Vehicles of Consciousness

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Despite its puzzling and elusive nature, contemporary theories almost universally associate consciousness with the vehicles that are used to represent information in the brain. To understand this tactic one must appreciate the connection between a widespread intuition about consciousness, on the one hand, and the computational approach to cognition, on the other.

The pertinent intuition is that conscious experiences are typically "about something". Right now, for example, you are aware of the shapes and meanings of these words. But you can easily shift your attention to ambient sounds, the position of your legs, or your plans for the rest of the day. In each case, your conscious experience is directed at some feature of the world, your body, or yourself. One natural way to characterise this intuition is to say that conscious experiences are *representations* in that they always convey *information* of some kind. [**Representation**]

Cognitive science treats cognitive processes as computations. To explain cognition is thus to model the information processing going on in the brain. For information to be processed it must take some physical form, that is, a computational system must contain *representing vehicles*: physical states that carry information in or to the system (commonplace examples of representing vehicles include speech sounds, text, and photographs). Put in these terms, the foundational claim of cognitive science is that cognitive processes are disciplined operations over representing vehicles of some kind.

There is an obvious confluence between the intuition and the computational framework. Conscious experiences are representations—they are information bearers. Cognition, according to cognitive science, consists of processes defined over representing vehicles. It is thus natural to suppose that conscious experiences are somehow associated with the representing vehicles on

which cognitive processes operate, and that the contents of consciousness are among the information carried by those vehicles. [**Consciousness, Contents of**]

Regarding this much there is some consensus, but when it comes to formulating a detailed theory of consciousness two quite distinct strategies have emerged. One approach focuses on the computational processes in which representing vehicles engage (call these *process* theories), the other on structural or dynamical properties of the representing vehicles themselves (call these *vehicle* theories).

Process theories currently dominate the theoretical landscape. According to the most popular of these, informational contents enter consciousness when they gain competitive access to a global workspace, permitting them to be broadcast throughout the brain (Baars 1997). [**Global Workspace Theory**] On the alternative higher-order thought (HOT) theory, the content of a representing vehicle becomes conscious when it is the target of a second-order representation (Rosenthal 1997). The common thread here is that, of all the representing vehicles present in the brain, only those caught up in specific kinds of computational processes – such as global broadcasting or internal monitoring – contribute to conscious experience.

Process theories focus on what representing vehicles *do*, rather than what they *are*. A process theory is thus a species of *metaphysical functionalism* about consciousness: conscious states arise when representing vehicles enter into certain causal (i.e., computational) relations, without regard to the physical structure or internal dynamics of those representations. A vehicle theory, by contrast, is overtly *non-functionalist*, because it identifies conscious experiences with intrinsic properties of the brain's representing medium.

In accounting for the rich structure of experience, vehicle theorists can avail themselves of the full range of properties revealed by neurobiology and biophysics. For example, it has been conjectured that the phenomenal unity of perceptual objects arises from the dynamic binding of feature-specific cells via the transient synchronization of their discharges (Singer 2001), and that the intensity or "degree" of some kinds of experience may be determined by the size of dynamic, large-scale neuronal assemblies (Greenfield & Collins 2005). Such hypotheses are not available to process theorists because their medium-neutral models are necessarily couched in terms of causal-cum-computational relations among mental representing vehicles.

A problem for vehicle theorists is that, in the absence of a fully fledged account of cognition, it is extremely difficult to identify which of the various kinds of physical states in the brain are in the representing business. One way forward is offered by connectionism, a computational theory

of cognition grounded in specific claims about the nature of the brain's representing vehicles. [*Connectionism*] Connectionists draw a distinction between information encoded in the synaptic connections between neurons (or more generally, in the organization of the brain), and information transiently encoded in patterns of neural firing activity. Such patterns are presumed to represent only a fraction of the information tied up in the long-term structure of the brain, and some theorists have suggested that the contents of consciousness correspond to information encoded in this way (Lloyd 1999, O'Brien & Opie 1999).

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