and literal speech. Our results support the idea that suppression of implausible literal meanings requires attentional resources and deep semantic processing to select the appropriate figurative meaning. Thus, the left prefrontal cortex seems to be particularly involved in controlled-conscious

processing of linguistic information. In contrast, we found stronger activation within the left medial superior parietal lobe for literal speech than for figurative expressions. We assume therefore that this region is specifically involved in automatic-semantic processing.

 Title:
 The argument from atomism

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Session:
 Saturday, June 25, 17:30-20:00: Poster Session

Abstract:
 The purpose of my paper is to add another to a list of dozen or so arguments for dualism: the 'argument from conceptual atomism': 1. Word meanings (= 'concepts') are non-complex (i.e. atoms) at the semantic level of representation. This is basically to say that semantic complexity is where there is syntactic complexity, which is what words (or rather lexemes) lack. A classical collection of arguments for atomism is in Fodor and Lepore (2002). 2. Concepts are not and do not supervene on syntactically (or physically) individuated mental representations, whatever neurological pattern these may be. Being represented by a particular symbol (or neural correlate) is a property non-essential to a concept. Essential to a concept is its content. 3. The contents of concepts are not, and do not supervene on, (causally individuated) inferential relations between syntactically individuated mental representations. Such inferences depend on a grasp of the concepts they are meant, by so-called 'inferentialists', to explicate

(e.g., Gentzen-style introduction and elimination rules for conjunction require for their understanding a grasp of the concept CONJUNCTION, see Fodor 2004). 4. The contents of concepts are not and do not supervene on referential ('informational', causal) relations to an environment, described in ways that do not presuppose the concepts in question. Generally speaking, how organisms relate to an environment depends on what conceptual resources they possess. In the absence of the latter, standing in causal relationships to an environment won't lead them to spring into existence; general learning rules cannot explain them, if they are atoms (Hinzen 2005). 5. If concepts are individuated by their content, and this content does not supervene on mental representations, inferential or referential relations, it seems they do not supervene on anything other than themselves. If physicalism is taken, as standardly, to rule out the existence of mental entities, physicalism is false. Basically, this result is expected: functionalism replaced behaviorism by allowing causal power to internal representations, assuming the meanings of the latter could be somehow functionally explained (by causal roles). But there is no reason to believe that the primitives of the combinatorial system of human thought and language can be so explained, if indeed they are atoms.

Title:
The Brain Basis of Differences between the Waking and Dreaming States of Consciousness

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Session:
Saturday, June 25, 9:00-12:30: Symposium 1

Abstract:

One approach to the study of the brain basis of consciousness is to compare the states of waking and dreaming at the phenomenological and psychological realms. Phenomenologically, we measure such formal properties of consciousness as internally generated percepts, capacity to correctly identify states, cognitive features like thinking, continuity and congruence, memory and emotional spectrum. Physiologically, we measure neuronal activity (in animal models) of cholinergic and aminergic all cell populations in the brain stem. In humans, we take account of the regional activation differences revealed by brain imaging. The integration of findings yields clear and matching differences at both levels that can be used to model the brains control of conscious states.

Title:
Spectrum inversion is possible: Implications of a formal proof

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Session:
Saturday, June 25, 17:30-20:00: Poster Session

Abstract:
Is it possible, John Locke pondered in his Essay of 1690, that "the idea that a violet produced in one man's mind by his eyes were the same that a marigold produced in another man's, and vice versa."? Could the colors I experience differ from yours, even if experiments reveal no difference between us? Locke's question is raised by inquisitive

children, but remains hotly debated by philosophers and by researchers in the cognitive and neural sciences because its answer is key to current theories of the relationship between brain activity and conscious experience (Bickle, 2003; Braddon-Mitchel & Jackson, 1996; Chalmers, 1996, 2002; Churchland, 2002; Crick & Koch, 1988; Gregory, 1998; Metzinger, 2000; Tye, 2000): If color scrambling of the type Locke envisioned is possible, this would entail that conscious experiences could change without concomitant functional changes in brain states. Locke's question has stirred prolific debate through the ensuing centuries, but no mathematical articulation or proof. In this presentation I prove that the answer is Yes: color scrambling is possible without violating scientific laws. I then discuss the implications of this Scrambling Theorem for functionalism. Functionalist theories of conscious experience propose that experience is determined by the functional architecture of a system: its inputs, outputs, internal states, and rules for changing state (Block & Fodor, 1972). Although in humans this architecture is implemented in the nervous system, it could equally well be implemented in other physical systems, such as computers. Proponents of functionalism typically deny that the experiences of one person could be scrambled from those of another with no experimental consequences (Chalmers, 1996, 2002; Churchland, 2002; Dennett, 1998; Tye, 2000). For if functional architecture determines conscious experience, then scrambling experiences would require changing functional architecture. Such changes would evoke differences between the two persons in controlled experiments. Some proponents of functionalism assert further that a clear sense to the question of color scrambling has not yet been articulated (Clark, 1983). If, however, color scrambling is well defined and possible without violating scientific laws, then functional architecture does not determine conscious experience, and we must look elsewhere, perhaps in quantum processes (Albert, 1994; Barrett, 1999; Penrose, 1994), for physical correlates of consciousness, or countenance fundamentally different approaches to the study of consciousness (Searle, 1994). Thus it is crucial to articulate a clear sense and definitive answer to Locke's question. This presentation does so.

Title:

Temporal aspects of change blindness & detection: stimulus- and response-locked EEG components of perceived and non-perceived changes

Authors:

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Session:

Monday, June 27, 14:00-16:00: Concurrent Session 3.1

Abstract:

A central question in the scientific study of perceptual awareness is the extent to which neuronal activity in distinct cortical areas correlates with conscious experience. Recently several independent studies have suggested that already in primary visual cortex (V1) neuronal activity correlates with subjective experience. However, it is unclear whether this correlation is based on the initial, intrinsic activity in V1 or on reentrant feedback from higher cortical areas. To address this question we studied the phenomenon of change blindness with event-related EEG potentials (ERPs). We exploit their high temporal resolution, and the fact that their inverting topographies to upper and lower visual field stimuli characterize sources in V1. One of the key questions we address is whether the initial stimulus-locked component or only later response-locked components correlate with subjective awareness of the change. Subjects viewed a flickering stimulus, consisting of 3 ring segments in the upper and lower visual hemifield each centered on a red fixation mark on a grey background. Subjects monitored the striped pattern of the 6 ring segments and reported changes of their

orientation (i.e. a flip by 90 degrees) by means of button presses (using 3 fingers of the left and right hand for the upper and lower visual hemifields, respectively). We compare stimulus- and response-locked ERP components induced by perceived (correct detects) and non-perceived changes (misses) and analyze their neural sources. This EEG study is a continuation of a recent functional imaging (fMRI) study using a similar stimulus and task (Hofstoetter et al, SfN, 2004). The BOLD imaging study showed that a transient, spatially localized BOLD signal increase within V1 followed perceived - but not missed - orientation changes and that the time of the peak of this response correlated linearly with subjects' reaction time. We discuss how the higher temporal resolution of our EEG measurements can add to the fMRI data, which suggested that the correlation of subjects' conscious perception with activity in primary visual cortex is due to reentrant feedback from higher cortical areas rather than intrinsic activation of V1.

Title:

Investigating consciousness by building anthropomimetic robots

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Session:

Saturday, June 25, 17:30-20:00: Poster Session

Abstract:

One of the clearest trends in consciousness studies in the last decade or so has been the increasing importance of the idea that embodiment, and the right kind of embodiment, may underpin many consciousness-

related phenomena. Perhaps unsurprisingly, this process has been paralleled by the realisation within both artificial intelligence and cognitive science that embodiment is also a key determinant of many cognitive abilities. The idea that cognition might be studied by examining artificial embodied systems has been slow to develop, but is at last coming of age; however, the extension of this approach to the study of consciousness is still little more than nascent. This is somewhat surprising, in view of Dennett's early paper setting out 'The practical requirements for making a conscious robot' [1], but one possible reason is the difficulty of raising the funding required to build state-of-the-art robots when the explicit aim is to use them for consciousness research. At Essex, we are fortunate enough to have overcome this difficulty; this talk will deal with the characteristics of the robots we are building, and the ways in which their specific embodiment can be exploited in the context of consciousness. Our project, 'Machine consciousness through internal modelling', will investigate the possible role of the robot's internal models of itself (the IAM - Internal Agent Models) in the formation of a system with at least some of the functional and phenomenal characteristics of consciousness-related cognition, and even consciousness itself. The key idea is that the conscious self is a real functioning entity within a virtual machine - an internal self-model which evolved as part of a complex cognitive structure enabling effective action planning in a dynamic and partially known world. Because we believe planning for action to have been the important driver, we have designed the robot to have as far as possible the same sensory and motor characteristics as humans, and to process the sensory and motor information needed for the control of action in a human-like way. This has entailed building a robot [2] with an analogue of a skeleton similar to our own, and with elastic analogues of muscles and tendons in positions similar to those of humans. The primate visual system is modelled very closely, with colour cameras mounted in eyeballs moved by analogues of the oculomotor system, giving the equivalents of pan, tilt, and rotation. Early visual processing is handled by a sophisticated and flexibly reconfigurable implementation of a saliency mapping system [3, 4], the outputs of which drive gaze control using both head and eye movements. We call this approach anthropomimetic robotics, because it goes far beyond the envelope-centred scope of humanoid robotics. Interestingly, it may be possible to use the robot to investigate not just

our own theories, but also those of others, in particular O'Regan and Noë [5]: if an anthropomorphic robot achieved mastery of visual and tactile sensorimotor contingencies in the way they claim humans do, what could that tell us about visual consciousness?

Title:

Visual salience facilitates entry into conscious scene representation

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Session:

Sunday, June 26, 14:00-16:00: Concurrent Session 2.1

Abstract:

Are we more likely to consciously register, remember, and report elements in a visual scene which are more conspicuous or salient? Focal visual attention is known to gate low-level visual information into higher-level processing, short-term memory, and consciousness. However, being merely attracted to something salient and attending to it does not guarantee that it will be retained in the conscious mental representation of a scene. Here we provide preliminary experimental evidence that, in dynamic natural scenes, out of all objects, actors, and actions which are attended to, those which are verbally reported are also more bottom-up salient than those which are not. Using an eye-tracker, we recorded gaze of one human participant watching twelve 30-seconds television clips, together with his online verbal descriptions of the scenes depicted in the clips. Eye movement traces were segmented into periods of fixation and saccadic gaze shifts. We manually isolated saccades towards each entity that had been reported verbally. Using a computational model of bottom-up visual salience,

we computed dynamic salience maps for all clips. We compare the distribution of instantaneous salience at human saccade targets to that at random targets using the Kullback-Leibler (KL) distance; KL scores above zero indicate that visual salience attracted gaze more than expected by chance. Our findings are three-fold: first, visual salience significantly attracted gaze overall, as scene locations saccaded to by the observer were reliably more salient than expected by chance ($KL=0.194 \pm 0.019$, $n=992$ saccades, t -test, $p < 10^{-27}$). Second, restricting the analysis only to human saccades directed towards objects, actors, or actions mentioned in the verbal report yielded an even higher score ($KL=0.372 \pm 0.055$, $n=319$, $p < 10^{-13}$), indicating that more salient scene elements were more likely to be reported. Third, restricting the analysis to only the first saccade onto each of the 88 different reported scene elements yielded an even higher score ($KL=0.546 \pm 0.120$, $n=88$, $p < 0.0008$), suggesting that instantaneous salience of a scene element when first gazed at may significantly influence whether it will be reported. In sum, our study suggests that, out of all the targets of human gaze over complex dynamic scenes, those which emerge as the central elements in the conscious representation of the scene are more bottom-up salient, supporting a role for bottom-up salience in facilitating entry into conscious mental scene representations.

Title:

A Direct Measurement of Auditory-Visual Temporal Integration

Authors:

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Session:

Tuesday, June 28, 12:00-14:30: Satellite Poster Session

Abstract:

The perceived time of occurrence of a visual stimulus may be shifted towards an auditory stimulus that follows within 200ms: the so-called 'temporal ventriloquism' effect. However this effect has only been demonstrated indirectly. Here we measure the perceived time shift directly. Subjects were presented with sequences of three stimuli comprising various combinations of visual (an LED switching on) and auditory (a 5ms burst of white noise) events and asked them to indicate which of the two intervening intervals was shortest. The two intervals totaled either 600 or 125 ms. The onset of the event in between the flanking stimuli was varied using the method of constant stimuli. A psychometric function was obtained from which the perceived temporal midpoint of the sequence was deduced. When the total duration of the sequence was 600 ms, shifts in the perceived midpoint were consistent with the shorter neural processing time of sounds relative to lights. For shorter intervals, when the central stimulus occurred within 100 ms of the flanking stimuli, there were additional shifts in which the perceived timing of a visual stimulus shifted by 15-30ms towards an auditory stimulus that followed it. These results show quantitative evidence for auditory-visual temporal integration.

Title:

Prefrontal, posterior parietal and temporo-limbic systems: Their functions and interactions as an integrative neurocognitive model for consciousness

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Session:

Saturday, June 25, 17:30-20:00: Poster Session

Abstract:

This paper relates to frameworks in cognitive neuroscience for the purpose of informing studies of human consciousness. It presents a theoretical model describing three key neurocognitive or affective systems intimately tied to higher consciousness. The scientific study of consciousness is increasingly influenced by cognitive neuroscience (CN). This relationship is not guided by large-scale neurocognitive frameworks. Ideas that operate deep within CN need to be translated into operational frameworks that will have utility in drawing brain-consciousness relationships. CN itself lacks such models that integrate diverse data into unifying frameworks. The proposed model focuses on the (1) temporo-limbic, (2) prefrontal and (3) posterior-parietal systems. Each system's distinct neural architecture (connectional and laminar arrangement) is described to bring forth the enormous impact of neural architecture on consciousness. Cognitive-affective complexes of each system that have particular bearing on the study of consciousness, are then detailed. (1) The temporo-limbic system and its role in thought that is depersonalized, excessively ruminative or emotional, mystical, religious, spiritual or fervently ideological: Here the model draws from behavioral neurology and affective neuroscience to emphasize the utility of temporo-limbic behavioral complexes in understanding consciousness. It also casts many temporo-limbic behavioral complexes as evolutionary maladaptations. 2) The prefrontal cortex (PFC) and its tie to cognitive control functions or "executive control": Neuropsychology describes prefrontal functions in terms of mechanisms of language, attention, planning, control of cognitive interference, and short-term (working) memory. Further distilled, "executive control" amounts to a core set of control, sequencing and working memory functions. They entail preparation and temporal sequencing of cognitive sets, regulation of emotional reactions, regulation of cognitive interference, and mnemonic memory. PFC design that shows top-down control over temporo-limbic output may be especially relevant to consciousness. (3) The role of the posterior parietal cortex (PPC) in cognitive representational frames, coordinate

maps and transformations: A link is drawn between this representational system and an individual's capacity to represent complex schema, ideas, frames of mind and abstractions in thinking. The PPC can create general, abstract and complex representational schema independent of sensory-motor input, making it a critical (yet ignored) system in consciousness studies. Finally, dynamic interactions between the three systems are described, to illustrate (a) how a particular profile translates into an individual's consciousness, (b) how similar profiles and similar permutations of PFC-PPC-temporo-limbic dynamics, across individuals, constitute particular group-or social-consciousness, and (c) how these systems and hence consciousness may be open to change and evolution.

Title:
Hypnotic paradoxes of consciousness and control

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Session:
Monday, June 27, 10:30-12:30: Symposium 4

Abstract:
In hypnosis consciousness and control may come apart in ways that force us to rethink the nature of both. Early accounts of hypnotic phenomena describe the creation of a hidden part of the psyche, which remained in contact with reality but did not exert control except in special circumstances. However, recent phenomenological analysis reveals the presence of a dual (not split) awareness of suggested and actual realities and the absence of awareness of both the self and the

hypnotist as intentional agents. Functional neuroscience findings highlight the multiple fragmentations between consciousness and control in hypnosis. Gamma synchronization shows a decline in integration between functionally distinct cortical regions during hypnosis suggesting both a decline in executive control over conscious representations and in turn in their availability to guide executive control processes. Imaging studies show executive control of Stroop induced response conflict declines in hypnosis but specific suggestion may elicit perceptual alterations, which prevent response conflict.

Title:
Spatially localized distortions of perceived duration

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Session:
Tuesday, June 28, 9:00-12:00: Satellite Oral Session

Abstract:
The perception of duration may simply reflect the time of neural activation induced by the processing of the stimulus. In this case duration would be encoded implicitly. Alternatively for short durations specialist neural mechanisms might exist that extract the duration of external events and represent this information explicitly. We report that apparent duration can be manipulated in a local region of visual space by adaptation to oscillatory motion, without concomitant changes in the time of onset or offset of the test patterns, demonstrating that apparent duration can be dissociated from the time course of

neural processing. Similar effects of adaptation to flicker on duration can also be dissociated from those on flicker perception per se. Although 20Hz visual flicker both reduces the apparent temporal frequency and duration of a 10Hz flickering test patch, 5Hz adaptation increases apparent temporal frequency with no effect on duration. The restriction of these effects to the adapted region of the visual field demonstrates that perceived duration in the subsecond range can be manipulated by adapting the spatially localised temporal mechanisms of early visual processing.

Title:

Born to be wild: grounding embodiment and content in self-sustaining systems

Authors:

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Session:

Saturday, June 25, 17:30-20:00: Poster Session

Abstract:

Both of the major approaches to consciousness and cognition have problems accounting for conscious content (Chalmers, 1996; Clark, 2000). On the one hand, computationalists have difficulty explaining how symbolic tokens gain their content. Recent attempts to overcome this problem include teleological theories that explain the meaning of an internal structure *i* of a system *s* through the past of the structure. That is, only systems going through a specific learning (Dretske 1990,

1994) or evolutionary process (Millikan 1989a, 1989b, 1990) are capable of having content in a non-derivative sense. Dynamical systems theorists, on the other hand, deny the need for internal representations altogether, and put cognition into the world (van Gelder, 1997). More recent versions of this position (i.e., Embodied cognition approaches) have difficulty explaining content because they have yet to clarify what embodiment is and why internal states of embodied systems are meaningful states for the systems that are embodying them. As a potentially integrative alternative, we propose the wild cognitive systems approach. We begin by modeling organisms as energy-transformation systems that are embedded within a larger, self-organizing energy-transformation hierarchy (Jordan, 1999, 2003; Odum & Odum, 1988; Vandervert, 1995). Kauffman (1995) argues that individual transformers sustain themselves within this hierarchy because they are autocatalytic. That is, the energy transformations (i.e., chemical reactions) taking place within the system produce products that serve as a catalyst, either for the reaction that produced the catalyst, or for some other transformation in the system. The notion of autocatalytic energy-transformation systems provides grounding for embodiment because it reveals that the fuel-source dictates the consumer. This is, the dynamics of an energy-transformer (e.g., a lion) must be such that they allow it to engage and overcome the dynamics of its fuel source (e.g., a gazelle). A 'body' therefore, constitutes an encapsulation, or embodiment, of the constraints that body must engage and overcome in order to capture its fuel source. This approach to embodiment also provides a grounding for content because the dynamics embodied within such 'bodies' are necessarily 'of', 'about', and 'emergent from' the transformational dynamics of the hierarchy from which they emerged. As a result, organisms constitute embodied world, and their self-sustaining (i.e., autocatalytic) internal states are meaningful (i.e., entail content) in the sense they are simultaneously 'about' (1) the macro-level whole (i.e., 'body') their work serves to sustain, as well as (2) the energy transformation hierarchy of which the 'body' is an embodiment.

Title:

Forward Models and Common Coding in Perception-Action Space: The Anticipatory Nature of Spatial Consciousness

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Session:

Tuesday, June 28, 12:00-14:30: Satellite Poster Session

Abstract:

The perceived vanishing point of a moving stimulus is displaced beyond the actual vanishing point. These forward displacements are often attributed to action-independent cognitive distortion (i.e., representational momentum—Hubbard, 1995, 1998). However, three recently discovered properties of spatial displacement indicate the displacement emerges from anticipatory forward models participants generate while sustaining perception-action coordinations with the stimulus. First, the displacement requires continuous perception-action engagement. The displacement is zero if (1) participants fixate a stationary target during the presentation of the moving target (Kerzel, Jordan, & Müsseler, 2001), or (2) participants produce the vanishing point themselves via a button press (Jordan, Stork, Knuf, Kerzel & Müsseler, 2002). Second, displacements get larger as participants plan further ahead (Jordan & Knoblich, 2004). If participants control the stimulus via right- and left-arrow key-presses, displacement is larger when button presses produce small versus large changes in dot velocity (i.e., participants need to plan further ahead when their actions have less impact). And third, displacements get larger as participants gain experience controlling the dot (Jordan & Hunsinger, submitted). Collectively, these findings indicate spatial perception is anticipatory (due to its dependence on planning). The notion of anticipatory spatial consciousness is also consistent with the following findings: (1) perceptual-motor learning involves the generation of

predictive systems (i.e., forward models—Blakemore, Frith & Wolpert, 2001) that allow one to select actions based on their anticipated sensory consequences, and (2) perception and action-planning share common neural resources (Hommel, Müsseler, Aschersleben & Prinz, 2001; Rizzolatti, Fadiga, Fogassi, & Gallese, 2002).

Title:

Complementary functions of saccadic, position/drift, and extraretinal responses to eye movements in V1 neurons

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Session:

Tuesday, June 28, 12:00-14:30: Satellite Poster Session

Abstract:

Eye movements are important for many aspects of visual awareness, but their contribution to visibility and stable perception during natural vision is not well understood. We investigated the effects of fixational and small voluntary eye movements on the activity of single V1 neurons in alert behaving monkeys. Visually-driven responses to eye movements could be separated into three categories: transient post-saccadic, sustained position/drift, and mixed, that are correlated with receptive field properties of respective neurons. Although bursts of spikes occur in many cells after abrupt stimulus movements caused by saccades, most cells also exhibit sustained firing in the intersaccadic drift periods if the stimulus remains on the receptive field, and some cells do not respond to saccades and have only sustained responses

during drifts. These results suggest complementary functions for the two types of visual activation. Transient post-saccadic bursts signal abrupt change or motion in the receptive field and can be utilized to detect salient stimulus features like edges irrespective of the current spatial position, and may help to maintain perceptual stability. Inter-saccadic discharge encodes stimulus position and conveys information about spatial details of a visual scene. In addition to the main visually-driven component, fixational and voluntary eye movements are accompanied by extraretinal effects that modulate ongoing firing in absence of visual stimulus. The extraretinal signal is biphasic: weak post-saccadic inhibition followed by slow enhancement. These signals may contribute to saccadic suppression as well as enhancement of stimulus visibility and discrimination following the saccades, by facilitating efficient updating of the scene.

