

Dichotomies of the visual brain

A workshop on neuroscience and philosophy - Tuesday June 17th

Perception – what we see – is a core philosophical area of debate. It is also the focus of intense neuroscientific research. To extract the philosophical lessons of recent perceptual neuroscience, Monash Philosophy organises a half-day workshop (2-4.30pm) on Tuesday 17th June on "Dichotomies of the Visual Brain". Two influential neuroscientists will present recent findings and theories on perceptual streams in the brain, followed by discussion.

Program:

2-3.15pm: **Prof. Melvyn Goodale** (Professor Canada Research Chair in Visual Neuroscience, Joint Appointment with Psychology, University of Western Ontario): Zombie vision: Action without perceptual awareness in the human visual system.

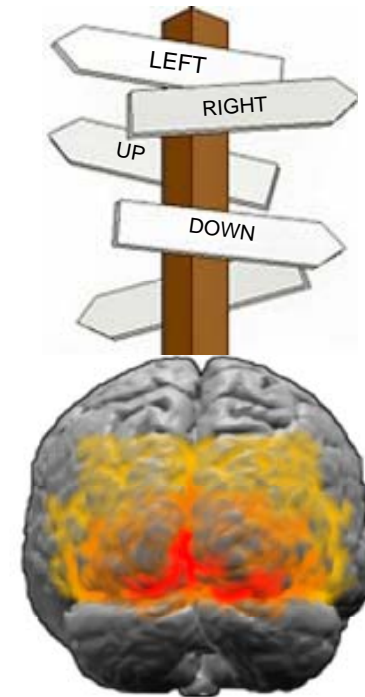
3.15-4.30pm: **Dr. Steven Miller**. (Victorian Neurotrauma Initiative Practitioner Fellow, Department of Psychological Medicine, Monash University, Caulfield Pain Management and Research Centre and Brain Stimulation Laboratory, Alfred Psychiatry Research Centre): The changing face of perceptual rivalry.

All Welcome

Manton Rooms SG01, Menzies Building (Building 11), Ground Floor, Clayton Campus, Monash University

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Zombie vision: Action without perceptual awareness in the human visual system

Professor Melvyn A. Goodale, Ph.D., F.R.S.C. (Centre for Brain and Mind the University of Western Ontario)

Almost all of our direct knowledge of the world beyond our bodies comes from vision. But vision does not simply provide information about objects and events in the world; in humans, at least, it provides a conscious percept of that world so compelling that it is sometimes difficult to comprehend that this experience arises entirely from the activity of ensembles of neurons in the central nervous system. Moreover, for most people, including many philosophers and scientists, it seems self-evident that the actions we perform on visible objects make use of the same visual representation that allows us to perceive those objects. According to this view, the visual system creates a single “general-purpose” representation of the external world that provides a platform for both cognitive operations as well as the real time control of goal-directed actions. There are good reasons to believe, however, that such a monolithic account is incorrect. I will argue that the contents of our visual consciousness are created by complex interaction between bottom-up input and stored knowledge of the world in the ventral stream of visual processing, whereas the moment-to-moment control of visually guided actions, such as skilled prehension, is mediated almost entirely by bottom-up input to the dorsal stream. This might sound rather like Cartesian dualism—the existence of a conscious mind separate from a reflexive machine. But the division of labour between the two streams has nothing to do with the kind of dualism that Descartes proposed. Although the two kinds of visual processing are separate, both are embodied in the hardware of the brain. Moreover, there is a complex but seamless interaction between the ventral and the dorsal streams in the production of adaptive behavior. The selection of appropriate goal objects depends on the perceptual machinery of the ventral stream, while the execution of a goal-directed action is mediated by dedicated on-line control systems in the dorsal stream and associated motor areas. Moreover, as I will argue, the integration of processing in the two streams goes well beyond this. The dorsal stream may allow us to reach out and grasp objects with exquisite ease, but it is trapped in the present. Evidence from the behaviour of both neurological patients and normal observers shows that, by itself, the dorsal stream can deal only with objects that are visible when the action is being programmed. The ventral stream, however, allows us to escape the present and bring to bear information from the past – including information about the function of objects, their intrinsic properties, and their location with reference to other objects in the world. Ultimately then, both streams contribute to the production of goal-directed actions.

The changing face of perceptual rivalry

Dr. Steven Miller. (Victorian Neurotrauma Initiative Practitioner Fellow, Department of Psychological Medicine, Monash University)

For several hundred years, and probably much longer, it has been known that the brain has a unique way of dealing with visual conflict. Present two different images simultaneously, one to each eye, and rather than superimpose the two images, the brain perceives each in alternation, every few seconds. This phenomenon of binocular rivalry, which requires mirrors or goggles to induce, has a counterpart in normal viewing of 2-D reversible figures such as the Necker cube and Rubin's vase-faces illusion. Because all these phenomena involve distinct perceptual flips every few seconds, despite the unchanging visual input, it is hardly surprising that several investigators have proposed that they share a common neural mechanism. What is surprising, however, is that a common mechanism, if indeed there is one, has remained elusive despite intense neuroscientific research over the last 20 years and psychophysical research over the last 100 years. In this talk, I survey the landscape of perceptual rivalry research and present the rationale and evidence for a novel explanatory model – the interhemispheric switch hypothesis. I present a series of brain stimulation studies in support of this model that I have conducted over the last 10 years with colleagues, Jack Pettigrew and Trung Ngo. This model proposes that the substantial high-level attentional resources of each cerebral hemisphere are employed independently and in alternation, to achieve the perceptual alternations of binocular rivalry and reversible figures. I conclude with some brief remarks on the scientific study of consciousness, as well as brain stimulation approaches to experimental neurophilosophy.

