

processing and its disappearance properties will not be affected by these higher levels, at least not the invisible periods. Importantly, it was shown that stimuli rendered invisible by MIB retain their capacity to produce orientation-selective adaptation (Montaser-Kouhsari et al. 2004) and to induce negative afterimages (Hofstoetter et al. 2004), suggesting a cortical representation of the invisible at these levels of processing. Moreover, stimuli that group perceptually into objects or *gestalts, such as collinear line segments or proximal dots tend to disappear and reappear in synchrony and less frequently, rather than disappear and reappear independently (Bonneh et al. 2001). When the configuration is changed during the invisible stage, its reappearance depends on the new configuration, with good gestalts reappearing in unity and bad gestalts in parts (Mitroff and Scholl 2005). This suggests that a representation of the invisible objects is available at the level of gestalt grouping. Finally, the three-dimensional segmentation of the mask relative to the target has a significant effect on disappearance. Specifically, more disappearance occurs when the mask is presented in front of the target, e.g. via binocular stereo disparity; thus, it is interpreted that the mask occludes the target.

Even though accumulating evidence does not enable us to explain the MIB phenomenon and its underlying mechanisms, we can still speculate. A useful first step is to view the visual system not as a device for representing external images, but instead as an interpretation system that may discard part of the input and complete missing input in order to arrive at a coherent and useful interpretation of the visual scene (see PERCEPTION, PHILOSOPHICAL PERSPECTIVES and ILLUSIONS for a discussion of related ideas). Accordingly, visual stimuli could be discarded if they are inconsistent with the selected interpretation. Indeed, a possible interpretation of a typical MIB stimulus is that the yellow spots are occluded by the mask. But why should the system make such an interpretation even when this appears least likely? One answer assumes that different levels of processing are involved. At the sensory level, the lack of transient stimulation of the targets may cause a decay of the response owing to adaptation mechanisms. This occurs all the time, even without the surrounding motion, but the system normally knows not to interpret this decay as a physical disappearance and to fill in the missing representation across time. However, when there is a perceptual hint that suggests otherwise, then the system may interpret the sensory decay as a real disappearance. Thus, MIB results from a sensory level process, an interpretation or decision level process and their interaction.

Conscious perception, as reflected in MIB and other multistable phenomena is fragile and unreliable, since under certain conditions salient objects may suddenly disappear or change their appearance dramatically. MIB, like other phenomena of this kind, is subject to experimental investigation, and may be used to study the neural correlates of consciousness.

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motor representation See ACTION SCIENTIFIC PERSPECTIVES

multiple drafts model The multiple drafts model of consciousness (Dennett 1991, 1996, 1998, Dennett and Kinsbourne 1992) was developed as an alternative to the perennially attractive, but incoherent, model of conscious experience that Dennett calls Cartesian materialism. According to Cartesian materialism, after unconscious processing occurs in various relatively peripheral brain structures, 'everything comes together' in some privileged and central place in the brain—which Dennett dubs the Cartesian Theatre—for 'presentation' to the inner self or *homunculus. (The homunculus is not literally a little man—with arms and legs and eyes, for instance—but just a whole self, capable of enjoying, suffering, deciding, and so forth.) Consciousness of an item occurs, according to this model, at the moment the homunculus witnesses the presentation of that item. There is no such place in the brain, but many theories seem to presuppose that there is. For instance:

(1) They provide analyses of the 'early, unconscious' processing in perception, but postpone indefinitely the task of saying where and when the results of all the transformations and discriminations are 'made available to conscious awareness'. Or (2) They argue that a decision 'by the brain' to act (e.g. to move a limb) takes several hundred milliseconds to 'rise' to consciousness, creating an ominous picture of human agents as sequestered in outposts in their own brains and deluded about their ability to make a conscious decision (e.g. Libet 1985, Wegner 2002). Or (3) They suppose that the initial transduction by sense organs of light and sound and odour and so forth into an unconscious neural code must be followed (somewhere in the brain) by a second transduction into some other medium, the 'medium of consciousness' (e.g. Mangen 1993).

It seems obvious that there has to be a time before which we are not conscious of some item and after which we are conscious of it. In some sense, then, we *become* conscious of various features of our experience, so there must be some kind of transition, if not arrival at a place or crossing of a boundary, then a change of functional state of one sort or another. Consider the simple case of consciously seeing a flash of light and thereupon pressing a button. Neither arrival of the flash at the retina, nor the subsequent triggering of a signal in the optic nerve is sufficient for consciousness, obviously. If there is no second transduction, occurring at a particular time and place in the brain, then how can we understand the difference between those brain processes that somehow subserve conscious experience and those that are entirely unconscious but nevertheless involve, or are responsive to, perceptual or other contents? The multiple drafts model is an attempt to improve on this question and then answer it with a deliberately non-committal sketch—not tied to specifics of neuroanatomy—that avoids the seductive trap of positing a (functionally defined) place in the brain arrival at which is sufficient for consciousness. A wide variety of quite different specific models of brain activity could thus qualify as multiple drafts models of consciousness if they honoured its key propositions:

- (a) The work done by the imaginary homunculus in the Cartesian Theatre must be broken up and distributed in *time and space* to specialized lesser agencies in the brain.
- (b) Once a specialist has done its work, *that work does not have to be done again* in a central re-presentation process. That means that the content involved does not have to be perceived again, discriminated again, enjoyed again, abhorred again (if it is, for instance, a pain) nor does it have to be moved

somewhere and presented again in order to be stored in memory.

