



An Emerging Scientific Consensus on a Multidisciplinary Approach Toward Understanding Consciousness?

A Review of

The Oxford Companion to Consciousness

by Tim Bayne, Axel Cleeremans, and Patrick Wilken (Eds.)

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The raven, who may live up to 40 years, mates for life, and stakes out and defends a territory, is one of the most widely distributed birds in the world and also has one of the largest brains of any bird. In field studies, it has been known to fish with strings for meat tied to trees and thus demonstrates complex insight (Heinrich & Bugnyar, 2005).

The raven demonstrates knowledge of the knowledge of other birds as well as the knowledge of the knowledge of other species, including humans, suggesting a rudimentary theory of mind. It passes on learned adaptations to its young, connoting culture. The raven is sometimes characterized as the archetypal trickster, creator, or even the omen of death in many mythologies. From a phenomenological perspective, it has been associated with prophecy and sovereignty, and it is thus uniquely suited to grace the cover of *The Oxford Companion to Consciousness*.

Trends in the Study of Consciousness

This volume, edited by Tim Bayne, Axel Cleeremans, and Patrick Wilken, contains 242 entries contributed by 250 authors on the topic of consciousness gleaned from an analysis of 10 years' worth of Association for the Scientific Studies of Consciousness (ASSC) meeting abstracts. The top five contributing countries are the United States (46.0 percent), the United Kingdom (29.0 percent), Canada (7.0 percent), Belgium (4.1 percent), and France (3.7 percent). The contributors are predominately based in departments of psychology (31.4 percent), philosophy (31.0 percent), cognitive neuroscience (12.0 percent), cognitive science (5.8 percent), and psychiatry (3.3 percent). The 242 subject entries could be classed into the broad categories of philosophy of mind (27.0 percent), neuropsychological syndromes (10.0 percent), psychophysics (7.4 percent), methods (7.4 percent), cognitive

neuroscience (7.0 percent), memory (6.6 percent), theories (6.2 percent), neurology (5.0 percent), psychiatry (3.7 percent), and modeling (3.7 percent).

Finally, several of the most influential contemporary theories of consciousness are reviewed, with a useful list of primary readings included. The most important aspects and concepts associated with philosophy of mind are well represented in this volume. Moreover, these tutorials are written at an introductory graduate level and therefore could constitute an excellent source of readings for both novices and seasoned experts of consciousness. Methods particular to the study of consciousness are also well represented in this compilation. Other intriguing topics such as animal consciousness, anomalies of consciousness, history, culture, and aesthetics are appended in the genuine inclusive spirit of ASSC meetings.

Theories of Consciousness

As Zeman (2001) noted, theories of consciousness can be roughly categorized into three types: neuroscience theories, information processing theories, and social theories. In *The Oxford Companion to Consciousness* many of the most important and contemporary theories of consciousness have been included: global workspace theory (Bernard Baars), multiple drafts model (Daniel Dennett), higher order representation theory (William Lycan), information integration theory (Giulio Tononi), neuronal global workspace theory (Stanislas Dehaene), two visual streams (Melvyn Goodale and David Milner), theory of mind (Bertram Malle and Jess Holbrook), and microconsciousness (Semir Zeki).

Missing from the compilation, though, is Christoph Koch and Francis Crick's neurobiological theory (Crick & Koch, 2003). This theory, developed in the early 1990s, was among the first to be explicitly articulated, and it is perhaps most famous for describing what the plausible functions of consciousness might be as well as describing what any theory of consciousness must seek to explain. From a reading of *The Oxford Companion to Consciousness*, it is evident that Crick and Koch's neurobiological theory, which is firmly based in systems neuroscience, has influenced all subsequent theories of consciousness to a great degree.

Some other prominent theories of consciousness that are not included in the compilation include synchronization theory (Wolf Singer), information-processing theory (Tim Shallice), slow cortical potential theory (Marcus Raichle), quantum mind hypothesis (Roger Penrose), and Gerald Edelman's dynamic core hypothesis. However, again, many of the dynamic core hypothesis axioms have been incorporated into the newer and currently highly influential information integration theory of Giulio Tononi (Tononi & Edelman, 1998). Many of the empirical studies associated with the nonincluded theorists have nonetheless been included under separate content headers. Hence, in a substantive sense, all the important theoretical content domains in the study of consciousness have been covered.

What is readily apparent in this encyclopedic format are the vast similarities in these theoretical approaches. All the current contemporary theories of consciousness that are included in this reference text make several interesting assumptions. Among these is that with the study of access consciousness (e.g., cognitive processes), it should be possible to explain the richness of phenomenal consciousness (e.g., qualia). The largely empirical and cognitive neuroscience approaches to consciousness advocated by these theorists avoid many of the philosophical conundrums associated with qualia and the "hard problem," in

effect postponing this important question until we have a better understanding of how consciousness is instantiated in the brain.