Title:
Visual motion dilates the time

Authors:
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Session:
Sunday, June 26, 14:00-16:00: Concurrent Session 2.3

Abstract:
It has been proposed that our time estimation relies on the number of changes we experience. In the present study, we investigated how visual motion - a form of changes in the visual modality - affects the subjective estimation of the physical time ranging from 0.2s to 1.0s.

The perceived duration was measured by a reproduction method, in which observers were asked to reproduce the duration of a stimulus by holding a key. Our first experiment (Exp.1) shows that the perceived duration becomes longer as the speed increases. The effect size increases up to an overestimation by 250ms and then saturates at that level. However, the effect size was not simply determined by the speed alone, but also depended on the stimulus duration; with longer presentation times, the dilation was attenuated and a faster speed was required to obtain the same level of time dilation. We tested two hypotheses that can account for the time dilation induced by the visual motion. The first is the change-based hypothesis that stimulus change is used as a temporal cue and the perceived duration is estimated based on the total amount of perceived changes. According to this hypothesis, the perceptually faster motion will result in a larger time dilation. The second is the mental rehearsal hypothesis that the time is estimated by the duration for the observers to mentally repeat the original stimulus with the perceived speed. This hypothesis predicts that perceptually slower motion should result in a larger time dilation. Therefore, these two hypotheses make two opposite predictions for perceptually slow motion. We conducted experiments with low contrast (Exp.2) and isoluminant (Exp.3) stimuli, which are generally perceived to be slower than high contrast stimuli. We found that the estimated duration becomes longer for the low contrast and isoluminant stimuli. This finding supports the hypothesis that our duration judgment is based on the mental rehearsal in the reproduction task. The cause of the time dilation found in Exp. 1 is now attributed to the underestimation of fast speeds, particularly for briefly presented stimuli. The relation to known motion psychophysics on perceived speed will be discussed.

Title:
Forward transition and snap-back in crossmodal simultaneity

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Session:
Tuesday, June 28, 12:00-14:30: Satellite Poster Session

Abstract:
Neural signals for vision and audition evoked by a single audiovisual event are not necessarily synchronous in the brain. To perceive a synchronous event as synchronous, the audio and visual neural signals that are separate in time need to be bound together. The mechanisms to achieve the binding are not understood. Here we report a novel audio-visual illusion that illuminates this issue. The visual stimulus is apparent motion consisting of a series of visual flashes revolving around the fixation point, and this cycle is repeated. At the timing of one of the flashes, a sound stimulus (1ms click) is given. In the first few cycles, the disk presented before the sound is perceived as simultaneous. However, as the cycle repeats itself, the disks occurring later become synchronous. Typically, the perceived synchronous disk moves steadily forward disk-by-disk. This forward transition continues until the disk presented far later than the sound (>200ms) is perceived as synchronous. However, when the discrepancy between the perceived timing and physical timing becomes too large, the synchronous disk suddenly snaps back to the original state - a more veridical temporal position. These two types of transition - steady forward transition and abrupt snap-back - are observed repeatedly during the view of many cycles. This crossmodal timing illusion implies that our timing judgment across modalities is not based on a fixed neural latency but changes dynamically even in a very short period of time. Our experiments show that visual attention is responsible for the modulation of perceived crossmodal simultaneity; Attention to a disk attracts the perceived timing of sound closer to the timing of the disk. We model the simultaneity judgment in a Bayesian

framework in which the only assumptions are that both the visual and auditory signals have uncertainty and that attention reduces the uncertainty by increasing signal to noise ratio. Our model captures the forward transition and the snap-back effect as well as attentional attraction of sound timing.

Title:
Color and Consciousness

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Session:
Friday, June 24, 14:00-17:00: Afternoon Tutorial

Abstract:
Our experience of colour is so intense that it is probably the canonical example used in discussions of qualia. The transformation of wavelengths of light into our percepts of colour is, however, complex, as are the uses to which colour percepts are then put. The core question we address in this tutorial is whether specific aspects of these transformations and uses give rise to colour experience. In pursuit of an answer we provide tutorial reviews of the anatomy and physiology of wavelength processing, the psychology of colour-constancy and colour categorisation, and the neurology of colour-specific visual deficits (of which there are many). By tying together evidence from each of these areas we show when colour information does and does not give rise to experience and take some steps towards establishing anatomical distinctions between the loci of the covert use of colour and of colour experience.

Title:
Helpful Looks More Attractive? Evidence for Sexual Dimorphism

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Session:
Saturday, June 25, 17:30-20:00: Poster Session

Abstract:
The ability to comprehend the mental states of others is key to successful social interactions. Essential to this 'mindreading' ability is a mechanism specialized for direction of gaze computation (Baron-Cohen, 1995) that can cause the reflexive orienting of attention to gaze directed locations (Driver et al., 1999). Do we implicitly distinguish between individuals whose eye gaze is informative versus uninformative? Does this discrimination lead to greater perceived attractiveness of helpful/informative individuals? In Experiments I and II, 24 women and 24 men viewed centrally presented frontal view faces (3 female, 3 male) for 900 ms after which the eyes looked either to the left or right. Participants responded to a target appearing to the left or right of the screen either 100 or 700 ms after eye gaze shifted. Unbeknownst to participants, faces were divided into three pairs (each pair consisted of one female and one male face) associated with a different probability with which eye gaze predicted target location: Pair I - 80% valid, Pair II - 50% valid, and Pair III - 20% valid. Faces were rated for attractiveness on a scale ranging from -100 (unattractive) to 100 (attractive) both before and after the visual orienting experiment. Both sexes were faster at detecting targets on valid trials regardless of eye gaze validity at 100 but not 700 ms

indicating the presence of reflexive visuo-spatial orienting at the shorter SOA. Women, counter to existing findings responded more slowly at the longer SOA, whereas men were faster as typical. Attractiveness ratings showed no effects of validity at 100 ms SOA, but women rated the informative faces (Pairs I & III) as more attractive after the longer SOA irrespective of baseline attractiveness. When questioned afterward, no participant reported noticing a relationship between facial identity and eye gaze validity. Thus, the perceived increase in attractiveness is not due to explicit processes. In Experiment III, 6 men and 6 women, explicitly informed of eye gaze validity (20% valid), detected a target presented at SOAs of 100, 700, and 1200 ms after eye gaze shift. Both sexes revealed faster reaction times to the informative but invalid trials at only the longer SOAs. We suggest that in the absence of explicit information, women's 'sticky' attention to faces underpins their implicit pickup of eye gaze. Though this does not translate into differential target detection times, it does lead to an increase in the perceived attractiveness of helpful/informative faces.

Title:
An imperative theory of pain

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Session:
Saturday, June 25, 14:00-16:00: Concurrent Session 1.2

Abstract: When discussing numerous issues in philosophy of mind, it is common to use Pains as one's standard example of a mental or phenomenological state. Despite the ubiquity of pains, however, it has

proven remarkably difficult to provide an accurate philosophical account of pain—that is, a careful description of the sort of phenomenal state it is, what it causes, and what if anything its content is. Traditional theories fall into two categories: those that treat pains as Simple Sensations, akin to seeing the color blue or smelling a magnolia, and those that treat pains as Simple Motivational states, akin to desires or judgments. I argue that both accounts are untenable, unable to account for either the intentional content or the distinctive motivational import of pains in a satisfying way. Instead, I argue for an Imperative Theory of Pain. This view has two main theses. First, that pains belong to an often overlooked class of imperative phenomena. Following Richard Hall, I argue that such phenomena have a content, but that content is strictly imperative. Pains—like hunger, itches, thirst, and so on—do not report on the world, but rather try to force us to satisfy the content of their imperative. Second, I argue that the imperative content of pains is strictly negative. In particular, pains are imperatives to not use parts of your body in certain ways. The pain of a sprained ankle tries to keep one from putting weight on the ankle, the pain of cramped legs keeps one from further exertion, and so on. The Imperative Theory it allows us to give a pseudo-motivational account of pain that both respects the unique phenomenology of pain and allows a unified treatment of morphine-pain type cases. It also allows us to give a unified account of the intentional contents of pain, opening the way for an internationalist account of the quale of pain. What's more, it allows us to unify our philosophical account of pains with a large body of research on the psychological and neuroscientific aspects of pain. I show how the imperative theory of pain fits well with recent neuroimaging data suggesting strong connections to attention and motor planning, particularly the postural planning areas in Primary Motor Cortex. This unified account thereby opens up the possibility of treating pains from a thoroughly scientific perspective, and suggests possible ways to extend such a treatment to other sorts of sensations.

Title:
Philosophy, physics and psychology in Libet's subjective time experiments

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Session:
Sunday, June 26, 17:30-19:30: Symposium 3

Abstract:
Libet's "backwards referral" and his "free will" experiments have generated many articles and books. I believe that the attention they have received is valid because the data are valid and need to be understood. A problem with both experiments is that the raw data aren't readily available in an easily grasped manner. I will provide handouts at the beginning of the satellite conference that provide graphical summaries of the data. In addition to discussing the handout's I'll discuss the following points: In discussions of mental timing it is often claimed that there is a 500 msec delay in conscious awareness. That number, obtained in one set of near threshold experiments does not apply to the "backwards referral" and "free will" experiments. Libet's data provide convincing evidence for backwards referral. However, like God, "backwards referral" must be understood as metaphor rather than as literal, as is befitting of Chronotheology (Bolbecker's term). In "free will" experiments involving the conscious decision to move one's hand, one needs to take into account individual differences in executive function among subjects. Some subjects, like me, often become aware of the intention to move the hand when the hand starts moving. Other subjects, I'm told, actually follow instructions and exert a conscious will for every hand motion. For the free will experiments to provide data for making a causal story, one needs to make a trial-by-trial separation of these two scenarios, based on the subject's trial-by-trial feedback, for the appropriate time-lock averaging needed to obtain the readiness potential. The slow linear rise of the readiness potential may be an artifact of summing a large number of heterogeneous potentials.

Title:
Tracking the hemodynamic footsteps of awareness in visual cortex

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Session:
Saturday, June 25, 9:00-12:30: Symposium 1

Abstract:
The primary visual cortex (V1) is necessary for most forms of normal seeing. Yet images can activate visual cortex even when they are not perceived. It has been suggested that differential activation at the level of V1 determines whether a given stimulus reaches awareness. Alternatively, perceptual mechanisms may enhance activity in early cortical areas via feedback projections. Or, neural activity in V1 may be dissociated from perceptual awareness. We studied the correlation between perception and hemodynamic activity in visual cortex in a change detection task. Whenever the observer perceived the location of a change, the blood oxygenation-level dependent (BOLD) signal increased in V1 and in nearby extra-striate areas. The evoked activity was localized and corresponded to the perceived location of the change. When a change was missed (or was ignored), it failed to evoke any hemodynamic response. That is, as reported earlier, hemodynamic responses in V1 correlate with what the subjects sees. Furthermore, the latency of the BOLD response increased linearly with the reaction time, with a slope of one. This and follow-up attentional control experiments are compatible with the hypothesis that the correlation between percept and hemodynamic activity in early visual cortex is mediated by top-down attentional mechanisms.

Title:
Attention-driven discrete sampling of motion perception

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Session:
Tuesday, June 28, 14:30-19:00: Satellite Oral Session

Abstract:
In movies or on TV, a wheel can appear to rotate backwards, due to the temporal subsampling inherent in the recording process (the Wagon Wheel Illusion). Surprisingly, this effect has also been reported under continuous light, suggesting that our visual system too might sample motion in discrete "snapshots". Recently, these results and their interpretation have been challenged. Here we investigate the continuous wagon wheel illusion (c-WWI) as a form of bistable percept. We observe a strong temporal frequency dependence: the illusion is maximal at alternation rates around 10Hz, but shows no spatial frequency dependence. We introduce an objective method, based on unbalanced counterphase gratings, for measuring this phenomenon, and demonstrate that the effect critically depends on attention: motion direction judgments around 10Hz were severely impaired by focused attention. A motion-energy model, coupled with attention-dependent temporal subsampling of the perceptual stream at rates between 10 to 20 Hz, can quantitatively account for the observed data.

Title:
Neural correlates of a motion illusion in primary visual cortex

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Session:
Monday, June 27, 14:00-16:00: Concurrent Session 3.3

Abstract:
When two static visual stimuli are displayed alternately at different locations, a perception of apparent motion can be induced. A more complex type of apparent motion is the 'motion quartet' (MQ). Here, four dots are presented at the corners of an imaginary rectangle, two dots from diagonally opposite corners at the same time. This configuration can be seen either in vertical or horizontal motion without any changes in the physical characteristics of the stimulus. When the MQ is presented for longer periods of time, observers report spontaneous switches between vertical and horizontal movement. It has been demonstrated in previous studies that the human motion complex (hMT/V5+) shows activity increases that are related to the perceptual switches between the two possible interpretations (Sterzer et al., 2003). In our study, we wanted to investigate in more detail whether there are neural correlates of the observers' perceptual state already at the level of primary visual cortex (V1). We used functional magnetic resonance imaging (fMRI) in humans to study the retinotopic representation of the MQ in V1. Especially, we focused on the cortical representation of the path of vertical motion. Participants had to fixate and look at a MQ that was presented symmetrically around the fixation cross. During the prolonged presentations of the MQ, participants were asked to indicate their current perceptual state (vertical vs. horizontal) by continuously pressing one of two buttons. In

the analysis, we looked for regions showing activity that was related to the subjects' reports. We found activity selectively related to the perceptual switch to vertical movement in regions of V1 that retinotopically represent the path of vertical apparent motion. By inspecting the event-related time courses for both vertical and horizontal motion, we observed in six subjects that these regions show a selective increase of activity during periods of vertical movement perception. Since it has already been demonstrated that hMT/V5+ is vital for the switches between vertical and horizontal movement perception, we suggest that feedback from hMT/V5+ to V1 is the most plausible explanation for our results.

Title:
No Consciousness Without Self-Consciousness: The Empirical Argument

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Session:
Sunday, June 26, 14:00-16:00: Concurrent Session 2.2

Abstract:
Can there be consciousness in the absence of all self-consciousness? Some philosophers and cognitive scientists have thought it self-evident that there can be, others that there cannot be. As a philosopher, I have argued before on theoretical grounds that there can be no consciousness without self-consciousness. In this paper, I present an empirical case for such dependence of consciousness on self-consciousness. The paper divides in three. In the first part, I consider

whether certain exotic kinds of blindsight suggest that the only thing that disqualified blindsight from being conscious is the absence of appropriate self-awareness on the patient's part. I argue that the discovery of primesight, reported by Weiskrantz et al. in 2002, suggests a condition which is qualitatively indistinguishable from conscious sight. If so, we can well envisage something like "super-primesight," which would be functionally and qualitatively indistinguishable from conscious sight, but will be unconscious. What makes it unconscious, I suggest, is the absence of the appropriate form of self-consciousness. The second part of the paper brings together, on the one hand, long-time work done by Braver, Cohen, and their collaborators on self-related monitoring and control and, on the other hand, an empirical study by Sahraie and her collaborators in Weiskrantz's lab of the difference between one blindsighted patient's vision in the blind part of his visual field and in the normal part of his visual field. These two separate empirical studies converge interestingly: it appears that a crucial part of the areas identified as responsible for self-related monitoring are activated in conscious sight but remain unactivated in blindsight. Finally, in the last part of the paper I consider the argument that consciousness must be independent of self-consciousness since infants and higher animals seem to be conscious even though they lack the capacity for metacognition. I offer a variety of possible responses, including especially Jerry Fodor's and David Rosenthal's, both of whom suggest that metacognition may be more ubiquitous than is sometimes thought. I also add a further response, to the effect that there is a primitive form of self-consciousness that can exist in the absence of metacognition. I suggest it may well be that consciousness is dependent on this basic self-consciousness even if it is independent of the more articulated self-consciousness found in adult humans.

Title:
Change blindness and implicit change detection: New evidence

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Session:
Monday, June 27, 14:00-16:00: Concurrent Session 3.1

Abstract:
What is the fate of information that fails to be consciously registered? On the one hand, Change blindness and other related phenomena (e.g. inattention blindness; the attentional blink) demonstrate that people's experience of the world is far more limited than one would think: Large changes fail to be noticed, incongruous moving objects or repeated stimuli escape detection, etc. Conversely, there is also a substantial (and controversial) literature suggesting that people's behavior can be influenced by aspects of the environment that they show little or no evidence of having processed consciously. Contextual cueing studies demonstrate that people's ability to locate a visual target among an array of distractors is facilitated when the distractors predict the location of the target, even in the absence of awareness of the contingency. Likewise, sequence learning studies show that people's RT to a target is influenced by the temporal context in which it occurs, again even in the absence of reportable knowledge about the fact that the material contains sequential structure. These findings raise interesting conceptual issues about the relationship between attention and consciousness. We address these issues in two novel empirical studies. In the first, we show that people's ability to detect gradual changes in the facial expression of a centrally presented actor is very poor (15% detection rate). The demonstration is surprising because (1) the change concerns features that we are particularly apt at detecting, (2) it occurs in the centre of the visual field, (3) in scenes that contain very few elements, and because (4) participants are instructed to detect a change. The second study involves a change detection task involving vertical and horizontal bars. Thornton and Fernandez-Duque (2000) showed that implicit detection of a change in the orientation of an item influences performance in a subsequent orientation judgment task. However, Mitroff et al. (2002) were not able to replicate this

result after having corrected methodological biases, and thus took Thornton et al's findings as artefactual. Here, we replicated the original study, correcting for all known biases, and found evidence for implicit change detection using this improved design. We interpret and discuss both sets of findings from the perspective that a representation's availability to consciousness depends in a graded manner on properties such as its strength, its stability in time, or its distinctiveness. This leaves open the possibility that weak representations can be causally efficacious, yet fail to enter conscious awareness.

Title:
What good is consciousness?

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Session:
Friday, June 24, 18:30-19:30

Abstract:
To understand the mechanism of a brain process, it is important that we have at least some idea of what it does. However, our scientific knowledge of the function of consciousness is limited, in the sense that we do not really know which are the psychological functions that can only be performed consciously. Here I argue that we cannot simply rely on theoretical speculations or commonsensical intuitions. Many assume that conscious information is available for the control and initiation of action. In particular, in the absence of immediate external stimuli, consciousness may play a special role. I argue against this view, based on experiments conducted using Libet's 'clock' paradigm.

Using this method, Libet has famously estimated the onset of conscious intentions in self-paced motor action generation to be about 200 ms before action execution which, despite later than the onset of the brain activity, is prior to the movement itself. Against many critics of his method, here I present fMRI evidence in support of its basic validity: when participants are estimating the onset of intention, the relevant brain area in the premotor system is activated, suggesting that the participants are in fact accessing some information that is likely to be related to action generation. However, based on further analyses of the fMRI data, I argue that Libet's 200 ms estimate might be exaggerated by a phenomenon called 'attentional prior entry': the fact that the participants have to introspectively attend so hard to their intentions may have biased their temporal perception, such that they think that their intention starts earlier than it actually does. If the onset of conscious intention is in fact too late for consciousness to have any causal impact on action execution, one possibility is that the experience of intention need not even be fully determined before action execution. To test this, a transcranial magnetic stimulation (TMS) study was conducted, and I found that TMS applied after action execution can in fact manipulate the experience of conscious intention, which the participants report as arising before the action. It could be argued that these self-paced actions are idiosyncratic examples. Here I also consider actions that are driven by goals or instructions, which have been held by psychologists to involve the central executive system and require consciousness. I argue that the setting up of these goals could also be driven by information unavailable to consciousness. Taken together, I argue that we should not assume any non-trivial function for consciousness without the backup of solid empirical evidence. This realization has important implications for research on the neural correlate of consciousness (NCC). In particular, unless one is to assume that visual discrimination/identification can only be performed consciously, one should not compare a 'conscious' condition against an 'unconscious' condition where performance is at chance, and claim that any difference in neural activity is part of the NCC. In the light of the foregoing argument, this commonly adopted strategy for the search of the NCC is flawed, because the two conditions differ not only in terms of subjective awareness but also in terms of objectively measured performance level, and the latter is not necessarily a special function

of the former. To deal with this problem I present an fMRI experiment where I controlled for basic performance level in two experimental conditions. The two conditions, however, differ in the subjectively reported level of awareness. A comparison of brain activity revealed specific activation in the prefrontal cortex (area 46), but not in the parietal, premotor or visual areas which are often thought of as parts of a widely distributed network central to consciousness.

Title:

Wakefulness without awareness: lessons from Terri Schiavo and other victims of the vegetative state

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Session:

Saturday, June 25, 9:00-12:30: Symposium 1

Abstract:

Consciousness is a multifaceted concept that has two major components: (i) arousal or wakefulness and (ii) awareness of environment and self. The vegetative state is a devastating medical condition where patients awaken from coma but fail to show any voluntary behavior. The internationally mediatized case of Terri Schiavo illustrates how hard it is for lay persons (and inexperienced physicians and policy makers) to accept that the observed behavior in this condition does not reflect integrative cortical function. Progress in intensive care has improved survival following severe acute brain damage. Although many patients recover from coma within the first days, some permanently lose all brainstem function (brain death),

while others evolve to a state of 'wakeful unawareness' (vegetative state). Those who recover, typically progress through different stages before partially (minimally conscious state) or fully recovering consciousness. Recognizing unambiguous signs of consciousness remains challenging, as reflected in the frequent misdiagnoses of vegetative, minimally conscious and locked-in syndromes. Consciousness is not an all-or-none phenomenon and its clinical assessment is limited to inferences made from observed responsiveness. I will here first define consciousness as it can be assessed at the patient's bedside, review the major clinical entities of altered states of consciousness following severe brain damage and discuss recent functional neuroimaging findings in these conditions with a special emphasis on the vegetative state. We will aim to disentangle the relation between the emergence of consciousness and : (i) global brain function; (ii) regional brain function; (iii) changes in functional connectivity; (iv) primary versus associative cortical activation in response to external stimulation (highlighting possible perception of noxious stimuli and pain).

