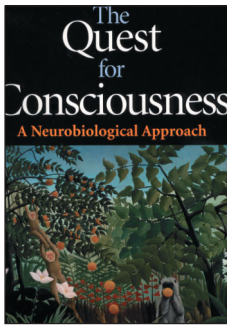


## Looking at your self



### The Quest for Consciousness: A Neurobiological Approach

by Christof Koch

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Reviewed by Jeremy M Wolfe

Christof Koch's book changed how I think about myself. While this is not a line that one typically associates with sober-minded reviews of books about neuroscience, it makes more sense if the book is entitled *The Quest for Consciousness*. Koch altered my thinking about my conscious self with the account of his efforts to understand how "the salty taste and crunchy texture of potato chips, the unmistakable smell of dogs after they have been in the rain, or the feeling of hanging on tiny fingerholds on a cliff a couple of meters above the last secure foothold, emerge from networks of neurons" (p. 2). A definitive explanation of these 'qualia' (the sensations and feelings of conscious awareness) remains some distance off, so Koch instead discusses the more reductionist project that he has pursued for many years in close collaboration with Francis Crick: they have been seeking the neural correlates of consciousness (which Koch abbreviates as the NCC).

And that is how it comes to pass that I am writing a review of this book. As a vision and/or visual attention researcher, I do not typically think of myself as studying the mysteries of consciousness, but if dreams were Freud's 'royal road' to the unconscious, vision is Koch's royal road to the NCC. If unraveling consciousness is an intractable problem, perhaps we can start by tackling the problem of visual awareness. Vision science provides a set of very useful phenomena for this purpose. Consider binocular rivalry, which is experienced when each of the two eyes are presented with a different stimulus at the same location in the visual field. Simultaneously looking at a pattern of vertical lines with the left eye and horizontal lines with the right eye does not result in seeing a plaid: the sum of the two images. Instead, what one experiences is a battle, with either the vertical or horizontal lines being perceived at each moment and each location for as long as you care to look. (You can try this yourself at <http://www.psy.vanderbilt.edu/faculty/blake/Rivalry/BR.html>.)

Today, using fMRI in humans or single-unit recording in alert, behaving monkeys, it is possible to monitor perceptual experience and concurrent neural activity. This makes it possible to assess whether specific brain areas are candidate parts of the NCC. For example, suppose we

find a cell that responds to a vertical grating presented to one eye. If we induce binocular rivalry by simultaneous presentation of a horizontal grating to the other eye, and the cell continues to respond regardless of the perceptual state reported by the observer, then it is not a part of the NCC. However, if the cell responds only when the observer reports seeing a vertical grating, then it might be part of the NCC.

Rivalry is just one of a variety of paradigms that allow the clever experimenter to distinguish between conscious and non-conscious processing. Recent interest has focused on the ability of attention to modulate the contents of conscious experience. In one version of a classic experiment, researcher Dan Simons has subjects intently watch a ball game, during which a man in a gorilla suit walks through the scene. Many observers fail to notice the gorilla, and are astounded, when they watch a replay of the tape, to find out that they somehow missed the beast. As with the rivalry example, any part of the visual system that unconsciously registers the presence of the gorilla can be ruled out of the NCC. (For demonstrations of 'change blindness,' see <http://www.viscoglab.com>.)

*The Quest for Consciousness* is heavily weighted toward vision research because those data are so useful to the NCC project. The book is written in a pleasant, colloquial style, with a couple of benign oddities. First, the author uses 'we' a lot. This it is not a faux-royal affectation; 'we' refers to Koch and Crick. Although not an author, Francis Crick's presence as close collaborator suffuses the book. Second, the book is very heavily footnoted, as if there were a continual struggle between Koch the raconteur and Koch the scholar. Both are good company, though jumping back and forth between them can make one feel a bit dizzy. You could, of course, skip the footnotes, but there is a good graduate school seminar in those footnotes. Koch seems to have read everything and wants to make sure we know that the smoothly flowing prose at the top of the page has deep roots in the scientific and philosophical literature.

Returning to my initial assertion, the book changed my view of my self by advocating an 'intermediate-level theory of consciousness' (terminology borrowed from Ray Jackendoff). Before I read the book, I tended to think in a vaguely visuo-centric, feed-forward way. I knew that most visual processing is inaccessible to consciousness. However, given that we are aware of the visual world, I assumed that consciousness was the goal and end-product of all that processing.

Koch demotes the NCC to an intermediate level that is not the realm of our highest abstract thoughts. Like the visual mechanisms of color constancy or object recognition, Koch argues that our higher thought processes of inference, decision, and the like are inaccessible to consciousness. These thought processes are the domain of a "non-conscious homunculus" (p. 298) that can produce a decision without giving the owner of that decision any conscious awareness of the process used to reach it. In Koch's view, we have a fairly compact, intermediate-level NCC that is, in effect, looking back at occipital cortex and forward into the frontal lobes. But don't leaf through the book to find the map of the NCC: it isn't there. This book should be considered as a progress report—one that could serve as a good casual read, the basis for a fine college seminar, or a foil for those with other theoretical positions. A sequel seems inevitable and will be welcomed. ■

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