- (c) There is a massively parallel process in the brain—in the cortices and subcortical structures they interact with—in which *multiple* (and often incompatible) streams of content fixation, transformation, influence, suppression, enhancement, 'binding', memory-loading, etc., take place simultaneously (and asynchronously). These are the *multiple drafts* out of which the appearance of a 'final draft'—the imagined draft of consciousness enacted on the imagined stage of the Cartesian Theatre—is created by the occurrence of 'probes' that retrospectively elevate some drafts at the expense of others. In the absence of such probes, the question of whether or not a content was conscious is ill-posed. (This will be explained below.)
- (d) 'Since *you* are nothing beyond the various subagencies and processes in your nervous system that compose you, the following question is always a trap: 'Exactly when did *I* (as opposed to various parts of my brain) become informed, aware, conscious, of some event?' (Dennett 1998:105)

Dennett replaced the metaphor of multiple drafts with the metaphor of *fame in the brain*. Just as *becoming famous* is not a precisely datable event like being transduced into a medium (such as television), so achieving fame (or 'clout') in the brain is not a precisely datable transition in the brain. It is a competitive phenomenon—not all can be famous. Even more important, consciousness is only retrospectively determinable. Since it is *constituted* by its sequelae, one must always ask the hard question: 'And then what happens?' (Dennett 1991:255) One cannot—logically cannot—be famous for just 15 minutes; that would not be fame. And a content cannot be conscious for 15ms and utterly forgotten afterwards; that would not be consciousness.

The perplexing questions about the timing of conscious experiences, to which the multiple drafts model is particularly addressed, can be further clarified by yet another analogy, where the same curious status can be transparently observed: speciation events in evolution. What animal was the last common ancestor of all the chimpanzees, bonobos, and human beings? We know the split occurred roughly 6 million years ago, and that some one animal in fact must be the most recent ancestor of them all. Every birth in every lineage is a potential speciation event but not one in a million turns out, in the fullness of time, to have been a speciation event. It is logically impossible to discern which births are speciation events at the moment they occur, because nothing about them at the time distinguishes them; that

status depends on whether or not they lead to further births and still further births, and the eventual triumph of that lineage of births over others. Speciation events are discriminable only by 'retrospective coronations'.

Similarly, those content-fixations in the brain that turn out to be have been conscious are those that happen to have the sequelae that ensure their fame—and this depends not just on their temporally and spatially local properties, but on the subsequent competition for fame with their rivals. (This means that there cannot be, except in some arbitrary way, any temporally local neural *correlates of consciousness, any more than there are temporally local biological correlates of speciation.) Contents begin to have influencing effects on other contents and other processes as soon as they are locally discriminated, and not only do these effects not have to be postponed until after some special state of consciousness is somehow achieved; their cumulative occurrence composes, over time, the very 'fame' that we retrospectively acknowledge as presence to consciousness. We can call the space in which all this competition and elaboration occurs the *global workspace and then note that arrival in the global workspace (however we draw its boundaries) is necessary but not sufficient for consciousness of some content, since not all contents vying in the global workspace achieve fame. Precisely when do these winning contents become conscious? That is an ill-posed question, for exactly the same reason that the parallel question is ill-posed in biology. All the specific events that go to compose the eventual 'fame' can be located in both space and time with considerable accuracy, but the onset of fame itself is clockable with precision only in those unusual cases in which all the relevant events are squeezed into a narrow time window.

A familiar version of the same problem arising for the timing of consciousness can be observed in the phenomenon of coming to notice the chiming of a clock. Only on the fourth peal, perhaps, did you become aware of the clock chiming, but you discover you can retrospectively count the chimes in conscious memory. But when were you first conscious of the first chime? When it happened, five seconds ago, or just now, when you experienced it in recollection just as the fifth chime pealed? If the clock had chimed just three times, would you ever have been conscious of those chimes? We could no doubt discover a host of processes initiated in your brain by the discrimination of those three chimes at the time they occurred, but would those processes have been 'enough for consciousness' (of a sort)? How much is enough? How much influence is enough for fame? How many descendants are enough for a species?

When these analogies are set aside, the literal claims of the multiple drafts model are so bland as to seem to be a denial of the very existence of consciousness—nothing dramatic happens:

Contents arise, get revised, contribute to the interpretation of other contents or to the modulation of behavior (verbal or otherwise), and in the process leave their traces in memory, which then eventually decay or get incorporated into or overwritten by later contents, wholly or in part. This skein of contents is only rather like a narrative because of its multiplicity; at any point in time there are multiple drafts of narrative fragments at various stages of editing in various places in the brain. . . . Probing this stream at various intervals produces different effects, precipitating different narratives—and these are narratives: single versions of a portion of 'the stream of consciousness.' If one delays the probe too long, the result is apt to be no narrative left at all. If one probes 'too early' one may gather data on how early a particular discrimination is achieved in the stream, but at the cost of disrupting the normal progression of the stream. (Dennett 1991:135–6)

This is not a denial of the existence of consciousness; it is the claim—hard for some people to credit—that consciousness is not what it seems to be (a magic show illuminating an inner stage). It is, instead, the relatively greater influence of various contents on the processes that control the body of an agent composed of those processes and capable of telling us (and reminding itself) about some of them. According to the multiple drafts model, any agent with such a phenomenon installed in it is conscious in just the way we are.

DANIEL C. DENNETT

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