Title:

"I act intentionally": an interdisciplinary account of the experience of acting

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Session:

Saturday, June 25, 17:30-20:00: Poster Session

Abstract:

Self-consciousness is classically described as immune to error through misidentification: one cannot be wrong about who entertains one's conscious experience. However, it has been argued that consideration of the experience of one's body and actions as one's own challenges this conception of self-consciousness as immune. The argument goes as follows. (a) One's and other's action would share the same neuronal representation (e.g. "mirror neurons"). (b) This would imply neutral representation of action: the possibility to be conscious of AN action without being conscious of WHO is acting. (c) An attribution mechanism would thus be necessary to identify WHO the agent is. (d) This mechanism would be subject to errors of identification, as further evidenced by cases of errors of bodily consciousness. (e) Conclusion: bodily experience would not be immune to error through misidentification. In this presentation I challenge the four points of this argumentation, and defend a different conclusion. (a') Empirical evidence does not allow to assert that executed and observed actions completely share the same neuronal representation. (b') The recording of neuronal shared representations does not imply in itself that experiential neutral representations can be isolated legitimately. (c') An attribution mechanism is necessary if and only if the neutral representation of an action can be legitimately dissociated from the representation of this action as mine. (d') Pathologies or experimental manipulations prevent non-observational bodily consciousness and make the subject an observer of his own action, but this is not the usual way to relate to one's body and actions. These situations only involve consciousness of the self-as-object and cannot give support to an interpretation of consciousness of the self-as-subject. (e') Immunity only concerns the self-as-subject and is thus not threatened by the above argumentation. I argue that, rather than being blended in neutral representations, self and others usually experience their respective actions as their own at the pre-reflexive level, before any attribution mechanism can come into play. The latter is necessary only if prereflexive self-consciousness is perturbed. At the non-observational level, bodily self-consciousness is an identification-free consciousness of the self-as-subject. These considerations lead me to talk about logical immunity under normal circumstances, abnormal circumstances including neuro- and psycho-pathologies, and experimental manipulations of normal subjects. This position neither denies the legitimacy of immunity nor does it raise it to the rank of an

immutable principle. It thus defines a terrain adequate for the investigation of the neuronal mechanisms underlying identification-free bodily consciousness.

 Title:
 Visual aftereffects to simple and complex shapes

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Session:
 Sunday, June 26, 9:00-12:30: Symposium 2

Abstract:
 Visual aftereffects are distortions that impact the perception of one following the extended viewing of a different one. Aftereffects demonstrate that our subjective perception can be shaped by prior visual experience, and they have long been used as a tool in psychophysics to explore the brain's internal representations of basic stimulus dimensions. Illusions caused by aftereffects can be striking, with common classroom demonstrations showing that a stationary pattern appears to drift, or that a straight line appears curved. Based largely on theoretical arguments, aftereffects are usually attributed to a temporary imbalance in the responses of feature-selective neurons at early stages of cortical processing. However, there is surprisingly little experimental work to confirm or refute this view of aftereffect generation. If one considers, for example, the tilt aftereffect, it is by no means clear that adaptation in a network of orientation-selective neurons in the primary visual cortex is responsible, though this is a commonly held belief. In fact, it is easy to demonstrate a nearly

identical tilt aftereffect with stimuli that are thought to only minimally activate orientation-selective neurons in this area, raising the question of why such different stimuli might give rise to such similar aftereffects. Furthermore, a number of new "high-level" aftereffects affecting complex stimulus dimensions have been introduced. These range from distortions in the convexity of a shape (Suzuki, 2001) to the identity or expression of a face (Leopold et al, 2001, Webster et al, 2004). High-level aftereffects are, in general, more robust to simple stimulus transformations (e.g. translation, scale) than their low-level counterparts, and are therefore unlikely to stem from simple mechanisms confined to a spatially localized receptive field. Recent work using binocular rivalry demonstrates that the face identity aftereffect is strongly diminished by perceptual suppression during rivalry, while the tilt aftereffect is not (Moradi et al., 2005), suggesting that their site of origin is different. Yet other studies show that the temporal dynamics of the face identity aftereffect are nearly identical to those of the simple orientation and motion aftereffects (Leopold et al, 2005). Taken together, studies of aftereffects using diverse stimuli paint a complex picture of how visual adaptation impacts different processing stages of the brain. In my talk, I will review this evidence, arguing that our "intuitive" views of aftereffect generation might be off the mark. I will also provide evidence that norm-based coding principles, first applied to adaptational aftereffects over 50 years ago, appears to play a role in the both the perceptual and neural expression of the face identity aftereffect.

Title:

Neural correlates of repetition priming with and without conscious identification of the primes

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Session:

Saturday, June 25, 17:30-20:00: Poster Session

Abstract:

Priming refers to a change in the speed or accuracy of the processing of a stimulus, following prior experience with the same, or a related, stimulus. Masked priming paradigms have shown that even when participants were not consciously aware of the briefly presented primes, priming effects could still occur. However, it is still unclear that partial processing of a stimulus (e.g., when the stimulus disappears before participants can identify it) with a longer period of processing time (e.g., few seconds) will still produce a priming effect. Furthermore, what is the neural mechanism of such priming? This study was aimed at investigating these two questions. Words in mirror-image orientation were presented through the goggles in a pseudo-random order and the participants were asked to press a button as soon as they identified the words during scanning. Some words were presented twice (primes and targets) and some words were presented only once (control group). The display durations of the primes were decided individually by each participant's performance in the pretest. The purpose of using this duration was to ensure that participants identified only about half of the primes before they disappeared. Functional MRI scans were obtained using a 3T scanner while the participants were doing the task. The behavioral results showed that unidentified primes produced a substantial priming effect, but the identified primes did not produce a significant priming effect, which might have resulted from a floor effect. Our fMRI data showed that unidentified primes exhibited repetition suppression in multiple brain regions, such as ventral visual pathway (including fusiform gyrus), parietal cortex, and some frontal regions. Although identified primes did not show a significant behavioral priming effect, they did show a very similar pattern of repetition suppression in all the regions shown in the unidentified condition. On the other hand, the identified condition, but not the unidentified condition, also showed repetition enhancement in the precuneus. This might be the indicator that participants were consciously aware the prior occurrences of identified primes but not the unidentified primes. A followed-up recognition test

supported this hypothesis. In conclusion, the present study showed that unidentified stimuli can still produce behavioral priming effects and repetition suppression as shown in the identified condition, but the identified stimuli may also elicit conscious recollections of their prior occurrences.

Title:

Disorders of agency in schizophrenia correlate with an inability to compensate for the sensory consequences of actions

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Session:

Saturday, June 25, 17:30-20:00: Poster Session

Abstract:

Auditory hallucinations, thought insertions, and delusions of influence have been declared as first rank symptoms and hallmark of schizophrenic psychopathology. In the presence of many of these positive symptoms, internally generated cognitive phenomena are being misattributed to the external world, suggesting an impaired ability to ascribe self-agency to the consequences of one's own behavior. If this interpretation were correct, we might expect that schizophrenics might also attribute the sensory consequences of their own eye movements to the environment rather than to themselves, challenging the percept of a stable world. In order to test this prediction we investigated the ability of schizophrenia patients to discriminate between retinal image motion resulting either from their

own smooth pursuit eye movements or from (additional) external motion sources. While performing such smooth pursuit, the images of a stationary environment inevitably slip over the retina with a velocity equivalent to that of the eye rotation. If relying on retinal information only, we would misattribute the image motion to the environment rather than to ourselves and thus misperceive the world as moving. This interpretation, jeopardizing reliable spatial orientation, is avoided by comparing the actual image slip with the amount of image motion predicted on the basis of the eye movement motor command: If both signals match the retinal image slip is interpreted as being self-produced, whereas if they do not match the difference must be attributed to the external world. Because schizophrenia patients with delusions of influence perceived a significantly greater amount of residual motion during smooth pursuit we support the idea that these patients are impaired in predicting the sensory consequences of their own actions. Thus, for the formation of an accurate self-awareness such sensory predictions may reflect a major prerequisite.

Title:

How to think about phenomenality and access

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Session:

Saturday, June 25, 17:30-20:00: Poster Session

Abstract:

For over ten years now, Ned Block has been pressing a distinction between two concepts of consciousness, which he calls "access-

consciousness" or "A-consciousness" and "phenomenal consciousness" or "P-consciousness". (At least since Ned Block (1995), "On a Confusion about a Function of Consciousness", Behavioral and Brain Sciences 18, 2, 227-47, reprinted in Ned Block, Owen Flanagan Güven Güzeldere (1997), The Nature of Consciousness: Philosophical Debates (Cambridge, MA: MIT Press). More recently, he has presented what he takes to be empirical confirmation of the distinction; see Ned Block (2005), "Two Neural Correlates of Consciousness", Trends in Cognitive Science 9, 2.) There surely is a conceptual distinction to be made, a distinction between aspects of conscious experience that require distinct kinds of explanation. Block errs, however, in trying to turn his conceptual distinction into a metaphysical distinction, in assuming that, because different types of explanation are required for phenomenality and access, the two aspects of conscious experience must be capable of existing independently of one another. In the first part of this paper, I argue, contra Dennett (Daniel Dennett (1995), "The Path Not Taken", Behavioral and Brain Sciences 18, 2, 252-3. Reprinted in Block, Flanagan, and Güzeldere), that Block's distinction is a perfectly good one and lay out what I take to be the right way to think about the distinction, by dividing questions about consciousness into two kinds, which I call "Zombie questions" and "Invert questions". In the second part of the paper, I argue that Block's purported cases of phenomenality without access are better construed as cases of weak access.

Title:
Changes in the tonic high-amplitude gamma oscillations during meditation correlates with long-term practitioners' verbal reports

Authors:
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Session:
Saturday, June 25, 17:30-20:00: Poster Session

Abstract:
We previously reported that long-term Buddhist practitioners (>10,000 hours of meditation) self-induce sustained electroencephalographic high-amplitude gamma-band oscillations and phase-synchrony during meditation (Lutz et al. 2004). These EEG patterns differ from those of controls in particular over lateral fronto-parietal electrodes. In addition, the ratio of gamma-band activity (25-42Hz) to slow oscillatory activity (4-13Hz) is initially higher in the resting baseline before meditation for the practitioners than the controls over medial fronto-parietal electrodes. Here we showed that these effects are still found when adepts are compared to age-matched controls. We demonstrated further that these high-amplitude oscillatory activities emerge over a time course of several dozen of seconds and correlated with the intensity of the meditative experience as verbally reported. These data provide new insights on the impact of voluntary conscious activity on changes in synchronous ongoing EEG oscillatory activities.

Title:
Investigating neuronal correlates of conscious visual perception

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Session:

Friday, June 24, 9:30-12:30: Morning Tutorial

Abstract:

Focusing on the neurophysiological investigation of bistable perception in primates, this tutorial aims at providing an overview of basic techniques used for dissociating percept-related activity from general visual activation. First, we will give a brief introduction to multistable perception, including binocular rivalry and temporally triggered perceptual suppression (e.g. generalized flash suppression). We will outline psychophysical results gathered with these paradigms and we will discuss common properties of perception during ambiguous visual stimulation. The advantages and disadvantages of using these phenomena as stimuli for neurophysiological studies will be evaluated, with particular emphasis on the problem of subjective perceptual report. We will present various strategies that have been employed to test the reliability of subjects when their perception cannot be predicted from stimulation. These techniques include statistical forecasting, intra-experimental behavioral reinforcement as well as monitoring of physiological markers such as involuntary eye movements. Covering differences between human and monkey approaches, we will demonstrate the application of each of these procedures. We will further discuss several techniques used for measuring correlates of subjective perception on the level of single neurons and larger cell populations, and confer some of their benefits and problems. On the basis of recently collected data, we will demonstrate how different neuronal signals (single unit firing rates, multiunit activity and local field potentials) can be related to specific contents of visual perception. Finally, we will talk about the insight these kinds of studies have provided into the neuronal mechanisms of perceptual organization and visual awareness.

Title:

The concept of state consciousness in the Higher Order Thought theory of consciousness

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Session:

Saturday, June 25, 17:30-20:00: Poster Session

Abstract:

David Rosenthal's Higher-Order Thought (HOT) hypothesis is one of the most widely argued for of the higher-order accounts of consciousness. In this paper, I address an inconsistency in his account of consciousness. Rosenthal's argument vacillates between two independent models of the HOT theory. At the heart of these two models are two different concepts of 'state consciousness'. While both concepts refer to token target states, the two concepts refer to those states in virtue of different properties. In the first section of this paper, I review the two models. In subsequent sections, I examine these models more closely. I argue that the second model is preferable to the first for several reasons. One reason is that it fits better with the commonsense concept of 'intransitive consciousness'. All else being equal, a theory that uses terms in a way that fits with our concepts should be preferred. But ultimately this model is also problematic. I highlight those problems and suggest that they might be averted by modifying a core feature of the HOT theory, the transitivity principle. In the second half of this paper I develop a version of the modified transitivity principle. I hypothesize that Rosenthal occasionally employs this modified model himself. This slip may make sense of some problematic aspects of his theory. I also suggest that the inconsistency identified in the first section of this paper might actually reflect these two versions of the transitivity principle. One version gives us a token target state centered concept of state consciousness, and the other, which discusses only mental state types, doesn't give us a theory of state consciousness at all. In conclusion I discuss some other concerns for the modified version of the HOT theory and argue

that, contrary to what Rosenthal and others often argue, the theory is not incompatible with the causal efficacy of conscious states.

Title:

Transient signals mask extrapolated position information of moving objects

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Session:

Sunday, June 26, 14:00-16:00: Concurrent Session 2.3

Abstract:

In the flash-lag effect (FLE) a moving object is perceived ahead of a briefly flashed object, although the two are physically aligned in space. Usually FLE does not occur when the moving object vanishes simultaneously with the flash (flash-terminated condition). Why does this happen? We hypothesise that the offset of the moving object elicits a strong transient from the retina. This transient carries accurate positional information that enables the visual system to perceive the correct vanishing point of an object by masking any extrapolated representations (Nijhawan, TICS 2002). In previous experiments we investigated moving objects that fade and therefore vanish without strong transients. This indeed caused the objects to be seen as vanishing in an extrapolated position (Maus & Nijhawan, ECVF 2004). In the present experiments we introduced a transient signal while maintaining object motion by abruptly reducing the luminance of the moving object at the time of the flash. While fixating a static cross observers viewed a rectangle moving horizontally across a computer screen. When the object reached the mid-position of the screen two

squares were flashed above and below the object. Observers adjusted these flashes until they appeared aligned with the moving object. In two experiments the object was either blanked for different durations subsequent to the flash, or abruptly decreased in contrast to fractions of the previous value and then increased linearly back to full contrast. When the moving object remained constantly on, a typical FLE was observed. When a blank was introduced the FLE was reduced and totally abolished for blank intervals longer than ~80 ms. Introducing an abrupt decrease in contrast of the moving object also decreased the effect, with greater contrast reductions (i.e. stronger retinal transients) leading to greater decrements. We conclude that transient signals (like a flash or abrupt disappearance of a moving object) are strong determinants of the positions of objects. These transients can override other competing positional signals. When such transients are absent, such as for smoothly moving objects, the extrapolated position is perceived and not overridden. In the present experiment we introduced transients while maintaining object motion, which leads to contradictory position information. Our results show that FLE is reduced more when transient signals are stronger or motion signals are disrupted longer, giving evidence for a competition between the two possible perceptual outcomes. These findings cast new light on the absence of flash-lag in flash-terminated displays.

Title:

Fading visual objects vanish in extrapolated position

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Session:

Tuesday, June 28, 12:00-14:30: Satellite Poster Session

Abstract:

Moving objects that disappear abruptly are not perceived to overshoot their final positions when observers fixate a static point (Kerzel, Jordan, & Müsseler, 2001). This apparently contradicts the notion of extrapolation to compensate for neural delays in the visual system (Nijhawan, 1994). This study evaluates the hypothesis that the vanishing point of an object is perceived correctly, because the retinal transient at the offset of the object overrides the perception of any extrapolated positions (Nijhawan, 2002). These off-transients are avoided in the present study by presenting a gradually fading dot on a circular long trajectory (LT). In a 2AFC task observers judged the point on the circle (e.g. 4 o'clock) where they perceive the LT dot as disappearing. This threshold is then compared to the visibility threshold for the same dot moving on a short trajectory (ST) at different luminance levels. Observers perceived the moving LT dot vanishing in positions where they were not able to detect the ST stimulus. A control experiment showed that attentional tracking of the moving dot or probability summation along the longer trajectory cannot explain this effect. In one condition the position and the time of the ST dot were made predictable by repetitive presentation of the ST dot in the same position. In a second condition the trajectory of the ST dot was made twice as long. Despite introduction of these conditions, the visibility of the ST dot remained below threshold in positions where the LT dot was clearly visible. We conclude that the fading LT dot is perceived to vanish in an extrapolated position, because there is no transient signal that facilitates the perception of the 'correct' vanishing point.

Title:

The qualitative character of spatial perception across modalities

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Session:

Saturday, June 25, 17:30-20:00: Poster Session

Abstract:

We sense the same spatial properties in different sensory modalities. We both see and feel the shapes and sizes of objects, and we see, feel, and hear where objects are located. So we must determine whether the sensations in virtue of which we sense the same spatial properties in different modalities are themselves the same. We must determine whether the qualitative character of sensing spatial properties is the same in different modalities. John Campbell (1996) argues that the qualitative character of seeing a shape is the same as that of feeling the same shape. This is a consequence, he claims, of his view that qualitative character is a function of the properties one senses. Since we see and feel the same shapes, he argues, the qualitative character of seeing a shape is the same as that of feeling that same shape. Some theorists have held that the qualitative character of sensing is a function, not of the properties one senses, but of the introspectible similarities and differences sensations bear to each other. If so, it could be that the qualitative character of seeing a shape is different from that of feeling that same shape. But Campbell rejects this view, since it holds we have only first-person, introspective access to our sensations. With only first-person access to sensations, he argues, we could not determine whether two people have the same sensations when seeing the same shapes. I argue that, although qualitative character is a function of the properties we sense, as Campbell claims, the qualitative character of sensing the same spatial properties is different in different modalities. We can best explain the qualitative character of sensations in terms of their roles in perceptual discrimination. We discriminate shapes, e.g., in respect of the ways they resemble and differ from each other, which suggests sensations of shape resemble and differ from each other in ways parallel to the ways shapes resemble and differ from each other (Rosenthal, 1991, 2005; Meehan, 2002). We can, according to this view, determine whether two people have the same sensations of shape by determining whether they make the same shape discriminations. Finally, I argue it is a consequence of

this view that the qualitative character of seeing a shape is different from the qualitative character of feeling that same shape.

Title:

You are not here: locating the self in the brain

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Session:

Sunday, June 26, 14:00-16:00: Concurrent Session 2.2

Abstract:

In a series of papers, Gallup and colleagues have argued that self-awareness and mental state attribution to others are closely connected cognitive capabilities. They contend that this claim finds support in recent empirical work into the apparent unified nature of the self concept and the apparent colocalization of self and other mental state attribution in the right front part of the brain (Platek et al 2004a, Platek et al 2004b, e.g.). This overall conclusion builds upon decades-long work conducted by Gallup that begins with his mirror self-recognition studies (1970, 1982), which, he argues, suggest that only creatures capable of recognizing themselves in mirrors can attribute mental states to others. Mirror self-recognition serves as a reliable indicator of theory of mind, Gallup argues, because one can only recognize oneself if one already possesses a rich self-concept integral to introspective self-awareness--or, as he writes, "you have to know who you are to be able to recognize who is being reflected in the mirror" (Platek et al 2004b). Though such colocation is itself controversial (see Turk et al 2002), this approach involves a more fundamental and troubling confound: mirror self-recognition requires that one recognize

one's body as reflected in the mirror, and this type of recognition does not cleanly connect up with the introspective self-awareness common to adult humans and necessary for theory of mind attributions. Moreover, data regarding errors of limb recognition such as autotopagnosia and asomatognosia indicate that body self-recognition is not easily colocalized with the results of Platek et al's study of self and other face recognition. In the case of autotopagnosia, for example, Felician et al 2004 conclude that somatosensory and visuospatial representations of one's own body and the body of others respectively involves the left superior and inferior parietal regions. Since presumably mirror self-recognition involves these kinds of representations, we have philosophical and empirical reasons for thinking that the self-awareness implicated in recognizing one's mirror image as one's own is not bound up as tightly with theory of mind as hypothesized by Gallup. No doubt our self-ascriptions of various states and properties span the mental and the physical. Nevertheless, as of yet we have little reason to believe that this "unity" proves neatly localized in the brain.

Title:

Phase synchronization but not gamma oscillations correlates with conscious perception

Authors:

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Session:

Saturday, June 25, 14:00-16:00: Concurrent Session 1.1

Abstract:

It has been proposed that conscious perception is correlated with phase locking synchrony among distant cerebral areas, but no direct participation of synchrony in visual awareness has been demonstrated so far. In this study we directly explore this hypothesis by measuring the spectral power and phase locking synchrony elicited by visible and invisible words. 15 subjects were instructed to decide whether a rapidly flashed word (33 ms) was the same or different from a second one presented for 200 ms. The flashed word was preceded and followed by two masking stimuli lasting 67 ms each and was made visible or invisible by changing the luminance of the masking stimuli. In the conscious condition subjects accurately distinguished the masked word whereas in the unconscious condition their performance dropped to chance level. Our results indicates that while visible and invisible words elicit similar spectral power in the gamma frequency range, only words that are consciously perceived elicit phase locking synchrony 100 ms after the presentation of the visible word. However, the difference observed between conscious and unconscious words might be explained based on a differential amount of cognitive processing between visible and non-visible stimuli. This possibility was tested in an unconscious semantic priming experiment, using the same word set. 30 subjects were instructed to determinate if a visible word belonged to a natural or a man-made category. Unknown to them, each visible word was preceded by a masked word (prime), which could be either semantically congruent or semantically incongruent with the visible word. The prime was omitted in one third of the trials, enabling us to subtract the brain activation due to the masking and target stimuli, and to evaluate the cerebral response specifically associated to the prime. Subjects responded faster to congruent than incongruent trials (15 ms), allowing us to conclude that the prime word, even though invisible, was processed up to semantic levels. Nonetheless, the presence of the prime stimuli modulates neither the spectral power nor the phase locking synchrony. Therefore, the observed synchrony in response to visible words found in the first experiment is most likely due to visual awareness than to the amount of processing involved in the task. Consequently, long distance synchronous activity might underlie visual awareness.