The entries submitted by truly international and high-caliber philosophers of mind are simply stellar. All the major important natural philosophical domains associated with the study of consciousness are covered, including questions of the appropriate level of explanation, logic of causes and correlates, pivotal questions that any theory must answer, discussions about phenomenology and qualia, as well as difficulties with reductionism.

Philosophy of mind, which constitutes a major proportion of all the entries (27 percent), is shown to be heavily influenced by the relatively young field of experimental philosophy whereby philosophical assumptions underlying principles about mind and brain relationships are empirically tested. With the closing of the Decade of the Mind, experimental philosophy has flourished, and some consensus has begun to develop on essential topics such as intentional action, free will, and determinism, as well as theories of linguistic reference. Hence, the explanatory philosophical gap is closing in on consciousness. The philosophy of mind entries provide a comprehensive overview of all the necessary terms and philosophical questions that have occupied the consciousness of leading thinkers in this area.

Practical Reasons for Studying Consciousness

Both clinicians and researchers are greatly interested in being able to assess global consciousness in a quantitative sense without using patients' own verbal report or behavioral indicators because external behavioral indicators are not well correlated with subjects' actual phenomenological experiences, such as in coma or during the rarely recorded instances when patients wake up during surgery. Whether it is the quantitative and objective assessment of the depth of anesthesia, the analysis of phenomenological aspects of psychiatric and neurological disorders, or the measurement of consciousness in nonhumans, unbiased quantitative assessments are needed.

Computational models of consciousness will readily benefit from assays of neural network complexity, information integration, and causal interactions among informational units provided by computer science. Finally, from an esoteric research perspective, functional brain scans of neural network interactions underlying conscious states would enable cross-correlation of network properties across individuals without contamination of verbal or motor "reports." A method to provide a complete computational account of consciousness might expedite interdisciplinary research, such as the investigation into the effects of mind on matter where behavioral effects are notoriously small but where neural effects in primary sensory cortex are quite large, rendering measurement problems tractable.

This volume presents all the requisite philosophical treatises surrounding consciousness in a succinct format for easy acquisition by students. This is in an era when few graduates of the world's top doctoral neuroscience programs have taken coursework in either philosophy of mind or natural philosophy. The field is rapidly moving beyond systematic studies of localized modules like face processing into the realm of higher cortical functions where global brain interactions instantiated by formal models and theories will be increasingly needed.

Speculation Abounds in Consciousness Research

There is a great amount of healthy speculation in the consciousness research field. For example, Zeman (2001, p. 1274) showed that by the time visual processing has proceeded to the early ventral stream occipitotemporal cortex (e.g., parahippocampal place area or fusiform gyrus, respectively), binocular rivalry studies of concurrently presented houses or faces correlate with activation in these areas and hence with awareness rather than with the content of the perceptual field per se. These effects are routinely as large as if these higher order visual cortical areas were being presented separately free-field to the observers.

This suggests that a provocative second generation of “neural correlate of consciousness” functional magnetic resonance imaging (fMRI) studies could potentially be designed. Real-time fMRI used in simultaneously interacting dyads with possible awareness only-based “neural phase locking” of binocular rivalry of special phenomenological stimuli would be examples to explore.

Although speculative, such brute force approaches to determining what the upper parameters of consciousness are would potentially carry with them a high payoff since the dual imperatives of reportability and observable behavior limit one’s understanding of just what consciousness consists of. The high proportion of entries in this volume that refer to work with brain-lesioned patients to study consciousness attests to the usefulness and dominance of cognitive neuroscience in this field. However, neurology and psychiatry are also well represented in consciousness studies, and perhaps the implementation of neuroimaging methods for functional aspects of psychiatric disorders will open up a new area of study at the intersections of cognitive neuroscience and psychodynamic psychology.

Summary and Conclusions

The Oxford Companion to Consciousness is a monument to the maturation of the field embodied in international associations such as the Association for the Scientific Studies of Consciousness. The only improvement that I would humbly suggest is that the compilation include a comprehensive subject and author index. This text belongs on the bookshelf of every new and seasoned researcher of consciousness studies. It is a remarkable achievement, given that consciousness became a respectable topic of scientific investigation only a mere two decades ago (Zeman, 2001). The editors have done a fine job of including the most topical, up-to-date, and encompassing survey of important data, concepts, theories, and methods suitable to this 21st-century interdisciplinary field.

I anticipate that in coming decades this compilation and efforts like it will in part be credited with advancing a common nomenclature and terminology. Many spectacular scientific achievements are likely to originate in this discipline in the coming decades. Hence, the raven is a fitting and suitable cover for *The Oxford Companion to Consciousness*, symbolizing the truly fascinating nature of this subject matter at the intersection of phenomenology and cognitive neuroscience.

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