Consciousness: Conscious, Subjective Experience

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*Consciousness* as a neuroscientific concept has been loosely employed to encompass several different meanings or aspects of cerebral function in human and nonhuman animals. The term is often applied to states of responsiveness to the environment—being conscious or in a coma, awake or asleep, and being alert or aroused within the waking state. These states can be described behaviorally by observing the human or animal. Here we restrict ourselves to the meaning of consciousness as one of subjective awareness and experience, whether it be sensory experiences of our environment, external and internal, or subjective experiences of our feelings and thoughts, or simply awareness of our own existing self and presence in
the world. Our own subjective inner life, including sensory experiences, feelings, thoughts, volitional choices, and decisions, is what really matters to us as human beings. And it is the cerebral, neuronal basis of our subjective experiences that is at issue in the problem of the mind-brain relationship.

Basic definitions and concepts

Conscious or subjective experience or awareness is clearly accessible only introspectively to the subject having the experience. It is a primary phenomenon whose nature cannot be defined by any other externally observable event, whether molecular or behavioral. There is considerable evidence that an individual and law of the neuronal representation between neural processes and conscious experience. But even a complete knowledge of the observable neural processes in the brain of another individual would not in itself tell us what that subject is experiencing or feeling.

There are no a priori rules governing the relationship between conscious mental events and brain events; the rules must be discovered. The phenomenon of subjective referral of a sensory experience in the spatial dimension illustrates this principle. The spatial configuration of a subjectively experienced visual image, for example, is considerably different from the configuration of neuronal activities in the brain that accompanies and represents the sensory input giving rise to the visual images; what you see, subjectively, is quite different from the neuronal pattern for that image. The cerebral neuronal representation is actually a spatial distortion of the original image coming into the eye; but subjectively the image is "referred" to the original source of the input in a way that corrects the neuronal distortion. Direct electrical stimulation of primary sensory cortex provides an even more obvious demonstration of this; a stimulus applied to the lateral portion of the postcentral gyrus produces a sensation that is felt to be located not at that stimulated site of the brain but is rather subjectively referred to, and felt in, the hand or arm and in a direction reversed from the postcentral representation. Clearly, a complete knowledge of the neuronal representation would not, without validation by the subject's report, tell us where or what sensation is being subjectively experienced. Similarly, the experience of color cannot be described by finding that certain neural units may respond to specific frequency bands of the light spectrum.

Although each individual has access to and can be certain about only his own conscious experiences and feelings, we do commonly concede and accept the premise that other human beings have their subjective experiences (except for those of us who want to adopt Bishop Berkeley's solipsism as a serious view of life). We are also confident that one person can communicate something about his subjective experiences to another. But the validity of what is communicated depends upon the degree to which both individuals have had similar or related experiences. A congenitally blind person can never share the conscious experience of a visual image, regardless of how detailed a verbal description he is given by a sighted individual. The same limitation applies to all experiences in less dramatic, more subtle ways. For example, electrical stimulation of somatosensory cortex can produce sensations related to but sufficiently different from those generated by normal sensory input, so that the subjects could only relate some roughly understandable approximation of these experiences to the experimental observer, in whom similar modes of sensory generation had never been employed.

Neuroscientific study of conscious experience

One of the chief long-range goals of neuroscience is to understand the neuronal basis of conscious experience, i.e., the mind-brain relationship. To investigate this problem we must be sure to adopt valid operational criteria for distinguishing the mental, the conscious experience side of the relationship; i.e., we must directly study the phenomenon of subjective experience if we are to obtain meaningful answers to the problem.

In the absence of direct observational access to the subject's conscious experience, we must rely on the subject's introspective report of experience. The observer must ask the subject the appropriate question about the latter's conscious experience and be confident that the subject understands the question. The report is often most conveniently verbal, but it may be nonverbal (e.g., a sign made by a finger) if the latter clearly represents the subject's introspective experience. Any report should be made only after sufficient time for introspection and not as part of any speedy reaction-time procedure. The issue of the accuracy and reliability of the subject's communication of introspective experience must be dealt with in each study individually. Suitable control tests can in fact be devised, and satisfactory reliability of reports is obtainable.

Reports of conscious experience vs. behavioral detection.

There is an imperative corollary of the foregoing operational definition of conscious experience: Any measured indicator that can be dissociated from or independent of subjective awareness would be invalid, not acceptable as a primary indicator of subjective experience. This would even include behavioral responses that depend on cognitive and decision-making processes, unless these were validated by the primary evidence of the subject's introspective reports. For example, we have all had the experience of driving an automobile and becoming subjectively engrossed in thoughts not related to the mechanics of driving; nevertheless, the driving proceeds while all sorts of sensory signals are being properly recognized, evaluated and acted upon (usually successfully), without any consciously introspective awareness or later recallability. Among experimental paradigms, signal detection studies provide sophisticated examples of a generally unacceptable approach to conscious experience. The forced-choice responses in such studies could be made independent of introspective awareness of the signal, although they may be excellent indicators of whether some type of detection has occurred. Even when subjects are giving confidence ratings of their responses in a signal detection study, they are rating their forced choices and are not necessarily directly reporting their subjective experiences. There is, in fact, evidence that signal detection can occur with signals that are distinctly below the threshold required for any conscious awareness of the signal. Indeed, most sensory signals probably do not reach conscious awareness; but many of them lead to modified responses and behaviors, as in simple everyday postural and walking activities, and have therefore clearly been detected and utilized in complex brain functions.

Do animals have conscious experience?

There is no way to answer this in any absolute sense. But it should be clear that it is difficult if not impossible to carry out valid studies of conscious experience in nonhuman animals. Obviously, we cannot meaningfully ask an animal to report about a shared introspective experience in the validity of which we have confidence. Second, as just noted, complicated cogni-