Title:

Emerging Ethical Issues in Consciousness Research: From Neuroethics to Consciousness Ethics

Author:

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Session:

Friday, June 24, 9:30-12:30: Morning Tutorial

Abstract:

While there has been considerable scientific progress in consciousness research during the last two decades, the ethical reflection concerning research methods, technological consequences, social impact and the wider anthropological and cultural ramifications only began very recently. This development is interestingly paralleled by the emergence of the new field of "neuroethics" in cognitive neuroscience (for a recent review, see Farah 2005, in TICS 9(1): 34-40). In this tutorial we will start out with a brief introduction into the different logical levels in philosophical ethics, and then proceed to the problem of domain-specific applied ethics. Do we need an applied ethics for consciousness research? In the second half of session 1 we will complement with a general overview about the new field of neuroethics and its current status. It is interesting to note how, quite recently, a number of researchers in the neuro and cognitive sciences have started to develop domain-specific ethical investigations. An interesting question is if any of these investigations are relevant for consciousness as well. We think some of them are. Therefore, we will then offer participants a catalogue of ethical issues in consciousness research, informing about those neuroethical issues that possess specific relevance in consciousness science. For instance, we will

sketch ethical problems and solutions such as the availability and use of consciousness-altering drugs (legal as well as illegal), the experimental use of animals in consciousness research, military funding, neuropedagogy, or the individual scientists' responsibility implied by the impact of new scientific methods, for example, various brain-scanning techniques and the use of "brain finger-printing" by legal authorities, on the life of individuals in society. The second session will try to define the current landscape of neuroethics for consciousness. We will conclude the tutorial with a third session that then turns to more general issues: What could the social and cultural ramifications of progress in consciousness research be? How is the general image going to change, and how can the to-be-expected consequences of such a change be assessed in a timely manner? How can we intelligently minimize the price we will pay for scientific progress, and how can we ensure distributive justice with regard to the many positive benefits consciousness research will offer in the decades to come?

Title:

Connectivity and simultaneity in the neural correlates of consciousness

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Session:

Saturday, June 25, 17:30-20:00: Poster Session

Abstract:

Given the inherent difficulty in elucidating the first principles behind subjective experience, identifying the neural correlates of

consciousness (NCC) is one of the tractable and practical approaches in the scientific study of consciousness. Data provided by imaging studies indicate a mapping between neural activities and elements of conscious experience on a local basis. Here, I provide a synthetic approach aimed at providing an integrated framework in which the growing data set of NCC can be streamlined. Specifically, I propose a model based on the connectivity between the various cortical areas, giving NCC a graph theoretic as well as local mapping aspect. As a supplementary guiding principle, I suggest to incorporate the temporal factor in considering the NCC. Based on various neuropsychological data, I propose a model that describes how the finite time (~100ms) required for the transmission of information via the synapses in perception is "compressed" into a specious moment in psychological time, making it possible for an element in conscious perception to represent a rich history of neural activities distributed over the connectivity of the cortical areas. In particular, I would argue how the small-world network architecture suggested by recent studies affect the way an integrated model of NCC is constructed over connectivity and time. In the second half of my paper, I describe an effort to model the NCC as a meta-cognitive process. Here, "meta-cognition" is used in a more general way than is conventional. Specifically, "meta-cognition" refers to the fact that any representation of information by the neural activities in the conscious domain must be characterized in reference to the subjective self. In this sense, activities in the sensory cortex need to be characterized in reference to those in the prefrontal areas. A model based on the overall connectivity of brain areas thus becomes a logical necessity. I propose some guiding principles aimed at generalizing the concept of NCC so that it reflects the meta-cognitive aspects of conscious experience.

Title:

Emergent properties, beliefs and action

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Session:

Saturday, June 25, 17:30-20:00: Poster Session

Abstract:

In this speech, I will restrict myself to the presentation of the relation evident between certainties and beliefs and their necessary conditions to intentional actions. My strategy is based on providing philosophical correlates and interpretations for some achievements of neuroscience. Therefore, I propose an account of the mind's role on causation that would be consistent with my general view of language and epistemology and a non-reductionist ontological model that takes emergentism of properties as its basis. My strategy to fit these two theses together stresses the difference between syntactic and semantic levels in the brain networks and broader matter of the relation between bottom-up causation and top-down regulation. I will argue that the semantic level presents novel emergent properties which are totally constituted by lower levels, but could not be reduced to those parts. I will focus on some works about decision-making, memory and brain areas related to these potentials. Some of Libet's works will be critically assessed in this discussion to show that the neuroscientists agree that the beliefs, as part of the shallow grammar, have causal relevance. Libet stresses that we have cultural values as rules of action. With my assessment of this notion, I intend to bridge the gap between my vision of science, language, and action and my account of the mind. Libet, Haagard and Eimer's works on delays between neural firings in the pre-motor cortex, motor cortex, and the idea of time for the veto will be assessed to help me provide an account of "Free Will" beyond the philosophical tradition. The relation between bottom-up causation and top-down regulation will be oriented by the discussion above as well as by different levels of information processing in the brain. Moscovitch and Umiltà's works are examples of the differences of information processing between the Hippocampus and the Frontal lobes that will be useful to my task as well as a reinforcement of some

of Libet's ideas. The more semantically loaded and interpreted character of frontal lobes will be one of my allies.

Title:

Perceptual asynchrony in visual and cross-modal binding: Evidence for Temporal Relativity

Authors:

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Session:

Tuesday, June 28, 12:00-14:30: Satellite Poster Session

Abstract:

If observers are asked to judge contingency of features between two attributes in a constantly alternating display, their performance sometimes improves when one attribute is presented ahead of the other. Here, we examined perceptual asynchronies in pairing related (velocity/direction of motion), unrelated (color/direction), and cross-modal (color/sound, direction/sound) attributes to examine if motion, color, and sound register in a fixed temporal reference frame. In Experiment 1 direction and velocity of a random-dot display independently alternated while observers indicated the direction of the fast dots. Binding improved when direction preceded velocity by ~30 milliseconds, demonstrating asynchrony between related attributes that share the same neural representation. In Experiment 2, dots alternated in direction and color (red/green). Binding improved if direction preceded color by ~60 milliseconds. However, if the alternating colors were not as distinctively different (i.e. shades of red) the asynchrony went away, indicating that the asynchrony for color is not invariant.

Control experiments ruled out confounding by task difficulty. In Experiment 3, observers paired alternating auditory and visual stimuli and reported the color or direction of motion that corresponded to a particular sound. Binding improved when the auditory stimuli followed visual alternations by ~70 milliseconds, confirming asynchrony in cross-modal binding. Notably, the difference between sound-color and sound-direction asynchrony was significantly less than the direct asynchrony in pairing color and direction. These findings are not compatible with fixed asynchronous processing schemes, suggesting that asynchrony in binding arises after modality-specific stages, and temporal cues and integration in perceptual binding are task-dependent.

Title:

Firing rate of V1 neurons predicts perception of ambiguous three-dimensional objects

Authors:

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Session:

Tuesday, June 28, 12:00-14:30: Satellite Poster Session

Abstract:

We studied single unit responses of V1 superficial layer neurons in a perceptual discrimination task. A rhesus monkey was trained to hold fixation during presentations of ambiguous and unambiguous (3D) structure-from-motion objects, and was required to report his percept in a 2 alternative forced choice task. We estimated the probability with which the firing rate of a given V1 neuron allows an ideal observer to

predict the monkey's perceptual choice. Neuronal responses to zero-disparity (ambiguous) objects were sorted according to the perceptual choices and the type of object on the preceding trial. The choice probability was determined for each neuron. Based on the sample of 159 neurons, 40% (65) of the cells showed a significant but relatively long latency bias ($p < 0.01$) starting 400 ms after the stimulus onset. Analysis of the sequence of trials revealed that perception and neuronal responses during ambiguous trials were affected by the preceding non-ambiguous trials in a time dependent fashion. Neurons recorded during ambiguous trials separated by long 3 ± 1 s intertrial-intervals (ITIs) revealed a short latency persistent firing rate increase if the preceding trial was congruent with the preferred direction/disparity of the neuron. Thus, the relative firing rate during ambiguous trials was predictive of the monkey's choice. This neuronal bias may reflect a perceptual stabilization following long ITIs. In a second experiment varying the ITI between unambiguous and ambiguous object trials, we found that the percept switched following an $ITI < 1$ s, while remained the same following an $ITI > 1$ s. These results suggest that a population of V1 neurons contribute to generating a perceptual bias deriving from two sources: a short latency bias induced by the previous exposure and a long latency perceptual bias representing a corroborative feedback from higher visual cortical areas (MT/MST). (Supported by NEI and J.G. Boswell Professorship to RAA and a Career Award from the Burroughs-Wellcome Fund to BP)

Title:

The sixth sense

Authors:

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Session:
Saturday, June 25, 17:30-20:00: Poster Session

Abstract:
Is perceptual awareness in the brain? The rapid advances of neuroscience have sparked numerous efforts to study the Neural Correlate of Consciousness. Prominent candidates for NCC range from a special role of neurons in cortical layer 5, synchronization of oscillatory activity, to neural dynamics in prefrontal cortex (cf. Crick & Koch 1998). Contrastingly, O'Regan & Noe (2001) suggest that perception is not established by the activation of specific brain structures, but by a strong connection of perception and action. The quality of sensory awareness is determined by the systematic changes of afferent signals resulting from behavior (sensori-motor contingencies). Support for such skill-based theories of perception is provided by experiments on sensory substitution. If a modality is a particular way of actively exploring the environment, it is not bound to a particular sensory apparatus. Following this line of thought, Bach-y-Rita (1972) has pioneered the transformation of visual stimuli to haptic information in normal and blind subjects. As even blind subjects possess the anatomical structures of a visual system, these experiments leave alternative explanations open. Here we follow a radical approach to create new sensori-motor contingencies and hence a new quality of perception. Adult subjects received orientation information, obtained by a magnetic compass, via vibrotactile stimulation around the waist. After six weeks of training we evaluated performance and perception by a battery of tests, including outdoor orientation tasks, navigation in a virtual environment, nystagmography, posturography, and subjective reports. Preliminary data evaluation indicates that (1) sensory information provided by the belt can be cognitively processed and training can improve performance (weak integration);(2) orientation information involuntarily influences behavior if it is inconsistent with other sensory inputs (strong integration);(3) coupling to reflexes like vestibular nystagmus and body sway is highly variable (limited subcognitive processing) and (4) in two of four subjects

profound changes of sensory experience occurred. These were NOT of the kind that a local magnetic field was perceived, BUT rather the actual spatial context is felt as being enlarged, the quality of spatial perception is transformed from a graph to a 2D-map, and spatial relationships are memorized unconsciously (new subjective experience). Importantly, mere stimulation without simultaneous exploratory activity remained without effect. These experiments demonstrate profound integration of a new quality of sensory information and provide a valuable contribution to our understanding of the nature of perception.

Title:
Motor space, visual space and the flash-lag effect

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Session:
Sunday, June 26, 17:30-19:30: Symposium 3

Abstract:
The vdt-lag premise (Nijhawan, Nature, 370, 256-257, 1994) states: The perceived position of a moving object should appear to lag the object's 'real' instantaneous position by a product of object velocity (v) and neural processing delay (dt). The dubious nature of this 'self-evident' premise has been a source of intense debate over the past decade. Mach (1897) denied the existence of Newtonian notions of 'absolute space' and 'absolute time', on the grounds that no observer could possibly measure these quantities. I will argue that the 'real' in the above 'vdt-lag' premise is an unobservable quantity, and show the

premise to be false using new analysis of flash-lag results. Furthermore, motor flash-lag (Nijhawan and Kirschfeld, Current Biology, 13, 749-753, 2003) reflects homologous mechanisms across the motor and visual systems; e.g. flash-lag anisotropy is found in both domains. This suggests that the visual and motor domains are two differentiated versions of the same, undifferentiated, proto central nervous system. This view is consistent with the existence of bi-modal (e.g. vision+action; vision+touch) neurons in pre-motor cortex. The suggestion is that many features of 'real' objects 'out there' (e.g. position) are due to descending (internal) neural signals, processes that are related to feed-forward motor control and to Helmholtz's notion of re-afference. The view that emerges is that an output of one modality (e.g. object-position given by the visual system) can be related (compared) to the output of another modality (e.g. hand-position given by the motor system), but not to some idealistic 'really' given position.

Title:

Flash-lag anisotropy for visual, motor and tactile movement

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Session:

Tuesday, June 28, 14:30-19:00: Satellite Oral Session

Abstract:

A flashed object presented in alignment with a moving object is seen as trailing behind the moving object. This flash-lag effect (FLE, Nijhawan, 1994) is asymmetric and considerably stronger for movement toward the fovea than for movement away (Mateeff and Hohnsbein, 1988). Three experiments were designed to test this

anisotropy for movement in different domains. In experiment I, we confirmed 'visual-visual flash-lag (FLEv-v)' anisotropy by asking subjects to fixate a central point on a CRT and compare the position, relative to a visual flash, of a visual target moving away from or toward the fixation-point. In experiment II, subjects moved their invisible forearm, either away from or toward a fixation-point, and compared the position of their index finger to that of a visual flash (motor-visual flash-lag task; FLEm-v). In experiment III, subjects were stimulated on their invisible forearm, or on the index finger by a tactile stimulus moving away from or toward a fixation-point. Subjects compared the location of the tactile stimulus with that of a visual flash (tactile-visual flash-lag task; FLEt-v). The subjects showed a FLEm-v anisotropy, in which finger movement toward the fovea produced a strong flash-lag effect, while movement away from the fovea produced almost no effect. Results from FLEt-v task gave evidence of a much larger anisotropy for tactile motion than that for FLEm-v and FLEv-v tasks. These findings show flash-lag anisotropy in three domains, revealing analogous mechanisms for spatial localization in vision, action and touch. These findings reinforce previous suggestions that different sensory systems, and the visual and the motor systems, function along similar principles (Sperry, 1952). Bi-modal neurons, e.g. 'vision+action' neurons (Gallese et al.) and 'vision+touch' neurons (Graziano et al.), found in the pre-motor cortex and other parts of the brain, may mediate the observed interaction between domains.

Title:

A puzzle about perception and time

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Session:

Tuesday, June 28, 14:30-19:00: Satellite Oral Session

Abstract:

When you listen to a piece of music you have a sense, now, of elapsed tones. How can the past, or the future for that matter, be present in perceptual experience? I discuss this puzzle. The question is particularly sharp for the enactive approach to perception (Noë 2004 and O'Regan and Noë 2001). On that view, a perceiver's sense of the presence of a feature depends on sensorimotor access to the feature. But there is no access to the sounds that have already elapsed. My discussion is based on work with Andy Clark.

Title:

Temporal magnet effect of visual flash to perceptual event boundaries

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Session:

Tuesday, June 28, 12:00-14:30: Satellite Poster Session

Abstract:

In recognizing ongoing human activity as meaningful perceptual events, temporal structures provide vital cues. Previous studies showed

that people can segment ongoing activity into temporal parts (Newtson et al., 1977; Zacks et al., 2001). We examined whether spontaneous parsing of ongoing visual activity affects the time perception. Observers judged the timing of a visual flash that occurred at random time in a short movie-clip of everyday activity (e.g., actor walking toward and stepping on a stair). The temporal judgment of the visual flash was mostly accurate. However, in the temporal proximity of putative event boundary (e.g., action transition from walking and stepping), the temporal judgment was biased toward the event boundary. A control experiment showed that this temporal magnet effect depends more on semantic segmentation than physical changes in the movie. The present results may be interpreted as a visual analogue of temporal magnet effect of an auditory click in speech segmentation (Fodor et al., 1965) and suggest that the spontaneous segmentation of ongoing activity changes the time perception around perceptual event boundaries.

Title:

Contingency and the self

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Session:

Saturday, June 25, 17:30-20:00: Poster Session

Abstract:

The discovery of mirror neurons suggested interesting implications for the relation between the self and non-self. Later studies suggested that neurons in those pre-motor areas code for contingency in the sensori-

motor domain, with the "mirror" as an exemplifying but potentially misleading metaphor. Elements supporting the perception of the self, such as ownership and agency, must be understood in terms of contingent associations between action and sense. The newly born does not know which subset of the sensory sensations belong to the own body. Only after the exploration of the contingency structure inherent in the sensori-motor domain does one become aware of the distinction between one's body and environment. The resulting perception of ownership and agency provides an infrastructure in which the causal relationship in the interaction with the environment is interpreted. The ownership and agency continue to be updated themselves, reflecting one's experience in the interaction with the environment. Here we report an experiment in the behavioral economics domain where we study how the different interaction constraints in a simple betting game affect the subjects' perception of ownership and agency, and result in a markedly different betting behavior. In each trial, the subjects had a choice of betting or escape, and tried to maximize the earned reward. We used a "flat reward" condition, where mathematically the subject's behavior did not affect the result of the game. The results were determined by a random process generated in a computer. Although the subjects were reasonably aware that it was not possible for them to influence the expected reward, the illusory sense of agency induced by different interaction design led to statistically significant difference in the betting behavior. The analysis of these results suggests that the perception of contingency structure in one's interaction with the environment affects the perception of agency. We discuss implications of our result for the burgeoning field of neuroeconomics. We also discuss the relevance of our results to the robust handling of uncertainty by the dopamine neurons in the midbrain, studied by Schultz and others.

 Title:
 Implicit temporal order priming

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Session:
 Saturday, June 25, 17:30-20:00: Poster Session

Abstract:
 Highly practiced actions unfold with a given temporal signature. Does the perception of the products of such actions contain both 'what' and, critically, 'when' information? In other words, is the perception of the product of a multi-part action sensitive to the means by which the product is brought about? In order to investigate this, we asked whether the temporal stroke order, shared among writers, in letter writing is part and parcel of the representation of the letter. Furthermore, are observers explicitly aware of this temporal order for purposes of report? In Experiments 1a and 1b, participants discriminated between visually presented capital letters (H or N) and non-letters while reaction times and errors rates were measured. Three modes of presentation were used. Dynamic modes involved three-frame animations of 100ms per frame with stroke order either Consistent or Inconsistent with writing action. In the Immediate mode the letter/non-letter followed fixation. The target remained onscreen either until a response was made (Experiment 1a) or for only 100 ms (Experiment 1b). Participants discriminated letters faster in the Consistent relative to the Inconsistent mode. Additionally, they were slowest in the Immediate mode. Compared to the Immediate mode, dynamic modes provide precise information about the time of onset of the resultant letter/non-letter, thus aiding anticipation of target appearance. In Experiment 2, a three-frame Dynamic Neutral mode, involving two frames of a visually uninformative "dot" before the final frame, replaced the Immediate mode. Letters in the Dynamic Neutral mode were discriminated as quickly as those in the Inconsistent, but more slowly than those in the Consistent. When queried afterward, no participant reported an awareness of the difference between the Consistent and Inconsistent modes of presentation. In sum, we suggest

that the serial nature of learnt actions is not only part of the underlying representations that code the actions themselves, but also part of the perceptual representations of the products of such actions. In the specific instance of letter perception, information concerning stroke order is an integral part of both the motor programs for letter production and their perception. Shared codes for action and perception (Hommel, Müsseler, Aschersleben & Prinz, 2001 Behavioral and Brain Sciences 24 849-937) make possible implicit priming of perceptual products via dynamic sequences that match action codes.

Title:
Suppressed patterns alter vision during binocular rivalry

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Session:
Monday, June 27, 14:00-16:00: Concurrent Session 3.3

Abstract:
The perception of orientation information contained in certain visual patterns can be manipulated by contextual information. Here we show that during binocular rivalry a suppressed oriented pattern can simultaneously alter the perceived orientation of the visible dominant pattern. When rivalrous gratings are presented intermittently the percept stabilises: successive dominant images are the same. Using intermittent binocular rivalry we were able to control the dominant pattern across multiple presentations, hence measure the influence of the suppressed inducer on the perceived orientation of the dominant

pattern. On each trial observers signalled whether the dominant grating appeared tilted left or right of vertical. The suppressed grating alternated pseudorandomly between $\pm q^\circ$ (CW and CCW) on different trials, ensuring that any illusion of orientation was not due to adaptation. The resulting orientation illusion displays a characteristic tuning function of attraction for small ($<30^\circ$) inducer-test angles and repulsion for larger angles. In addition, we show that a suppressed surround grating affects the perceived orientation of a central pattern in the same way as a visible surround. However, suppression reduces the effective contrast of the surround by a factor of 6-7. A neural model can provide a quantitative explanation of these illusions. These findings demonstrate that dominant and suppressed information can simultaneously rival and interact, hence the conceptualization of dominance and suppression during binocular rivalry might require revision.

Title:
Meaning psychologism

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Session:
Monday, June 27, 14:00-16:00: Concurrent Session 3.2

Abstract:
In the past few years, a number of philosophers (notably, Siewert 1998, Horgan and Tienson 2002, Pitt 2004) have maintained the following three theses: (1) that there is a distinctive sort of phenomenology characteristic of conscious thought, as opposed to other sorts of conscious mental states; (2) that different conscious

thoughts have different phenomenologies; and (3) that thoughts with the same phenomenology have the same intentional content. The last of these three claims is open to several different interpretations. It might mean that the phenomenology of a thought expresses its intentional content, where intentional content is understood as propositional, and propositions are understood as mind- and language-independent abstract entities, such as sets of possible worlds, functions from possible worlds to truth-values, structured n-tuples of objects and properties, etc. Or it might mean that the phenomenology of a thought is its intentional content α that is, that the phenomenology of a thought, like the phenomenology of a sensation, constitutes its content. The second sort of view is a kind of psychologism. Psychologistic views hold that one or another sort of thing α numbers, sentences, propositions, etc. α that we can think or know about is in fact a kind of mental thing. Since Frege, psychologism has been in very bad repute among analytic philosophers. It is widely held that Frege showed that such views are untenable, since, among other things, they subjectivize what is in fact objective, and, hence, relativize such things as consistency and truth to the peculiarities of human psychology. The purpose of this paper is to explore the consequences of the thesis that intentional mental content is phenomenological (what I call —meaning psychologism") and to try to reach a conclusion about whether it yields a tenable view of mind, thought and meaning. I am inclined to think that the thesis is not so obviously wrong as it will strike many philosophers of mind and language α that, in fact, it might entail a defensible and interesting account of mentality, and that it might succeed where other views α in particular, the causal-information views of mental content that have been at the forefront of research in analytic philosophy of mind for the past thirty years α have failed. Issues explored include the role of propositions, the relation of thoughts to their contents, the question of objectivity, and the distinction between meaning psychologism and inference psychologism.

Title:

Perspective taking and emotion recognition in children with pervasive developmental disorder: a comparison with normal children and children at risk of attention/hyperactivity deficit disorder

Authors:

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Session:

Saturday, June 25, 17:30-20:00: Poster Session

Abstract:

Questions concerning perspective taking are rising in the fields of cognitive development and neurodevelopmental disorders. Close to the notion of "Theory of mind" (ToM) it refers to one's capacity to infer mental states to an intentional agent, such as beliefs, intentions and emotions (Baron-Cohen, 2001). Although some have argued that ToM deficits stem from conditions "specific" to autism, the debate has not been resolved. Recent research indicates that intellectual capacity, mainly verbal, modulates performance on ToM tasks. Furthermore, executive functioning deficits have been identified in autism, ADHD and PDD (Barkley, 1997; Frith & Frith U, 1999). Although different brain loci have been identified for autism and ADHD, it can be hypothesized that children with ADHD may show some deficits in perspective taking tasks. However, this has not been the object of extensive research in ADHD literature. Therefore, our study seeks to compare children with PDD, children "at risk" of ADHD and normals for different first and second order ToM tasks (Sally-Ann, Coint test, Smarties) and to draw a link between these cognitive competence and emotion recognition competence. Results indicating a link between subjects' verbal IQ and performance on perspective taking and emotion recognition tasks will be discussed.

Title:

Distortions in the perception of time in music

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Session:

Saturday, June 25, 17:30-20:00: Poster Session

Abstract:

The perception of time has been the focus of a great deal of research and has involved a number of different theories that attempt to explain the way we experience time. Various theoretical explanations for the experience of time have been developed that assume internal mechanisms are responsible either in terms of an internal clock or an internal information processor. Time perception itself has been explored through the use of the filled-duration illusion in the auditory modality. However, researchers have been puzzled in accounting for these findings and internal clock-based accounts do not help. In this illusion it is found that the perceived duration of a time interval depends on how many acoustic events occur within that interval. We report a study exploring the filled duration illusion, which uncover some of the potential properties that might be important to the dilation and compression of time in sound. This study involves altering the pitch properties of the acoustic events within the filled duration. The results suggest that perceived duration varies with pitch relations in the stimulus. We interpret the pattern of perceived duration in terms of musically strong and weak events that have differential effects on the dilation and contraction of time. Finally, we consider these results in terms of the perception of time in music.

Title:

Neural correlates of change blindness in the human medial temporal lobe

Authors:

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Session:

Saturday, June 25, 17:30-20:00: Poster Session

Abstract:

Observers are often unaware of changes made to the visual environment when attention is not focused at the location of the change. This phenomenon, known as change blindness, has been extensively studied using psychophysics and fMRI. Yet its correlates at the single cell level remain unclear. We recorded from the medial temporal lobe (MTL) of patients with pharmacologically intractable epilepsy, implanted with depth electrodes and microwires, to localize the focus of seizure onsets. Subjects were presented with one set of 4 simultaneously presented images twice, each time for 1s, with a brief blank interval of 1.5s between the 2 presentations. On half the trials, a change occurred at one of the four locations, and subjects had to report whether they detected the change or not. In separate "screening" sessions, specific images that cells were visually responsive to ("preferred stimuli") were determined. We investigated neuronal

responses when the set of preferred stimuli were used as changing elements. We have currently recorded from a total of approximately 700 cells in 9 patients of which 29 were visually responsive under this paradigm. These were located in the amygdala, hippocampus, entorhinal cortex and parahippocampal gyrus. Over these cells, the preferred stimuli elicited significantly higher firing rates on correct trials (e.g. change detection) compared to incorrect (e.g. change blindness) trials. For each cell, we were able to predict on a trial-by-trial basis (using an ROC analysis) whether or not a change occurred 67% of the time on average. This prediction was significantly higher than chance on correct trials, but on incorrect trials prediction was at chance. On a trial-by-trial basis, we are also able to predict the behavioral decision of the subject above chance (59%). Thus, the firing rates of certain MTL cells might constitute a neural correlate of change detection and change blindness.

Title:

Charles Bonnet syndrome in a patient with right hemianopia following left anterior temporal lobectomy for drug-resistant epilepsy

Authors:

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Session:

Saturday, June 25, 17:30-20:00: Poster Session

Abstract:

The Charles Bonnet syndrome (CBS) is a condition in which individuals experience complex visual hallucinations without demonstrable psychopathology or disturbance of normal

consciousness. Reduction in vision, due to peripheral eye pathology as well as pathology within the brain, is associated with the syndrome. Episodes can occur for variable periods of time (from days to years), with the hallucinations changing both in frequency and in complexity during this time. A number of factors may trigger or stop the hallucinations, presumably exerting their effect through a general arousal mechanism. People, animals, buildings, and scenery are usually reported. Emotional reaction to the hallucinations may be positive or negative. CBS represents a condition characterized by the dissociation between visual perception and the sensory input. We report a patient presenting with CBS associated with right hemianopia resulting from an anterior left temporal lobectomy performed for the treatment of a drug-resistant focal epilepsy. A 49-year-old woman suffering from a drug-resistant left temporal lobe epilepsy associated with a left mesio-temporal cavernous angioma underwent prolonged video-EEG monitoring for seizure recording. The results of video-EEG monitoring indicated an epileptogenic area that extended from the left anterior lateral neocortex and temporal pole to the left mesio-temporal region, including the cavernoma; therefore a left antero-mesial temporal lobectomy was performed. In the days following surgery the patient presented a transitory aphasic disorder and episodes of complex visual allucinations with completely preserved consciousness, lasting from minutes to hours. The patient was aware of the fictitious nature of the visual phenomena, she could describe them in detail, without any emotional involvement. The content of the allucinations was represented by unfamiliar women and children, and brightly coloured landscapes. EEG recordings excluded the epileptic nature of this phenomena. CT/MRI scans showed the results of the anterior temporal lobectomy. CBS has been rarely reported in young patients undergoing anterior temporal lobectomy. Recent functional imaging studies showed that hallucinations of colour, faces, textures and object were associated with activation of ventral extrastriate visual cortex; the hallucination content reflected the functional specialization of the activated region. Pathophysiological hypothesis postulate a reduced or completely absent afferent input of the visual system to cortical visual areas, implying that missing inputs to primary visual cortex disinhibit visual association areas. In our patient, the altered visual input to primary visual cortex was caused by a surgical lesion in

the central visual pathway between the lateral geniculate nucleus and the primary visual cortex.

Title:

Single-cell representation of novelty and familiarity in the human hippocampus-amygdala complex requires task relevance

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Session:

Saturday, June 25, 17:30-20:00: Poster Session

Abstract:

The human medial temporal lobe (MTL) has long been recognized as an essential structure for the formation and storage of long-term memory. While lesion studies have demonstrated that a functional MTL is required for memory acquisition, the cellular and molecular mechanisms underlying this process remain poorly understood. One of the main difficulties in investigating memory are the inherent limits of animal models. It remains controversial to what degree animals possess the capability of explicit recall and recollection as opposed to recognition. We have conducted in-vivo single-cell recordings from intracranial depth electrodes implanted in the hippocampus-amygdala complex of epilepsy surgery patients to investigate memory formation in humans. Using this technique, we are able to simultaneously record 10-40 neurons. This allows us to correlate behavior with single-cell

responses. Theoretical models of learning and memory formation have long proposed that novelty detection is one of the crucial components for initiating memory formation. Multiple studies have demonstrated strong effects of novelty: i) skin response measurements show strong effects of novel items, ii) PET and fMRI studies have shown increased activity for novel items in the MTL and iii) short exposure to novel environments reduces the minimal stimulus strength necessary for in-vivo LTP induction in the hippocampus. The cellular basis for this novelty effect, however, remains elusive. We have conducted psychophysical experiments to address this question. The experiment consists of a series of pictures presented to the subject. The task of the subject is to classify the pictures as novel or familiar. We find that approximately 25% of all recorded single neurons from the hippocampus-amygdala complex show strong novelty effects. These effects appear rapidly (1/2 h) and after only one single presentation ("one-shot learning") of a visual stimulus. One intriguing question remaining about above finding is whether the emergence of novelty responses requires task relevance, e.g. awareness. In above task, the subject was required to report whether the stimulus presented was novel or not and thus explicit awareness of this fact was required. We used a classification task consisting of a sequence of images presented to the subject. For each image, the subject is asked to indicate whether the picture contains an animal or not. Unknown to the patient, each picture is presented multiple times. This, however, is not relevant for the task. Surprisingly, we find that the same neurons, which in the animal classification task have signaled novelty or familiarity, do not do so in the animal classification task. The emergence of novelty detector neurons in the human hippocampus-amygdala complex thus requires task-relevance.

Title:

Is consciousness required for the composition of two mental operations?

Authors:

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Session:

Saturday, June 25, 17:30-20:00: Poster Session

Abstract:

What are the types of processes for which consciousness is necessary, and which cannot be performed subliminally? In the present study, we investigate the hypothesis that consciousness is required whenever a novel chain of two (or more) mental operations is performed on a single input, leading to a more complex composite task. More specifically, we predict that consciousness will be indispensable when the output of one processor is to be fed as input to another. We designed a novel set of tasks on digits, based on the composition of two elementary tasks. The first one required participants to add or subtract 2 to a single digit. The second task was a semantic categorization as smaller or larger than 5. This enabled us to build a hierarchy of tasks of graded complexity: participants would either do the calculation alone, or the categorization alone, or a categorization of the result of the calculation. The design was such that the complexity of the stimulus response associations were equated across tasks, allowing us to unconfound it from the complexity of the internal computations. We used visual meta-contrast masking to manipulate conscious access to the stimulus, and we use a subjective scale to assess participants' awareness on a trial-by-trial basis. Within short blocks, where participants performed one of the above defined tasks, we varied the intensity of masking, so that some of the stimuli were clearly seen, some not seen. Our preliminary results indicate that when participants are not aware of the stimulus they still perform better than chance on all but the most complex task — which is

precisely the one that requires "piping" information between two processors. Analysis restricted to constant near threshold stimuli enable us to show that the dissociation is solely due to the subjective functional state of consciousness. Analysis of response times reveal that the dissociation cannot be explained in terms of treatment time. Although these results require replication and extension, they are compatible with the conscious neuronal workspace hypothesis, which postulates that two elementary tasks relying on distinct neural processors cannot share information without it being broadcast through the conscious workspace.

Title:

Independence of visual awareness from attention at early processing stages

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Session:

Saturday, June 25, 17:30-20:00: Poster Session

Abstract:

A fundamental question in the cognitive neuroscience of consciousness is the relationship between visual selective attention, i.e. the selection of visual input for detailed processing, and visual awareness, i.e. the subjective experience of seeing the stimulus (Dehaene & Naccache, 2001; Rees & Lavie, 2001). According to widely accepted idea only the results of attentional selection reach visual awareness (Dehaene & Naccache, 2001). An alternative and equally plausible model postulates that awareness is independent of

attentional selection, i.e. contents of subjective visual experience may also exist outside the focus of attention (Lamme, 2003). We tested these models by tracking the independent contributions of attention and awareness to electrophysiological brain responses. Previous event related potential (ERP) experiments indicate that negative responses around 200 ms from stimulus onset correlate with visual awareness, producing visual awareness negativity (VAN) (Kaernbach, röger, Jacobsen & Roeber, 1999; Wilenius-Emet, Revonsuo & Ojanen, 2004; Koivisto & Revonsuo, 2003). Selective attention to target stimuli, as compared to non-target stimuli, is reflected in ERPs as a negative amplitude shift around 200 ms after stimulus onset. This phenomenon is known as selection negativity (SN) (Hillyard & Anllo-Vento, 1998). The similar timing and polarity of VAN and SN raise the question whether they are a single phenomenon, reflecting the activation of the same attentional mechanism. In the present study, participants (N=12) followed a procedure in which selective attention was manipulated by asking subjects to attend to a prespecified letter occurring randomly among nontarget letters in the center of the screen. Each stimulus was followed by a mask, rendering stimulus either nonconscious (short SOA) or conscious (long SOA). Control experiments were conducted with constant stimulus-mask SOA to show that electrophysiological effects of awareness did not result from the different timing of the masks at the short and long SOAs. Results of the experiments show enhanced negativity (VAN) to detected stimuli, as compared to undetected stimuli. SN was observed 160-300 ms after stimulus onset, replicating typical findings in attention research. Effects of visual awareness emerged 40 ms before those of attention, but the electrophysiological effects of awareness were modulated by attention at late processing stages (200-700 ms after stimulus onset). The present study provides electrophysiological evidence that the neural processes responsible for visual selective attention and visual awareness can be dissociated from each other at early stages of processing: the electrophysiological correlate of visual awareness initially emerges earlier than the effects of selective attention.

 Title:
 Emergent materialism

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Session:
 Saturday, June 25, 17:30-20:00: Poster Session

Abstract:
 According to the emergent materialist the mind is physical but ontologically distinct from its underlying physical realisation. Although it is the dominant position emergent materialism faces a number of challenges. I will argue that the standard functionalist account of emergence cannot meet these challenges but an alternate structuralist account can. In order for us to know that materialism is true we need to know that the mind physical. The problem for the emergent materialist is that it seems that any evidence which would close the explanatory gap between the mental and the physical would also be evidence for reduction. The standard functionalist account of emergence cannot meet this challenge. Because functional types are relational types, functionalist accounts of the mind do not in and of themselves provide any information about the nature of the relata. In contrast, on a structuralist account of emergence the nature of the constituents is crucial. Something is structurally emergent if the nature of the whole depends on the arrangement of the parts. Although liquid water is composed of H₂O it is not identical to H₂O. The same set of H₂O molecules in a different arrangement could be steam or ice. Nevertheless it is possible to explain the nature of the emergent system (water) in terms of the nature of the constituents (H₂O). Because the possible arrangements of the constituents are determined by the nature of the constituents the "explanatory gap" between the constituents and the system can be bridged without reducing the system to its constituents. The emergent materialist also needs to reconcile the claim that the mental is physical with the claim that there are uniquely

mental causal powers. The functionalist cannot meet this challenge. Because functional emergence is consistent with token identity the causal powers of any token mental state must be identical to the causal powers of its token identical brain state. The "structuralist" avoids this problem because they deny token identity across levels. A molecule of H₂O is not identical to water: an individual molecule is not a liquid. Because the system has causal powers in virtue of the arrangement of the constituents the system has causal powers which the isolated constituents lack. But because the arrangement of the constituents and therefore the emergent causal powers are determined by the nature of the constituents there is an explanatory connection between the constituents and the emergent causal powers. The emergent materialist must adopt a structuralist, not functionalist account of emergence.

Title:
What time is it?

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Session:
Tuesday, June 28, 9:00-12:00: Satellite Oral Session

Abstract:
How does one determine the time of occurrence of one's own movement (or of one's intention to move) by reading a clock? We asked subjects to report the number they saw on a counter when they pressed a key whenever they felt to do so. Considering that time may be needed to sample the counter upon the triggering event, we expected the subjects to report a number coming after the actual time

of the key press. On the contrary, the number they reported preceded the actual time of the key press. Reading errors varied between individuals but usually they were smaller than expected on the basis of visual latencies, which are known to be long. However, these errors became much larger when the succession of digits in the counter was random (i.e. unpredictable) instead of regular. The most likely explanation is the involved visual delay was not compensated. We conclude that subjects don't passively read a "real" time on a counter. When they are in a situation where they can anticipate, they correct for visual delays by antedating digit reading, and they do so automatically (and unconsciously). Recent experiments in our laboratory (with Michael Pesavento) suggest that the amount by which subjects correct their time estimates depends on their personal experience, that these corrections are learned, and that they can be transferred from task to task.

Title:
A theoretical justification of consciousness

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Session:
Saturday, June 25, 17:30-20:00: Poster Session

Abstract:
In recent years the topic of consciousness has gained some credibility as a serious research issue, at least in philosophy and neuroscience, e.g., [Crick 1998]. However, there is a lack of theoretical justifications of consciousness: so far no one has shown that consciousness is really

useful for solving problems, even though problem solving is considered of central importance in philosophy [Popper, 1999]. Our fully self-referential Gödel machines [Schmidhuber 2003, 2004] may be viewed as providing just such a justification [Schmidhuber 2005]. They are the first mathematically rigorous, general, fully self-referential, self-improving, optimally efficient problem solvers, "conscious" or "self-aware" in the sense that their entire behavior is open to introspection, and modifiable. Essentially, a Gödel machine is a computer that rewrites any part of its own initial code as soon as it finds a proof that the rewrite is useful, where the problem-dependent utility function, the hardware, and the entire initial code are described by axioms encoded in an initial, asymptotically optimal proof searcher which is also part of the initial code. This type of total self-reference is precisely the reason for the Gödel machine's optimality as a general problem solver: according to our Global Optimality Theorem [Schmidhuber 2003, 2004, 2005], any self-rewrite is globally optimal—no local maxima!—since the code first had to prove that it is not useful to continue the proof search for alternative self-rewrites. Let us now go a bit more into the details: All traditional algorithms for problem solving are hardwired. Some are designed to improve some limited type of policy through experience [Kaelbling, 1996], but are not part of the modifiable policy, and cannot improve themselves in a theoretically sound way. Humans are needed to create new / better problem solving algorithms and to prove their usefulness under appropriate assumptions. Gödel machines eliminate the restrictive need for human effort in the most general way possible, attacking this "Grand Problem of Artificial Intelligence" by leaving all the work including the proof search to a system that can rewrite and improve itself in arbitrary computable ways and in a most efficient fashion. They are universal problem solving systems that interact with some (partially observable) environment and can in principle modify themselves without essential limits apart from the limits of computability. Their initial algorithm is not hardwired; it can completely rewrite itself, but only if a proof searcher embedded within the initial algorithm can first prove that the rewrite is useful, given a formalized utility function reflecting computation time and expected future success (e.g., rewards). One can show that self-rewrites due to this approach are actually globally optimal, relative to Gödel's well-known fundamental restrictions of provability [Gödel, 1931]. These

restrictions should not worry us; if there is no proof of some self-rewrite's utility, then humans cannot do much either. The initial proof searcher is $O()$ -optimal (has an optimal order of complexity) in the sense of Universal Search [Levin, 1973]. Unlike hardwired systems such as Hutter's [2001, 2004] and Levin's [1973], however, a Gödel machine can in principle speed up any part of its initial software, including its proof searcher, to meet arbitrary formalizable notions of optimality beyond those expressible in the $O()$ -notation. If we equate the notion of consciousness with the ability to execute unlimited formal self-inspection and provably useful self-change (unlimited except for the limits of computability and provability), then the Gödel machine and its Global Optimality Theorem do provide the first theoretical justification of consciousness in the context of general problem solving [Popper, 1999].

Title:

Is there any use for EEG bispectral index monitoring in the evaluation of consciousness in severe brain damaged patients?

Authors:

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Session:

Saturday, June 25, 17:30-20:00: Poster Session

Abstract:

The bispectral index (BIS) of the electroencephalography (EEG) is an empirical, statistically derived variable that was initially designed as a measure of depth of general anesthesia [1]. The aim of this study was to investigate the potential interest of BIS recording in monitoring

consciousness in severely brain damaged patients : coma, vegetative state (VS), minimally conscious state (MCS) and emergence from MCS. In 41 patients surviving an acute traumatic (n=15) and non-traumatic (n=26) brain injury a total of 182 sedation-free, good quality EEG epochs were correlated with the level of consciousness as assessed by means of behavioral "consciousness scales" : Glasgow Liège Scale (GLS) [2], the Coma Near Coma Scale (CNC) [3] and the Wessex Head Injury Matrix (WHIM; French adaptation [4]). BIS showed a better correlation with behavioral scales as compared to spectral edge frequency (SEF95) and total power of the EEG. BIS values (mean±SD) in coma, VS, MCS and emergence from MCS were 53.8±23.5; 63.8±14.7; 78.8±16.1 and 89.0±13.0, respectively. MANOVA showed significant differences in BIS values between these clinical entities (F=480; p<0.001). Post-hoc ROC analysis showed that at a BIS cut-off value of 50, unconscious patients (coma or VS) could be differentiated from conscious patients (MCS or emergence from MCS) with a sensitivity of 75% and specificity of 75%. In conclusion, EEG-BIS monitoring seems a useful reflection of consciousness in unsedated severely brain-damaged patients and thus may have a role in the objective monitoring of such patients in the acute and subacute setting. Further research is warranted to better understand the not infrequent false positives and false negative findings and to evaluate whether BIS or related EEG measures (e.g., quantification of complexity or approximate entropy) contain independent prognostic information for comatose and vegetative patients.

 Title:
 Experience without attention?

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Session:

Saturday, June 25, 14:00-16:00: Concurrent Session 1.2

Abstract:

It is sometimes suggested (e.g., by James 1890; Searle 1992; Siewert 1998) that our conscious experience is, in general, rich with detail. For example, at any given moment, a person might have both central and peripheral visual experience of the scene before her; auditory experience of a refrigerator hum and traffic in the background; tactile experience of her clothes on her skin and the structure of the chair she sits in; proprioceptive experience of her position; conscious visual imagery; a feeling of hunger; inner speech. Such "rich" views of experience contrast with "thin" views (e.g., Jaynes 1976; Dennett 1991; Rensink, O'Regan, and Clark 1997; Hurlburt in preparation), according to which experience is normally constrained to one or a few items in attention. Rensink (2000) has recently pointed out the lack of direct evidence on this question, though both he and Lamme (2003) offer some suggestions for ways to approach this question using the tools of vision science. This paper approaches the question in a rather different way: By asking subjects directly. Certainly a raft of difficulties attend first-person methodologies (see Jack and Roepstorff, eds., 2003 and 2004 for discussion), as I myself have argued (e.g., Schwitzgebel 2002, 2004). However, first person reports offer at least a suggestive starting point and are worth collecting. The present research adapts a version of the "Descriptive Experience Sampling" methodology employed by Hurlburt (1990, 1993). Subjects were each given a random beeper. After each beep, they were asked to describe their experience immediately prior to the beep, when - in most cases - they were engaged in normal unselfconscious activity. Twenty subjects were divided into five conditions. In the first condition, they were asked to describe the entirety of their experience. In the second, they were asked simply whether they had visual experience, and if so what that experience was. The third condition similarly asked about tactile experience. The fourth and fifth conditions asked about experience in the far right visual experience and tactile experience in the left foot, respectively. Subjects in the first two conditions reported visual experience in almost all samples, despite in some cases denying the presence of visual attention. Tactile and visual peripheral experiences

were somewhat less commonly reported, but still considerably outran reports of attention to the relevant sensory objects.

Title:
Dualism Reconsidered

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Session:
Monday, June 27, 16:30-17:30: Keynote

Abstract:
I believe the traditional mind-body problem has now been put into a shape where it admits of a scientific solution. Consciousness -- as qualitative, ontologically subjective and intentional phenomena -- is caused by neurobiological processes and realized in the brain system. How exactly does it work as a biological phenomenon? An essential step in the formulation of the problem was to get rid of the idea that consciousness as a first person phenomenon could be eliminated by reducing it to some third person phenomena--But the irreducibility of consciousness has led to a revival of certain forms of dualism. Dualism is becoming respectable again. I argue that dualism is as incoherent as it ever was, that the arguments for it are bad arguments, and that one can recognize the reality and irreducibility of consciousness without accepting dualism.

Title:
Posture and localization in body image

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Session:
Saturday, June 25, 17:30-20:00: Poster Session

Abstract:
The experience of one's own body is one of the most conspicuous and interesting aspects of the phenomenology of consciousness. Body image is a particularly interesting element of consciousness when one is interested in the dynamic construction and maintenance of phenomenal experience, as the image of the body is constantly updated based on the contingency between action and sensory feedback. There could be a possible difference of opinions on the distinction between body schema and body image. We adopt the working hypothesis that body image refers to any conscious perception about one's body which can be verbally reported. Space is an important element of the body image. For example, the assignment of tactile stimuli on one's body surface (tactile localization) is a ubiquitous experience in daily life. The perception of the "posture" of one's body is also important functionally, especially for the hands, which are involved in many maneuvers. It is interesting to ask the possible relations between tactile localization and posture, as they are manifestly intertwined. Here, we report a series of experiments that indicate that the accuracy of tactile localization on fingers can be influenced by hand posture. We used the illusory perception induced when the subjects crossed two fingers (Aristotle's illusion) to monitor the effect of hand posture on tactile localization. It is found that the subjects are able to report the position of the tactile stimuli on the fingers more accurately when the hand is in the "palm up" position, compared to the "palm down" position. This result has some interesting

implications for the cortical processing of hand posture and tactile localization. We consider the possibility that a rotation of body image is involved, with the "palm up" position used as the default hand posture for tactile localization. In this respect, we report the analysis of reaction time in different postures of hand. We also discuss the general principles involved in the perception of tactile stimuli and posture. Posture is an actively controllable spatial configuration of the body, whereas tactile stimuli are inflicted upon the body from the environment. We discuss how the perception of one's own hand reflects this general condition on tactile stimuli and posture.

Title:

Visibility, gaze specificity, and crossmodal synchrony assessed by aftereffect

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Session:

Sunday, June 26, 9:00-12:30: Symposium 2

Abstract:

The adaptation/aftereffect paradigm has been regarded as "psychophysicists' electrode" to probe into the neural mechanism underlying visual experiences. Here, I will report several new paradigms/findings along this line, from our psychophysics laboratory at Caltech and in collaboration with other laboratories. (a) Visibility and detectability modulated by edge adaptation. We showed that detectability of visual object can be modulated by adaptation to the edges of the object. In the worst case, observers failed to detect a

luminance-defined object up to 7 or 8 seconds in the test after adaptation (Kamitani & Shimojo, 2002). In a subsequent study, we separated and compared effects of transient vs. sustained adaptor, and found that they led to a rapid gain control and sustained adaptation to the spatial patterns, respectively (Moradi & Shimojo, 2003). (b) Aftereffects induced by invisible adaptors. We found that an adaptor faded away more by Troxler filling-in turned out to yield even a stronger orientation-selective aftereffect (Moradi & Shimojo, 2005). In the case of face adaptation (identity, expression), on the other hand, we found a positive correlation between visibility of adaptor (modulated by binocular rivalry) and strength of aftereffect (Moradi, Koch & Shimojo, 2005). This is in a contrast with lower-level perceptual adaptations where visibility of adaptor is largely ineffective on the strength of aftereffect. (c) Gaze-specific processing assessed by aftereffect. By adapting to one stimulus in one gaze direction and another in another gaze direction and then measure aftereffect at various locations, one can assess gaze-dependent, or gaze-direction-specific adaptation. We found that both depth and color aftereffects do have such gaze-contingent components (Nieman, Hayashi, and Shimojo, 2002). (d) Auditory-visual synchrony adaptation. When one is adapted to a constant time delay between auditory and visual inputs, both the direct (temporal order judgment) and the indirect (stream/bounce effect) measures showed evidence of negative aftereffect; that is, the subjective simultaneity point was biased towards the adapted A-V delay (Fujisaki, Shimojo, Kashino & Noshida, 2004). All these new paradigms/findings opens possibilities of further investigation on functions and mechanisms of the sensory systems. Adaptation/aftereffect will remain to be a powerful tool in this era of perceptual awareness and human brain imaging.

Title:

Reaction time and meta-awareness: Your hands reveal what your mind doesn't know

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Session:
Saturday, June 25, 14:00-16:00: Concurrent Session 1.3

Abstract:
Previous research has documented that in a variety of tasks -including encoding and sustained attention tasks (Smallwood et al., 2003, 2004 A & B) -it is possible to observe reliable changes in reaction time (RT) which are associated with periods of off-task thinking. One possible reason that these patterns exist in the RT data is that the individual has momentarily lost track of the task, a phenomenon which may reflect a failure of meta-awareness (Schooler, 2002). This talk will describe the results of a series of experiments using both random and RT contingent thought probes which support the notion that deficits in meta-awareness drive changes in RT during cognitive tasks.

Title:
On the fate of negative emotional stimuli: Levels of (un)consciousness mediate vigilance vs. defense

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Session:
Saturday, June 25, 14:00-16:00: Concurrent Session 1.3

Abstract:

Much research suggests that stimuli are automatically evaluated as positive or negative. Common paradigms include affective priming, wherein response times (RTs) to pleasant and unpleasant targets are faster when preceded by evaluatively congruent primes (Fazio et al., 1986), and emotional Stroop effects, wherein RTs are slowed when emotionally relevant (vs. neutral) words are presented (Williams et al., 1996). Strikingly, automatic evaluation effects occur even with unconsciously presented primes, suggesting that it is a fundamental process possessing considerable adaptive significance. Moreover, negative (vs. positive) stimuli typically produce more powerful automatic evaluation effects, whether conscious or unconscious. Such findings dovetail with a broad range of evidence (cf. Mineka & Ohman, 2002; Ohman & Mineka, 2001) suggesting that negative stimuli are preferentially processed, again consistent with evolutionary preparedness interpretations. However, although RT paradigms show that negative stimuli receive greater attention, they do not address whether negative stimuli are actually detected better than positive stimuli, which evolutionary preparedness interpretations would predict. Dijksterhuis and Aarts (2003) addressed this question by using a direct (accuracy) rather than indirect (RT) paradigm. They presented pleasant and unpleasant words unconsciously, and indeed found an unpleasant superiority effect. Whenever unconscious effects are claimed, however, it is essential to examine how consciousness is operationalized (Snodgrass et al., 2004). Subjective threshold approaches (e.g., Dijksterhuis & Aarts, 2003) degrade stimuli until participants deny awareness. Under such conditions, however, discrimination accuracy still exceeds chance, suggesting that such effects may be weakly conscious. In contrast, objective threshold approaches (e.g., Greenwald et al., 1989) further degrade stimuli until participants not only deny awareness but moreover perform at chance on discrimination tasks. Such stringency, however, might weaken or eliminate unconscious effects (Reingold & Merikle, 1990). This "Goldilocks" dilemma (i.e., too lenient vs. too stringent), however, assumes a single, underlying unconscious process. In contrast, we (Snodgrass et al., 2004) propose that subjective and objective threshold methods index qualitatively distinct phenomena. Here, we examine word valence influences on detection under both objective

and subjective threshold conditions. We replicated Dijksterhuis and Aart's (2003) subjective negative superiority effect, but found the reverse (i.e., a pleasant superiority effect) under objective conditions, suggesting that subjective and objective threshold phenomena are indeed qualitatively distinct. Moreover, objective pleasant superiority was mediated by defensiveness-related personality factors, suggesting unconscious defense. In contrast, subjective negative superiority was not, and seems consistent with a vigilance interpretation. Implications for the structure of consciousness and evolutionary preparedness interpretations are discussed.

Title:

An fMRI study of conscious and unconscious priming in a line length comparison task: The role of conscious conflict monitoring and illusion

Authors:

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Session:

Saturday, June 25, 14:00-16:00: Concurrent Session 1.3

Abstract:

Looking for neural correlates is among the main approaches in the scientific study of consciousness currently. This study aimed to elucidate the neuro-cognitive basis of conflict caused by conscious and subliminal priming. Functional Magnetic Resonance Imaging (fMRI) was employed to study these cognitive processes using a geometric (line) version of Dehaene et al's (1998) numerical priming paradigm. This new stimuli format doesn't have the interference

problem of the numerical version in which subjects need to hold a reference number in memory to compare the target number with. As mentioned by Dehaene et al (2003), this can cause interference especially in the conscious priming condition where the subject may compare the prime with the target instead of the reference number. In addition, using line stimuli made it possible to assess the role of illusion (Müller-Lyer). The stimuli were lines with two parts whose positions and lengths were changed randomly. The subjects were asked to select the longer part of a briefly presented target line. The target line was preceded by a congruent or incongruent prime line presented briefly, either masked (unconscious) or unmasked (conscious). In the congruent condition, the longer parts of the prime and target lines were on the same side while in the incongruent condition they were opposite to each other. The parts of the prime lines had arrows (wings) that in the illusory conditions were not in the same direction and caused the Müller-Lyer effect, but in fact the parts were equal in the latter case. In the activation of brain areas, including dorsal Anterior Cingulate Cortex (dACC), there was a significant interaction between congruency and consciousness. The incongruent priming activated dACC but only in the conscious condition. In the unconscious condition, reaction times were decreased by congruent priming and increased by incongruent priming, even for illusory differences in the line parts. However, unlike Dehaene et al's (2003) result, this behavioral effect was not observed in the conscious condition, presumably a result of the different stimuli used in the present study that led to easier conflict reduction, or may be due to the small sample size (eight subjects). The effect of illusion was observed in the occipital lobe and the effect of unconscious priming was observed in the parietal lobe, showing local but not global and distant activation in these automatic processes. The involvement of parietal cortex, but not dACC, in unconscious priming may indicate that different areas are involved in automatic and conscious priming-related conflict reduction. The possible reasons for some differences between brain activations and behavioral data in Dehaene et al (2003) and the present study and the implications for cognitive modeling will be discussed.

Title:

Controlling the contents of visual consciousness: mechanisms of competition and selection revealed by 'virtual lesions' of human parietal cortex

Authors:

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Session:

Sunday, June 26, 14:00-16:00: Concurrent Session 2.1

Abstract:

Behavioural studies demonstrate the limited capacity of conscious visual perception (e.g., attentional blink, inattention blindness). To ensure that processing of visual input is coherent and meaningful, therefore, mechanisms of attention selectively bias a subset of information to reach perceptual awareness at the expense of competing information. Topdown (e.g., behavioural goals) and bottom-up (e.g., abrupt onsets) processes enhance potentially important sensory information, and suppress processing of less important distracting information. Previously, we have exploited transcranial magnetic stimulation (TMS) as a 'virtual lesion' technique to investigate the causal role of posterior parietal cortex (PPC) during shifts of spatial attention. Initially, we revealed the critical role of the right angular gyrus (AG) during reflexive shifts of visual-spatial attention¹. In a further study, we demonstrated that the right supramarginal gyrus (SMG) is necessary for voluntary control of visual, but not somatosensory, spatial attention². This degree of modality-specificity is consistent with a biased competition model of attention³

in which control mechanisms bias competition at multiple levels of processing, rather than via a unitary supramodal orienting system⁴. In the present study, we explored biased competition within the parietal cortex more directly. Sixteen participants performed a peripheral localisation task in which a visual target appeared within the left or right hemifield, either in isolation, or with competing distractors presented simultaneously at the contralateral spatial location. Event-related repetitive TMS was delivered either to the right AG, SMG, or superior parietal lobule (SPL) during the first 300ms of target presentation. Initially, we found that stimulation of both the SPL and SMG reduced the competitive strength of task-irrelevant contralesional stimuli causing a reduction in the behavioural cost normally associated with contralateral presentation of distractors. Secondly, we applied an event-related double-pulse TMS protocol to reveal the time course of these competitive mechanisms. The results replicated our initial finding, and further identified a critical epoch at 120ms following target onset. The early involvement places these regions in an ideal position to modulate sensory processing in visual cortex to bias competition, and thus ultimately, to aid control over the contents of visual consciousness.

Title:

Conscious experience in the aetiology of the Capgras delusion

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Session:

Saturday, June 25, 17:30-20:00: Poster Session

Abstract:

A person suffering from the Capgras delusion believes that their wife, or other close relative, has been replaced by an impostor. Stone & Young (1997) proposed a two-factor account of this delusion. They argued that the first factor is damage to affective components of the face recognition system. This damage causes the person to have an anomalous experience of the spouse's face, where the spouse is identified but the normally concomitant affect is absent. They further proposed that anomalous experiences demand explanation and that the delusional belief is the deluded person's explanation. A second factor is required to account for why a deluded individual is prepared to entertain and maintain such a bizarre explanation when there are many more plausible candidates available, and also to account for cases of people who have the first factor but who do not form the delusion. Stone & Young's specific proposal on the second factor was that people with the Capgras delusion have a bias towards an externalising explanatory style, have a tendency to "jump to conclusions" and do not share the normal human bias toward conservatism in belief formation. This account has been subject to a good deal of scrutiny since 1997. In particular, Davies & Coltheart (2000) suggested that the deluded individual may not be explaining their experience but merely endorsing the content of their experience as veridical (see also Bayne & Pacherie, 2004). Langdon & Coltheart (2000) argued that the second factor must be a deficit not a bias. In this paper, I turn the spotlight of attention back onto the first factor. It has been a tacit assumption in this debate that the anomalous experience that constitutes the first factor is a conscious one. The experimental evidence for the first factor is that deluded individuals, unlike controls, show no increase in autonomic response to familiar faces. Whilst this is evidence for impairment to the affective processing of faces, it is not direct evidence for a claim about the conscious experience of the deluded individual. Indeed, it is independently plausible that the affective processing in question is non-conscious. This paper explores how a two-factor explanationist account might proceed on the assumption that the anomalous experience is non-conscious. I argue that such an account must be radically sub-personal and will throw light on the nature of conscious and unconscious experience more generally.

Title:

Neural mechanisms underlying a motion-dependent distortion of retinotopy in area V4

Authors:

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Session:

Saturday, June 25, 14:00-16:00: Concurrent Session 1.1

Abstract:

Visual neurons follow changes in the environment with latencies up to a few hundred milliseconds. Thus, by the time a neuron responds to a moving stimulus, it will have moved to a new location. Psychophysical studies have documented perceptual effects showing that the visual system may attempt to compensate for these neural delays. In one study, Cai & Schlag (VSS 2001) found that the location of an odd-colored flashed element appearing within an apparent motion sequence is perceived shifted along the motion trajectory. To gain insight into the neural mechanisms underlying this perceptual shift, we quantified the shift in humans and then presented the same sequences to monkeys while recording neuronal responses in area V4, a color-selective, retinotopically-ordered area. We positioned the apparent motion sequences to sweep across the neuron's receptive field. On each trial the odd colored flash element appeared at one location within the sequence. The same flash locations were tested with the sequence moving in two opposite directions. If the V4 neurons respond to the veridical location of the flash, those responses should be identical when embedded in oppositely moving sequences. Instead we find that motion direction shifts the positions where the odd colored flash element elicits a response. This shift is consistent with the

neurons encoding the perceived, not veridical, location of the flash element. The shift was significant across the population of neurons, was apparent in the first spikes elicited by the flash element, and was similar in magnitude to the mislocalization perceived by humans. Motion alone was not sufficient to cause the shift: when tested with identical motion sequences composed entirely of a single color a neuronal shift was not induced. Although the shift was only observed when there was a transient color change, the shift does not depend on the cells being selective for the colors used: we found no correlation across neurons between color selectivity and neuronal shift. We also found that motion following the flash was not necessary: the neuronal shift was undiminished when the flash element terminated the sequence. This is surprising because a terminal flash much reduces the perceptual shift in humans. These results show that although the V4 neuronal shift we recorded is sufficient to explain the perceptual illusion in the full motion sequence, the final percept is likely the result of processing across multiple areas.

Title:

What is it like to be Beethoven? Uneasy answers to the hard problem

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Session:

Saturday, June 25, 17:30-20:00: Poster Session

Abstract:

A very common notion that researchers use when discussing the scientific search for consciousness is the discrimination between the easy problems and the hard one. The easy problems deal with the neural correlates of consciousness in our brain, while the hard problem discusses qualia - the inner, incommunicable subjective experience. It is argued that while we clearly advance in our scientific approaches towards the easy problems, we are still far from understanding anything with regards to the hard problem. We show that some novel insights into the hard problem can be achieved when one tries to look at the problem from the perspective of information theory. We try to suggest an approach that doesn't try to "reduce" the mental activity by a physical/mathematical explanation, but rather suggests a new method of discussing the problem. Our approach points out some connections between physical time, biological evolution and the limitation of any symbolic language as key figures in the development of what we call qualia. We then try to suggest a way of measuring the degree of consciousness in various organisms towards a better understanding of the requirements from any future scientific theory of consciousness.

Title:

Have I seen you before? Repeated exposure effect for neutral and affective faces

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Session:

Saturday, June 25, 17:30-20:00: Poster Session

Abstract:

Effects of repeated exposure on social judgement were tested in two experiments. In the exposure phase participants were supraliminally (1000 ms) or subliminally (16 ms) repeatedly exposed to neutral and affective facial stimuli. In the rating phase participants were exposed both to old (previously repeatedly exposed) and new pictures presented randomly for 1000 ms each. They were asked to say whether they could like the person presented on picture and to answer by using 5-point scale (1-completely disagree, 5-completely agree). Control groups had the same procedure, but with grey rectangle instead of pictures exposed during exposure phase. Analyses showed enhancement effect due to repeated supraliminal exposures. Repeatedly exposed neutral, happy and fearful faces were evaluated significantly higher than novel stimuli and than in control condition (classical mere repeated exposure effect). Old pictures of sadness, surprise and anger were preferred more than novel stimuli. It suggests that the affect generated during exposure phase is rather specific. The exception was disgust in which case non-specific effect was obtained. The possible interpretation will be discussed. Keywords: affect, facial expression, repeated exposure effect, social judgement.

Title:

When self-monitoring breaks down: The differential role of external and internal information for the perception of self-action in schizophrenia

Authors:

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Session:

Saturday, June 25, 17:30-20:00: Poster Session

Abstract:

It is commonly assumed that we are able to attribute self-agency to sensory events by comparing the predicted sensory consequences of one's own actions with the actual sensory afferences. Accordingly, delusions of influence (DI) in schizophrenia patients might result from a disturbance of this comparison process. Evidence supporting this concept, however, is still controversial and often fails to identify the exact deficit and circumstances responsible for this breakdown of self-monitoring. Here we hypothesized that DI can be related to deficits in perceiving one's own actions. In particular, we speculated that in case of a mismatch between the predicted and the actual sensory consequences of one's behaviour, DI might arise because schizophrenia patients would rely more on the latter, i.e. external information about selfaction, because their internal sensory predictions might no longer be accurate. To test this hypothesis, healthy controls and schizophrenia patients had to perform center-out pointing movements, which were fed back visually by presenting subjects a virtual marker of the tip of their index finger in an otherwise dark environment. In a first experiment we asked whether subjects were able to detect angular distortions of the visual feedback of their movements. In line with our hypothesis, schizophrenia patients showed higher detection thresholds in recognizing the manipulated sensory feedback on their action. Furthermore, the ability to detect such distortions of sensory feedback correlated significantly with the strength of DI as assessed by a subscale of the SAPS, which specifically scored for DI. In a second experiment visual feedback was first presented in spatio-temporal correspondence with respect to the actual hand position, before it was then changed by a constant angular bias of 30° in order to drive adaptation. Here, the perceived pointing direction of schizophrenia patients shifted significantly stronger in the direction of the trajectory rotation than the perceived pointing direction of controls. However, in motor 'catch-trials' without any

visual feedback schizophrenia patients showed a compensatory motor-adjustment opposite to the direction of the imposed visual rotation which was comparable that of controls. This shows that the deficits of schizophrenia patients in perceiving their actions are not accompanied by deficits in performing their actions. Our results suggest that schizophrenia patients are specifically impaired in the attribution of self-agency to the sensory consequences of their own actions: They tend to rely on external rather than internal information regarding self-action and thus are highly likely to misattribute the outcome of their behaviour in situations when external information is ambiguous.

Title:

And then what happens? Implicit and explicit processes in preference change through choice

Authors:

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Session:

Saturday, June 25, 17:30-20:00: Poster Session

Abstract:

Choice Blindness is the failure to detect mismatches between intention and outcome in simple decision tasks. In particular, we have investigated this effect for choices between human faces based on facial attractiveness (Johansson et al., submitted, Hall & Johansson, in preparation). We have shown that when evaluating facial attractiveness, participants may fail to notice radical changes to the

outcome of their choice. We have used this effect to investigate the nature of intentions. As a strongly counter-intuitive finding, choice blindness warns of the dangers of aligning the technical concept of intention too closely with common sense. In addition, we have studied introspective awareness. Using choice blindness as a wedge, we are able to 'get between' the decisions of the participants and the outcomes they were presented with. This has allowed us to show, unequivocally, that normal participants may produce confabulatory reports when asked to describe the reasons behind their choices. But one of the goals of consciousness research is to be able to move beyond snapshot measures, and study the dynamic interplay between implicit and explicit processes (as Dennett 1991, says, to ask the hard question: And Then What Happens?). In our current set of experiments we are investigating what happens when choice blindness is incorporated into a longer series of choices, with repeated instances of verbalization, and with (explicit and implicit) feedback from outcomes being used as the partial basis for the next round of choice. For example, we have found that exposure to the outcome in a choice blindness trial can lead to a preference change in line with the manipulated choice, and that this effect is strongly modulated by the level of introspective involvement shown by the participants. At ASSC9 we propose to present this (hitherto unpublished) material, and discuss the interface between conscious and unconscious processing with respect to choice, introspection, and preference formation.

Title:

The functional significance of conscious memory experience

Authors:

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Session:

Saturday, June 25, 17:30-20:00: Poster Session

Abstract:

The encoding and retrieval of memory is a largely unconscious process. Memory supports, rather than enters, consciousness most of the time. It is interesting to question the nature and functional significance of the cortical processing when memory related processing enters conscious experience. When a retrieved memory is held as a working memory and perceived consciously, for example, the functional significance is expected to be different from when the memory is used in an unconscious manner. Recognition can occur either consciously or unconsciously. When there is a failure in the memory retrieval process, the subject might have the feeling of knowing (FOK). The nature of FOK as a particular phenomenal aspect of conscious experience, as well as its functional significance, is an interesting theme for research in the scientific study of consciousness. Here we report a series of experiments originally aimed to reproduce in the declarative memory domain the results of Walker and his colleagues on the temporal reconsolidation of procedural memory. We conducted a simple memory task where the subject was asked to recognize objects shown previously. The objects were line drawings taken from the Snodgrass & Vanderwart(1980) set. In the recognition phase, we asked the subject to report the original position (out of 4 possible candidates) as well as whether they recognized the object. Declarative memory studied in this experiment was found to exhibit a certain degree of lability when actively recalled, consistent with the results reported by Walker et al. Thus, active memory retrieval appears to interfere with the memory reconsolidation process. The conscious retrieval of memorized items has double-faced significance in memory consolidation. On the one hand, consciously retrieved memory has a better chance of being voluntarily recalled later. On the other hand, it can become labile. We report our analysis of the time course of the rate of successful recognition, degree of FOK, and voluntary recall. Based on these results, we discuss the functional significance and phenomenal characteristics of conscious memory experience.

Title:

Electrical status epilepticus during slow sleep: A model of the disruptive effects of focal epileptic activity during sleep on cognitive functions and behaviour

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Session:

Saturday, June 25, 17:30-20:00: Poster Session

Electrical status epilepticus during slow sleep (ESES) is an age-dependent and self-limited condition whose distinctive features are: a) a characteristic age of onset (with a peak around 4-5 years); b) heterogeneous epileptic seizure types; c) a typical EEG pattern characterized by continuous and diffuse paroxysms occupying at least 85% of slow sleep; d) variable neuropsychological regression consisting of IQ decrease, reduction of language, disturbance of behaviour (psychotic states) and motor impairment. Despite the long-term favourable outcome of epilepsy and status epilepticus during sleep, the prognosis is guarded because of the persistence of severe neuropsychological and/or motor deficits in approximately half of the patients. From a physiopathological point of view, the most intriguing issue is the relationship between ESES and the pattern of neuropsychological and/or motor derangement. The duration of ESES and the localization of interictal foci (i.e the cortical areas involved by epileptic activity during sleep) seem to play a major role in influencing the degree and type of cognitive dysfunction; moreover, there is a close temporal association between ESES and mental regression. These observations along with experimental data, have led to the hypothesis that apparently infraclinical epileptic discharges during sleep may disrupt cognitive and/or motor functions. It has been also postulated

tha many developmental or acquired defects of language (such as acquired epileptic aphasia or Landau-Kleffner syndrome) or behaviour (such as autism) in children are a consequence of apparently subclinical spikes interfering with specific cerebral processes. This condition may represent a model of the clinical effects of a localized disruption of EEG activity caused by focal epileptic activity during sleep. Giulio Tononi's group recently reported that local increase of slow wave activity during sleep after learning is associated with improved performance of the learned task after sleep (Huber et al., Nature, 430: 78-81, 2004). These findings have been interpreted admitting a homeostatic process regulating the amount of slow wave activity. On the basis of these findings, we can speculate that prolonged focal epileptic activity during sleep (as it occurs in ESES) interferes with local slow wave activity at the site of the epileptic focus, impairing the neural processes and, possibly, the local plastic changes associated with learning and other cognitive functions.

Title:

Conscious decision making in uncertain conditions

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Session:

Saturday, June 25, 17:30-20:00: Poster Session

Abstract:

One of the most important roles of the nervous system of animals is to make an appropriate decision in solving the problems faced in life by integrating incoming sensory information and stored memory, which

ultimately contributes to the propagation of their genetic information. In this sense, consciousness is an interface between massively parallel sensory processing and serial motor processing. It is well-known that we human beings can behave flexibly even when we have only incomplete information about the surrounding environment, suggesting that the meta-cognitive process that compares the information evaluated automatically at early stages of parallel information processing is crucial in human decision-making. Here, we report a psychological experiment where the subjects have to behave in an uncertain condition. We used a task similar to the Wisconsin Card Sorting Test (WCST), in which the subjects were instructed to choose one of the four cards, without any preceding knowledge and got rewards determined in accordance with features of selected card and the implicit rules. We found that the reaction times were negatively correlated with gains, suggesting that the reaction time could be a measure of the internal model that represented the context for getting rewards efficiently. By analyzing the reaction times and gains, we investigated the cognitive processes invoked while subjects were playing the WCST like game. When the implicit rule changed and an error occurred, the reaction times got longer in a subsequent games, suggesting that subjects always monitored the output, checked the consistency of the internal model and tried to modify it when they encountered an inconsistent result. In addition, the duration necessary for acquiring the internal model got shorter as subjects played the game more and more, while the meta-rule remained unchanged, implying that they had learned not only the rule faced in each game but also the meta-rule underlying the implicit rule. The tendency where the duration to acquire the internal model got shorter could be seen even when the rule was changed every games, thus the reward was determined in a pseudo-random way impractical. We conclude that the meta-cognition is a key factor in human decision-making. Thus the studies on the decision-making process would be helpful for understanding the functional aspects of consciousness.

Title:

An information integration theory of consciousness

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Session:

Monday, June 27, 9:00-10:00: Keynote

Abstract:

Clinical observations have established that certain parts of the brain are essential for consciousness whereas other parts are not. For example, different areas of the cerebral cortex contribute different modalities and submodalities of consciousness, whereas the cerebellum does not, despite having even more neurons. It is also well established that consciousness depends on the way the brain is functioning. For example, consciousness is much reduced during slow wave sleep and generalized seizures, even though the levels of neural activity are comparable or higher than in wakefulness. To understand why this is so, empirical observations on the neural correlates of consciousness need to be complemented by a principled theoretical approach. Otherwise, it is unlikely that we could ever establish to what extent consciousness is present in neurological conditions such as akinetic mutism, psychomotor seizures, or sleepwalking, and to what extent it is present in newborn babies and animals. A principled approach is provided by the information integration theory of consciousness. The theory claims that consciousness corresponds to a system's capacity to integrate information, and proposes a way to measure such capacity. The information integration theory can account for several neurobiological observations concerning consciousness, including: i) the association of consciousness with certain neural systems rather than with others; ii) the fact that neural processes underlying consciousness can influence or be influenced by neural processes that remain unconscious; iii) the reduction of consciousness during dreamless sleep and generalized seizures; iv) the time requirements on neural interactions that support consciousness.

Title:

Awareness and attention are different: Study of aftereffects produced by invisible stimulus

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Session:

Sunday, June 26, 14:00-16:00: Concurrent Session 2.1

Abstract:

Understanding attention is thought to be key to understanding consciousness (Posner 94 PNAS). Some psychologists (for example, O'Regan & Noe 01) claim that what we are aware of is what we are attending to, and vice versa. Others claim attention and awareness are supported by distinct neuronal mechanisms (Lamme 03 TICS, Koch 04 'The quest for consciousness'). Theoretical arguments tend to be difficult to resolve in the absence of precise, non-axiomatic definition of these two processes in terms of their underlying neuronal mechanisms. Here, we provide psychophysical evidence that suggests awareness and attention are different. We used a new technique, called continuous flash suppression (CFS), combining binocular rivalry with repetitive flash suppression. With CFS, we can project visual stimuli onto one retina without subjects seeing the stimuli at all reliably for a longtime (minutes). Indeed we can present the adaptors long enough to induce their associated afterimages and aftereffects. First, we demonstrate that the intensity of negative afterimages, traditionally thought to arise from the retina, can be reduced when the adaptors were perceptually suppressed via CFS. On the contrary, the

intensity of afterimages is enhanced when attention is withdrawn from the adapting stimuli (Suzuki & Grabowecky 03 J exp psy). From these studies, we conclude that the lack of awareness and the lack of attention result in the opposite effects (in the case of negative afterimages). Second, we ask if attention can modulate processing of the invisible stimuli. We used Gabor patches to induce the tilt aftereffects (TAE), which is known to be modulated by attention. The Gabor patches perceptually suppressed by CFS still produced reliable TAE. The degree of TAE from the invisible stimuli did not differ whether the spatial location for the invisible adaptor was attended or ignored. However, when the subjects attended to a visible Gabor patch presented in the opposite hemifield of the invisible adaptor, TAE was significantly modulated by attention. TAE was larger if the visible target shared the tilt angle with the invisible adaptor, while TAE was smaller if the visible target had the opposite tilt angle. We conclude that feature-based attention can modulate TAE induced by the invisible stimuli, while spatial attention requires awareness of the adaptor to modulate TAE.

Title:
Does perception count on action?

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Session:
Saturday, June 25, 17:30-20:00: Poster Session

Abstract:
Noë thinks that bodily skill is an important part to perception. If someone was born totally paralyzed (i.e. an inert perceiver,), he will

never have perception at all. Thus, for perception, action is indispensable. However, according to the two visual systems hypothesis, proposed by Milner and Goodale, visual for action and for perception are two autonomous systems. That is, they could exist independently. Noë doesn't think that the two visual systems hypothesis is a threat of his theory because "the enactive approach does not claim that perception is for acting or for guiding action". Action is a necessary part but not constitutive part. To Noë, "the perceiver's ability to perceive is constituted by sensorimotor knowledge". In the first place, two visual systems hypothesis doesn't claim that action is guided by perception, too. Second, what is sensorimotor knowledge? What's relation between action and sensorimotor knowledge? Roughly speaking, sensorimotor knowledge are patterns of change as a perceiver moves. Thus, it is reasonable to say that it comes from action. If two visual system hypothesis is true, perception and action are two separate systems, then anything comes from action might not have any contribution to perception. Thus, two visual system hypothesis is not orthogonal to the enactive approach as what Noë thinks. However, in this paper, I would like to argue that Noë's enactive theory is compatible to the two visual systems hypothesis: Two visual system hypothesis doesn't exclude the possibility of action being a subsystem of perception system. Here, conceptually, action and perception still are two separate systems, although anatomically perception depends on action. However, two visual systems hypothesis doesn't exclude the possibility of perception without action, for instance, a newborn baby. Then, there is a further problem: If sensorimotor knowledge comes from action, how should a newborn baby have perception? Now, there are a lot of evidences that an infant has perception. If there are some innate sensorimotor knowledge, then sensorimotor knowledge doesn't come from action necessarily. If so, does perception depend on action? What a newborn infant can perceive is limited and related to survive. Thus, it seems that appealing to evolution might solve the dilemma.

Title:
The temporal structure of visual perception: insights from an illusion of reversed motion

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Session:

Sunday, June 26, 14:00-16:00: Concurrent Session 2.3

Abstract:

Temporal subsampling of the perceptual stream can cause illusory reversals of the perceived motion direction. This "Wagon Wheel Illusion", most apparent in movies or on television, can also be observed under continuous illumination, suggesting that our visual systems too might sample motion in a sequence of discrete epochs (Purves et al, Proc. Nat. Acad. Sci. USA, 1996). This phenomenon is bistable by nature, with the actual motion direction generally dominating perception (Kline et al. Vis. Res, 2004). Previously we reported that a motion energy model subsampling visual inputs at a rate between 10 and 20 Hz can quantitatively predict the relative durations of real and illusory percepts during continuous viewing of the illusion (VanRullen et al, Society for Neuroscience, 2004). Here we use pairs of gratings drifting in opposite directions to investigate this effect. By way of these "counterphase" gratings of slightly different contrasts, one can directly manipulate the ambiguity of motion direction, and enhance the relative strength of the illusory percept. We find that motion direction judgments for these stimuli are selectively impaired around 10 Hz, as predicted by the temporally subsampled motion energy model. This impairment vanished when focal attention was directed away from the motion stimulus: we used a dual-task paradigm to draw spatial attention to a stream of rapidly presented randomly rotated letters at the center of the grating. Under these conditions, simultaneous motion direction judgments were in fact better at 10 Hz than when attention was directed to the motion itself.

This is one of very few known instances where focal attention is found to impair performance. These results support the idea that, at least in some circumstances, the visual system represents motion in discrete epochs, and that this effect is mediated by focal attention. We extend these investigations using electro-encephalographic (EEG) recordings in which we compare the EEG power spectrum obtained during periods of perceived real motion with periods of perceived illusory motion. We weigh these EEG results against the predictions of our motion energy temporal subsampling model.

Title:

The ownership of thoughts and the comparator model

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Session:

Saturday, June 25, 17:30-20:00: Poster Session

Abstract:

Schizophrenia is often thought of as an impairment of the self, mostly because of positive syndromes. Indeed, psychiatric research has inspired a lot of recent theories about the human self-consciousness. It is widely assumed that the feeling of ownership is one of the basic features that make self-consciousness possible. We will focus on the ownership of thoughts, which is said to be lost during thought insertion. Campbell (1999) explains the feeling of ownership of thoughts with the help of the comparator model, characterizing thoughts as motor processes. This model is originally developed for motor control. In this picture, there is an intention to move, which leads to a desired state. During the movement the desired state is

compared with the actual state; in the case of matching a feeling of ownership ("I did this") arises, whereas in the case of mismatch the cause is attributed to some external force (see Frith 1992). Parallel to this picture, Campbell assumes an intention to think a thought *p*, which is compared to the thought *p* occurring in the actual stream of consciousness. Equally, the case of matching leads to the feeling of ownership, whereas mismatches lead to the delusion of thought insertion. According to Campbell, the function of this mechanism is to "keep thoughts on track", i.e. it enables us to think goal-headed. However, several problems arise in this picture. Since the intention to think *p* must have the same content as the thought (to be matchable), it seems that this intention is itself a thought with content *p* which presupposes another intention. This leads to an infinite regress. Moreover, it implies that it is possible to imagine thoughts without actually thinking them, to name only two of the problems. Because of these problems, we think (contra Campbell) that thoughts cannot be characterized as motor actions, but rather as intentions for actions capable of triggering movements. Moreover, thought insertion requires a two-factor account (as shown for various delusions by Davies et al. 2001) involving thought production and a rationalization module. The delusion of thought insertion requires that the rationalization (or the access to it) is impaired. Rationalization is a well described process (see the theory of cognitive dissonance by Festinger 1957) that is responsible for (at least a large part of) self-ascriptions. We conclude that the feeling of ownership is a rather complex and high-level feature of self-consciousness.

Title:

Distortions in the visual perception of spatial relations: implications for visual Space

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Session:

Saturday, June 25, 17:30-20:00: Poster Session

Abstract:

The visual experience is of a continuous and unique spatial manifold within which visible features and objects are embedded. Optical illusions of various types show that this manifold can be distorted by its contents, suggesting some form of relativistic space. The mapping from actual space to perceived space appears to be one-to-one and so the distortions experienced are not radical. However, we present data showing one-to-many distortions, indicating a non-unique visual space. For example, the size of the gap between the adjacent ends of two co-aligned lines is seen as less than the distance between two dots with the same physical separation. It is as if the lines are shrinking visual space along their axis. However, this effect only obtains when the two lines have the same orientation. The space is distorted by oriented objects, but only for objects of the same orientation and not for objects of other orientations in the same portion of visual space. This implies that it is necessary to talk of there being multiple visual spaces or manifolds, each one distorted independently of the others. This seems to threaten the experienced unity of visual space. Ultimately we find it simpler to question the notion of visual space itself. To finish we turn to a discussion of instances where visual space is not perceived, the best being an example of a regular tessellation from the floor of San Marco in Venice which is not seen as regular.

Title:

Alteration of visual perception by direct influence from auditory cortex to visual cortex

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Session:

Monday, June 27, 14:00-16:00: Concurrent Session 3.3

Abstract:

When, where, and how in the human brain multisensory integration happens is not yet precisely known. In addition to this integrative nature there are other situations, termed as multisensory illusions, when the perception of one sensory modality can be influenced or even altered by another sensory modality. An example of such illusion is the sound-induced double-flash effect where a single brief visual flash accompanied by two auditory beeps often produces a perception of two visual flashes (Shams et al., 2000). We want to investigate at what level of perceptual processing this modulation occurs and whether alteration of visual perception can be induced by auditory cortical areas. MEG signals were recorded from eleven subjects in the sound-induced double-flash illusion experimental paradigm. Illusion, i.e. the perception of two visual flashes, was reported for 60% of the trials. To measure the influence between auditory (A) and visual (V) cortical areas (A2V and V2A), we used a recently introduced index, termed as partial directed coherence (PDC) that reflects a frequency-domain representation of Granger causality (Granger, 1969). PDCs were computed for alpha (8-12 Hz) and beta (13-21) bands between nine MEG sensors located in visual and auditory cortical regions. For illusion trials, alpha band analysis revealed the following main results: (i) significant A2V effect during 20-100 ms post-flash onset, (ii) modulation within V during 60-140 ms, and (iii) further A2V effects during 100-180 ms. Beta band analysis revealed qualitatively similar A2V influences for the latter time period. Contrarily, almost non-significant A2V modulations were observed for non-illusion trials but with identical stimulus configurations. Additionally, we also

investigated the pre-stimulus period (100 ms prior to flash onset) and found clear and robust differences between illusion and non-illusion trials in terms of significantly stronger A2V modulation. We have found a robust signature of direct modulation of visual cortex by auditory cortex at the very early stage of stimulus processing, and this auditory directed visual modulation is strongly correlated with the subjective perceptual response. Also we found a significant effect of such intersensory modulation in the prestimulus period on the quality of post-stimulus responses. Here we showed that information within one sensory area could be significantly modulated by direct influence from another sensory area. - Hide quoted text - The quality of sensory perception can be crucially dependent on such direct influence.

Title:

A limited defense of the ability hypothesis

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Session:

Saturday, June 25, 14:00-16:00: Concurrent Session 1.2

Abstract:

Introspective access to consciousness plays a central role in the knowledge argument against physicalism. Although Mary already knows the physical facts about red and red experiences, when she is released from the black and white room she recognizes that she didn't know that *this* is what it's like to see red. "This" here refers to a quality of her conscious experience, a quality that marks the difference between visual perceptions of red and textbook-descriptive thoughts about red. Mary accesses this qualitative difference by introspectively

reflecting on her conscious experience. Furthermore, her introspection apparently reveals that this isn't a quality described in her textbooks; instead, it appears to be an intrinsic quality of her color experience. In this paper, I attempt to answer the knowledge argument by defending a model of introspection, one that explains introspective access in terms of the automated self-application of theoretical concepts. I contend that introspection is analogous to the "expert awareness" of chess masters who just "feel" the weakness of a particular board position, or chicken sexers who directly "see" the femaleness of certain chicks. The automated nature of expert awareness explains why our qualitative states seem to possess intrinsic qualities. In automated expert awareness, we are rarely conscious of the relational information that underwrites our cognition. Indeed, in the examples mentioned, subjects often cannot describe how they identify the features they perceive. These features appear intrinsic to us because we are unaware of the relational information we actually perceive. However, my model has the following consequence: in principle, Mary can explicitly elucidate her introspective theory before leaving the black and white room. So on this view, Mary does not learn anything new upon gaining her freedom. Instead, I argue that she gains a new ability - the ability to automatically self-apply her introspective-theoretic concepts. She already possessed the requisite theoretical knowledge in the room, but she lacked the ability to properly apply it in introspection. And it is this introspective access that explains her apparent gain in knowledge. Thus, I am defending a version of the Lewis/Nemirow ability hypothesis. And though there are a number of standing objections to this approach, I argue that my modified version has the resources to avoid the relevant counterexamples.

 Title:
 Acquisition of implicit knowledge under temporal and depth
 limitations of information processing

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Session:
 Saturday, June 25, 17:30-20:00: Poster Session

Abstract:
 The results of the numerous experiments suggest that implicit learning is an automatic and unconscious process which results in formation of abstract knowledge. If these characteristics are indeed at the core of implicit learning, regularities in the learning material should be detected automatically and hence should not involve conscious analysis and control. Implicit learning should be more robust than explicit learning to manipulations which impair conscious information processing during rules acquisition. If such predictions are correct implicit learning should be less vulnerable to limitations of information processing. In the previous studies, the influence of such limitations on knowledge acquisition was examined in dual task procedure. The results of the experiments indicated that implicit learning is not impaired by necessity to perform secondary task. This could indicate that participants were not consciously analyzing and controlled the material. To address this question alternative manipulation were used. In particular, time pressure and the level of processing were manipulated. Three experiments were conducted, using artificial grammar learning procedure. The goal of the first experiment was to examine the influence of time pressure on classification performance. The results show that the implicit learning effect occurs even in speeded presentations during the acquisition phase. In the second experiment the level of processing manipulation was introduced in the acquisition phase. The results suggest that participants were able to acquire implicit knowledge at the lower level of processing than explicit knowledge. The third experiment was an extended replication of the second experiment. To assess the conscious control of the knowledge acquisition, confidence ratings were introduced. The analyses are in progress. The results of the experiments suggest that implicit learning is more robust than explicit learning to manipulations (speeded presentation, manipulation of level of processing) which

impair conscious information processing, i.e. implicit learning can occur without conscious analysis and control of the acquiring material.

Title:

Is your unconscious prepared? Preference and word meaning determine unconscious facilitation and inhibition

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Session:

Saturday, June 25, 17:30-20:00: Poster Session

Abstract:

Despite over a century of experiments, the existence of unconscious perception remains controversial. Some camps deny unconscious perception exists outright (Holender, 1986; Holender & Duscherer, 2004); some argue for its existence, but only when demonstrating very simple effects (Loftus & Klingler, 1992); others claim that meaningful effects are best found at the subjective threshold (ST) (Cheesman & Merikle, 1984, 1986); and still others contend that meaningful effects are found at both the ST and lower objective threshold (OT), and that these effects are qualitatively different (Snodgrass, Bernat, & Shevrin, 2004). A prior study (Snodgrass, Shevrin, & Kopka, 1993), done below the OT, provided evidence that is difficult to explain in a single-process conscious perception model. Unlike more common unconscious perception paradigms that rely on indirect reaction time effects, this paradigm looked at direct accuracy effects on a forced choice identification task involving pleasant and unpleasant words. Under certain conditions, Ps who preferred to approach the task by

looking very carefully at the stimulus field (looking) performed below chance overall, while Ps who preferred to approach the task by allowing words to pop into their heads (popping) performed above chance overall. Unfortunately, evaluative meaning (pleasant vs. unpleasant) effects could not be validly analyzed because they were confounded by response bias. Accordingly, the present study's aim was twofold: 1) examine evaluative effects by controlling for response bias, and 2) further investigate looker inhibition. Results showed a Preference X Semantic interaction, with poppers facilitating unpleasant words, and lookers inhibiting unpleasant words. Most impressively, lookers identified unpleasant words at a rate below chance at the OT. Similar patterns were seen at the ST, but because it is the only level at which below chance responding is possible, inhibition can only be ascertained at the OT. Consider that in order to incorrectly identify stimuli at a significant level, a majority of those stimuli must first register, and then subsequently be inhibited so as to not be correctly identified. These results contradict evolutionary preparedness theory as it has been recently interpreted in unconscious perception literature (Dijksterhuis & Aarts, 2003). This interpretation of the preparedness model holds that even at unconscious levels, humans should initially attend to unpleasant stimuli to be on guard for possible threat. The looker inhibition effect shows that preparedness theory may require modification as applied to unconscious processing.

Title:

Unconscious affect

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Session:

Saturday, June 25, 17:30-20:00: Poster Session

Abstract:

Psychologists and philosophers tend to view affective states as intrinsically conscious. That is, for a state to count as 'affective', the state has to be accompanied by a phenomenal experience, or the conscious feeling component. In my presentation I will argue that affect can exist in a fully nonconscious form (Winkielman & Berridge, 2004). I will present several arguments from evolution, philosophy, neuroscience, and experimental psychology. First, I will argue that neural systems underlying basic affective reactions evolved prior to systems underlying conscious awareness. Second, I will argue that affective states in animals and humans are typically controlled by subcortical brain systems whereas phenomenal awareness is typically controlled by cortical brain systems. Third, I will review experimental evidence showing that even in healthy, typical participants, positive and negative affective reactions can be elicited without triggering any phenomenal awareness of those reactions (Winkielman, Berridge, & Wilbarger, 2005). Specifically, I will present studies where subliminally-induced unconscious 'liking/disliking' reactions influence a variety of behaviors, including consumption of a novel beverage, judgment of novel pictures, as well as economic choice. All these effects occur without any changes in subjective affective experience as a result of exposure to affect-inducing stimulus. I will interpret these data with the following neural hypothesis. Unconscious 'liking' and 'disliking' is mediated by specific subcortical brain systems, such as the brainstem, amygdala, nucleus accumbens and its connections. Ordinarily, conscious liking (feelings of pleasure or displeasure) results from the interaction of separate brain systems of conscious awareness with those core processes of unconscious affect. But under some conditions, activity in brain systems mediating unconscious core 'liking' may become decoupled from conscious awareness. The result is a genuinely unconscious affect. I will discuss how we can establish whether the absence of affective experience is genuine or a result of reporting issues or absence of meta-awareness (knowing that one is feeling). Further, I will discuss the psychological and neural conditions that determine whether affect is conscious and non-conscious as well as the costs and benefits of having "affective experiences". Finally, I will relate my position to contemporary debates about the relation

between emotion and consciousness (Feldman-Barrett, Niedenthal, & Winkielman, 2005).

Title:

Dendritic gap junction networks: The neural correlate of consciousness?

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Session:

Saturday, June 25, 17:30-20:00: Poster Session

Abstract:

The neural correlate of consciousness is often equated with axonal action potentials. Indeed, frequency and patterns of spikes correlate with behavior. However, the best indices of consciousness (i.e., synchronous EEG oscillations in the gamma range, BOLD signal in fMRI, and cellular actions of general anesthetics) do not correspond with spikes, but with dendritic and cell body activities. Moreover, it is dendrites and cell bodies that perform complex information processing, account for most synaptic plasticity, and constitute the majority of neuronal bulk. Dendrites also contain networks of mixed polarity microtubules conducive to subcellular and molecular-level information processing, the results of which may contribute to synchronous oscillations. A fair amount is known about gamma oscillations synchronized by dendrodendritic and axoaxonic gap junctions linking GABAergic interneuronal networks, astrocytes, and

conceivably, pyramidal cells. These gap junctions span 3.5 nm and consist of two hemichannels composed of homomeric or heteromeric combinations of connexin and pannexin subunits (see Söhl et al., *Nature Rev. Neurosci.*, 2005, 6:191). There are at least 20 connexin and 3 pannexin genes; approximately 10 connexins are found in brain. Neurons are particularly rich in connexin36, connexin45 connexin47, and pannexin1. Microtubules make direct contact with connexin26, a small connexin found in astrocytes (Giepmans, *Cardiovas. Res.* 2004, 62:233). Recent reports indicate connexin36 knockout mice demonstrate normal activity and emotional behavior, but are impaired on recent object recognition and sensorimotor tasks (Frisch et al., *Behav. Brain Res.*, 2005, 157:177). These behavioral results were attributed to connexin36 deficits interfering with synchrony of gamma frequency oscillations. Additional connexins and pannexins presumably prevent complete disruption of gamma activity. Reports are mixed concerning connexin36 deficits affecting very fast oscillations (> 150 Hz) in the hippocampus, called ripples (Maier et al., *J. Physiol.*, 2002, 541:521 cf. Pais et al., *J. Neurophysiol.*, 2002, 89:2046). Similar to fast gamma rhythms, ultrafast ripples have been associated with perception and memory. We have previously suggested a relationship between consciousness and gap junctions fusing dendrites, axons and glia together into hyperneurons that include hundreds of thousands of synchronized cells distributed throughout cortex, thalamus and other brain regions (see Woolf & Hameroff, *Trends Cog. Sci.*, 2001, 5:472). Dynamically regulated by plasticity of cytoskeletal structures, this syncytium of approximately 1 million neurons can change rapidly when ignited by particular axonal inputs. Microtubules computationally active in hyperneurons qualify as Hebbian assemblies (i.e., coalitions, cartels, or modules), still the best functional description of the neural correlate of consciousness.

Title:
Monocularity and the neural substrate for vivid visual consciousness in human

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Session:
Saturday, June 25, 17:30-20:00: Poster Session

Abstract:
Human visual consciousness certainly consists of many levels. For instance, when one views Leon Harmon's painting of Lincoln, three levels of consciousness may occur: the awareness of the colors and patterns in the painting, the awareness of a face in the drawing, and the awareness that the face is Lincoln's. The visual consciousness at the first level (i.e., the vivid visual consciousness of patterns and colors) may occur without any sense of object recognition. Counterintuitive or not, vivid visual consciousness in humans is monocular! This idea has its root in the "suppression theory" of perception proposed by some early students of binocular rivalry (BR) such as Porta (1593) and Dutour (1760). BR is a striking phenomenon where a viewer experiences alternating periods of different percepts when the two eyes receive disparate stimuli. Logically, the suppression of the consciousness of a monocular image must happen at a monocular site - this is because that once the two images are mixed at a binocular site there is no possibility to retrieve the identity of either of them. The suppression stage in BR is the neural substrate for vivid visual consciousness. The suppression theory maintains that despite having two eyes we normally see with only one eye at a time. In reality, however, both suppression and binocular superimposition may occur in normal viewing. Binocular superimposition is the maintenance of two monocular images in consciousness - this also implies the monocularity of vivid visual consciousness. Mapping onto the neuroanatomy of the primate visual system, I have suggested that the neural substrate for vivid visual consciousness is the principal thalamic recipient layer (i.e., layer 4C) in the primary visual cortex (V1). Layer 4C has been traditionally viewed as the very first stage of cortical visual processing; however, in terms of the dynamics of

conscious visual perception, this layer is also the very last processing stage for each and every episode of visual conscious perception. From this we can infer that the vivid visual consciousness involved in various visual appearance (spreading, fillingin) and disappearance phenomena (e.g., binocular rivalry, monocular rivalry, Troxler effect, fading of retinally-stabilized images, the ebbs in the ebb-and-flow cycles of afterimages, motion-induced blindness) all occurs in layer 4C. Of course, it is important to note that all such phenomena may indeed involve many levels of visual cortical processing, but the final cortical processing stage for vivid visual consciousness appearance/disappearance is layer 4C in V1.

Title:

A new way of looking at the hard problem

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Session:

Saturday, June 25, 17:30-20:00: Poster Session

Abstract:

In David Chalmer's terms, the problem of consciousness can be divided into two kinds of problems: the easy problems and the hard problem. In this paper I will argue that we should reconsider the hard problem of consciousness in view of the challenge raised by Alva Noë's sensorimotor contingency model of visual consciousness. Furthermore, I will suggest that, even if Noë's externalistic approach to visual consciousness succeeds in providing an explanation for the objective content of perception, the hard problem remains intact. Noë maintains that the case of Tactile-Vision Substitution System (TVSS)

provides support for his theory. He claims that in the case of TVSS, tactile brain areas play a visual role, and the quasi-visual phenomenology follows the functional role rather than the brain area. Given the fact that the subjects of TVSS report perceptual experience that is distinctively non-tactile, however, the subjects still have tactile sensation. In view of this, I suggest that we should make a distinction between sensation and perception in order to clarify the problem of consciousness at different levels. We should deal with the problem of consciousness at the level of sensation and the level of perception respectively. At the level of sensation, the content of sensation is non-representational, non-computational, physiological, and it belongs to the first-order property of the biological system. At the level of perception, the content of perception is representational, intentional, computational, and it belongs to the second-order property of the biological system. Although I argue that we should make a distinction between sensation and perception, these two kinds of mental states essentially presuppose subjectivity. In other words, the contents of sensation and perception are irreducibly subjective. The externalistic approach to perception which Noë maintains seems to solve the objective aspect of the problem of the content of perception only. Noë maintains a position which he called phenomenal objectivism. But, being a phenomenology, subjectivity is essential. Noë seems to try to objectify subjectivity in terms of his geometrical perspectivity. In doing so, he misses subjectivity, hence leaves out the subjective aspect of the content of perception. On the other hand, Noë does not provide an explanation for the content of sensation which is non-representational, non-computational, and physiological. To explain the content of sensation, an internalist approach seems to be required.

Title:

Spontaneous neural activities in a small world

Authors:

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Session:
Saturday, June 25, 17:30-20:00: Poster Session

Abstract:

Recent analysis of small-world networks provides an interesting and challenging venue for thought in the scientific study of consciousness. In a small-world network, there is a locally dense connectivity as well as globally distributed pathways, making it possible for the system to provide locally defined as well as globally emerging functionality. The co-existence of local and global functionalities is one of the relevant themes to be elucidated in the study of neural correlates of consciousness (NCC). Thus, the dynamics and the functional significance of small-world networks appear to be promising themes for research in the scientific study of consciousness. The studies on preferred cortical states (PCS) have suggested a close connection between functional cortical states and spontaneously occurring activities. Here we report a simulation study aimed at clarifying the functional significance of spontaneous neural activities in a small-world network. We study the spatio-temporal pattern of spontaneous as well as externally driven neural activities in the generic network architecture. In particular, we study how the different levels of random connections away from spatially regular synaptic connections affect the resulting spatio-temporal activity patterns, employing the Hodgkin-Huxley equations and other generic systems describing the dynamics of neural networks. We provide a series of data analysis suggesting the close relation between spontaneous neural activities and the dynamical adaptability of the network to the changing external situations. By studying networks with different properties of local and global connectivity, we suggest that the actual connectivity of the biological brain is optimized in realizing the intimate marriage between spontaneous neural activities and dynamical functional adaptability. We discuss the relevance of our result to some salient aspects of conscious cognition, such as active vision and body image.

Finally, we compare the dynamics of the system studied in this report with the dynamics of modern digital computers, the theoretical foundations of which are provided by the Turing machine and other related models. We propose that the co-existence of locally as well as globally rich spatio-temporal activity patterns in a small-world network with an appropriate level of spontaneous activities is one of the most important properties of the cortical network that gives rise to conscious experience.

Title:
Antedating of saccade targets

Authors:
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Session:
Tuesday, June 28, 14:30-19:00: Satellite Oral Session

Abstract:

Subjects typically experience the temporal interval immediately following a saccade as longer than a comparable control interval. One explanation of this effect is that the brain antedates the perceptual onset of a saccade target to around the time of saccade initiation. This could explain the apparent continuity of visual perception across eye movements. This "antedating" account was tested in three experiments in which subjects made saccades of differing extents then judged either the duration or the temporal order of key events. Post-saccadic

stimuli underwent subjective temporal lengthening and had early perceived onsets. A temporally advanced awareness of saccade completion was also found, independently of antedating effects. These results provide convergent evidence supporting antedating, and differentiating it from other temporal biases.

Title:

Visual consciousness in human 3-D volumetric object perception

Authors:

Qi Zhang and Ken Mogi

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Sony Computer Science Laboratories.

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Session:

Saturday, June 25, 17:30-20:00: Poster Session

Abstract:

Visual consciousness is an issue which has been studied from long time ago. Many researches have focused on the occipital visual areas to study the visual perception and found that some cortical areas were specially in charge of certain perception, such as fusiform area was special for face perception and lateral occipital complex area for object recognition. Here we studied the visual consciousness in the 3-D volumetric object perception. We used a type of visual illusion which is named as the pantomime effect (Zhang et al, 1998), in which an illusory 3-D volumetric object is perceived with binocular viewing due to some stereoscopically displayed inducing objects. On the other hand, we also used a kind of stimuli where a similar volumetric object is induced by monocular shading cues. We conducted fMRI experiments to measure the brain activities when subjects were observing these stimuli. We found that the perception of both types of 3-D volumetric object involved a large range of the brain cortical

areas, including the prefrontal and parietal cortex besides of the occipital visual cortex. The common areas for both types were the occipital visual areas including BA17, 18, 19, and the parietal areas of BA7, 40. There is a significant difference in the prefrontal cortex for these two types of perception. That is the left prefrontal cortex involved more for the perception induced by the binocular stimuli in the pantomime effect, while the monocular shading cues involved more areas in the right prefrontal cortex. Also the temporal cortex of BA20, 37 was more activated in the perception induced by the monocular shading cues. We propose that 3-D spatial information is processed in the parietal cortex, and the left prefrontal cortex is in charge of the inference of the relationships among the inducing objects in the pantomime effect, while the right prefrontal cortex process the brightness information from the temporal cortex. Both bottom-up and top-down processes exist for attaining the consciousness of a volumetric object. Hence we conclude that the visual consciousness recruits a systematic network ranging in the whole brain, from the occipital cortex to the prefrontal and parietal cortex, and the prefrontal and parietal cortex play important roles in the 3-D volumetric object perception. In addition, the mechanisms of consciousness of the volumetric object perception induced by the pantomime effect and the monocular shading cues are different in the brain.

 POSTER SESSION

- 1 Akalis: Implicit Attitude Change: Can Do-It-Yourself Debiasing work?
- 2 Aleksander: A depictive extension to enactive theories of perceptual consciousness
- 3 Aleksander: Emotions in volition: avoiding illusions
- 4 Baars: A brain interpretation of visual consciousness: The view from Global Workspace Theory
- 5 Balas: Implicit knowledge and affect in intuitive problem solving
- 6 Banks: Conclusions about free will based on Libet's work have ignored crucial issues of causal sufficiency and necessity
- 7 Barresi: Intentionality naturalized
- 8 Beaton: Is sensory-motor conceptual grounding sufficient to account for conscious experience?
- 9 Boenke: Plasticity of attentional effects: ERP differences induced by between-trial interference (Garner effect) and within trial interference (Stroop effect)
- 10 Boly: Studying pain processing using fMRI without requiring subjects' subjective report
- 11 Bressler: Contrast defined motion produces the motion aftereffect without awareness
- 12 Bridgeman: Objective reality and slope perception in near and far space
- 13 Briscoe: Consciousness as a learned phenomenon (a neural mechanism for inner speech, and hence consciousness)
- 14 Brown: What is a brain state?
- 15 de Regt: Velmans and Peirce on the scientific study of consciousness: So close yet so far
- 16 Demany: The audibility of changes in non-perceived pitches: A paradoxical property of auditory memory
- 17 Dessoulavy: Can the importance of stimuli and place of presentation influence change blindness effect?
- 18 Dooremalen: Evolutionary epiphenomenal qualia
- 19 Droege: Time and the observer redux
- 20 Farber: Implications of NCC theory for the evaluation of nonhuman consciousness
- 21 Ferrari: Self-awareness in autism: First vs. third person evidence
- 22 Fishman: Unnoticed unwanted thoughts: What you don't (meta)-know can hurt you
- 23 Frantzen: Understanding qualitative experiences: Can fish experience pain?
- 24 Gabriel: The nature of semantic abilities in a split brain patient
- 25 Ghajar: Being ahead to know now: Anticipatory timing in the production of attention
- 26 Giger: It is not so bad to feel sad: How mood moderates the use of implicitly acquired knowledge
- 27 Gottschling: Perceptual Simulation: The problems of perceptual content and perceptual experience
- 28 Haddad: The interference of action in the flash-lag effect
- 29 Hameroff: Libet's backward time, quantum information and the "knowledge argument"
- 30 Hillert: The specific role of the left prefrontal cortex in sentence processing
- 31 Hinzen: The argument from atomism
- 32 Hoffman: Spectrum inversion is possible: Implications of a formal proof
- 33 Holland: Investigating consciousness by building anthropomimetic robots
- 34 Jagaroo: Prefrontal, posterior parietal and temporo-limbic systems: Their functions and interactions as an integrative neurocognitive model for consciousness
- 35 Jordan: Born to be wild: grounding embodiment and content in self-sustaining systems
- 36 Khurana: Helpful Looks More Attractive? Evidence for Sexual Dimorphism
- 37 Legrand: "I act intentionally": an interdisciplinary account of the experience of acting
- 38 Lin: Neural correlates of repetition priming with and without conscious identification of the primes
- 39 Lindner: Disorders of agency in schizophrenia correlate with an inability to compensate for the sensory consequences of actions
- 40 Love: How to think about phenomenality and access
- 41 Lutz: Changes in the tonic high-amplitude gamma oscillations during meditation correlates with long-term practitioners' verbal reports

42 Matey: The concept of state consciousness in the Higher Order Thought theory of consciousness

43 Meehan: The qualitative character of spatial perception across modalities

44 Mogi: Connectivity and simultaneity in the neural correlates of consciousness

45 Mograbi: Emergent properties, beliefs and action

46 Nagel: The sixth sense

47 Onzo: Contingency and the self

48 Parkinson: Implicit temporal order priming

49 Poissant: Perspective taking and emotion recognition in children with pervasive developmental disorder

50 Reddy: Neural correlates of change blindness in the human medial temporal lobe

51 Rubboli: Charles Bonnet syndrome in a patient with right hemianopia following left anterior temporal lobectomy for drug-resistant epilepsy

52 Rutishauser: Single-cell representation of novelty and familiarity in the human hippocampus-amygdala complex requires task relevance

53 Sackur: Is consciousness required for the composition of two mental operations?

54 Salminen: Independence of visual awareness from attention at early processing stages

55 Schier: Emergent materialism

56 Schmidhuber: A theoretical justification of consciousness

57 Schnakers: Is there any use for EEG bispectral index monitoring in the evaluation of consciousness in severe brain damaged patients?

58 Sekine: Posture and localization in body image

59 Stone: Conscious experience in the aetiology of the Capgras delusion

60 Surf: What is it like to be Beethoven? Uneasy answers to the hard problem

61 Sweklej: Have I seen you before? Repeated exposure effect for neutral and affective faces

62 Synofzik: When self-monitoring breaks down: The differential role of external and internal information for the perception of self-action in schizophrenia

63 Tärning: And then what happens? Implicit and explicit processes in preference change through choice

64 Tanabe: The functional significance of conscious memory experience

65 Tassinari: Electrical status epilepticus during slow sleep

66 Taya: Conscious decision making in uncertain conditions

67 Tu: Does perception count on action?

68 Vosgerau: The ownership of thoughts and the comparator model

69 Watt: Distortions in the visual perception of spatial relations: implications for visual Space

70 Wierchon: Acquisition of implicit knowledge under temporal and depth limitations of information processing

71 Winer: Is your unconscious prepared? Preference and word meaning determine unconscious facilitation and inhibition

72 Winkelman: Unconscious affect

73 Woolf: Dendritic gap junction networks: The neural correlate of consciousness?

74 Wu: Monocularity and the neural substrate for vivid visual consciousness in human

75 Yan: A new way of looking at the hard problem

76 Yanagawa: Spontaneous neural activities in a small world

77 Zhang: Visual consciousness in human 3-D volumetric object perception

Note: Dessoulavy (17) is next to Sweklej (61); Lindner (39) and Vosgerau (68), are next to Synofzik (62); Giger (26) is next to Balas (5).

LOCATIONS OF EVENTS

- * Keynotes and Symposia and will be held in the Baxter Lecture Hall in Baxter.
- * Concurrent Session 1 will be held in Baxter lecture hall in Baxter.
- * Concurrent Session 2 will be held in BBB24, located downstairs on the S. side of Beckman (note: not the Beckman Institute or Beckman Auditorium).
- * Concurrent Session 3 will be held in Beckman Institute Auditorium, BI134.
- * The Satellite Meeting will be held in Beckmann Institute, BI134.
- * The Poster session will be held outside around the 'Gene Pool' between the Beckman Institute and Beckman Auditorium. Snacks and cash bar will be provided.
- * The Graduate Student Social will be held in the South Recreation Room in the Catalina's, immediately west of the N. and S. Wilson Ave. Parking Structures. Guides will be available at the poster session on Saturday to lead the way.
- * There are two cafeterias on campus, one in Chandler, and the other in the Avery Center. In addition the Athenaeum offers more formal dining.
- * Coffee can be bought from the Red Door cafe located on N. side of Winett, and also in the coffee shop directly between the Broad Center and Beckman Institute.
- * An ATM is available outside on the N. side of Winett, and inside on the E. side of Spalding. The Winett building also houses the Caltech bookstore, and computer store.
- * The nearest convenient bar is located NW of campus within the Mexican restaurant Amigos on the SW corner of Wilson and Colorado.
- * The location of the ASSC After Party will be announced immediately after the final keynote talk on Monday.



Mark your calendars
for next year!



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