

**The Presence of Mind:  
Optimality, Uncertainty and Consciousness in Neurons**

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**Biographical information:**

Mr. Britton is a doctoral candidate in the Cognitive Neuroscience Program of the Psychology Department of the City University of New York. He is an adjunct faculty member of the City College of New York, teaching "Mind, Brain and Behavior" to undergraduates using Christof Koch's Quest for Consciousness as a primary text. Mr. Britton is a research scientist in the Life Sciences division of the Nathan Kline Institute in Orangeburg NY, who is currently investigating the neural dynamics of multisensory integration using electrophysiology methods with behaving non-human primates.

**Abstract:**

A purely materialist stance founded on well-accepted facts of neuroscience leads to the "strong neural network" position that consciousness is the electrochemical activity of coalitions of neurons in the brain. The complex systems paradigm of non-optimal biological evolution answers the attendant questions of why it is like something to have sensations (qualia), and why there exists the uniquely personal and private sensation of being, or self, or consciousness. Self-organization, uncertainty absorption and recursion provide the three functional principles of the fundamental cortical algorithm that instantiates the conscious mind.

Drawing on the neuroscientific perspective set out by Christof Koch, biological complex adaptive systems theory as presented by Stuart Kauffman, and information systems concepts first articulated by Herbert Simon, a paradigm for understanding the functions of neuronal networks in biological organisms develops. This paradigm frames the neuron as a non-optimal, satisficing uncertainty absorber, adequately (perhaps even well-) equipped to provide an adaptive response mechanism for organisms needing to address the fundamental evolutionary questions: "How do I differentiate self and other?", "What do I do next?", and "Did that work out OK?" A fundamental algorithm emerges as neurons physically arranged into networks of sufficient complexity self-organize into informational structures in the cerebral cortex. Structural relationships among neurons, especially convergent excitation, lateral inhibition, and center-surround formations, combined with neurons' use-dependent self-modification properties, cause the self-organization of coalitions of neurons into recursive patterns of hierarchical feature detectors throughout the cortex as the organism processes the sensory data of its life experience, finding regularities in the environment and changing in response to them. Sensations, or qualia, are these electrochemical interactions of coalitions of neurons, encoding meaning by indicating the detection of patterns of experiential regularities and contrasts. In humans, at the apex of this hierarchy are neural coalitions whose receptive fields are other neural coalitions of qualia, which are formed from experience-induced patterns rather than direct sensory data, encoding semantic rather than episodic meaning; but these are still non-optimal satisficing uncertainty absorbers. Koch presents evidence for a neuroscientist's version of the philosopher's zombie: non-conscious neural patterns that receive sensory data and produce motor output in learnable, adaptive, high performance and useful processes that can be honed to greater perfection than conscious processes. This concept generalizes to the idea of consciousness being the coalition of neurons assembled by just such a non-conscious process whose receptive field is the current (and constantly shifting) set of qualia coalitions.

This paradigm has several implications. Non-optimality is central to the role of neurons and neuronal coalitions, as evidenced in perceptual illusions and mistakes. That our semantic concepts are such fallible and non-serial neuronal coalitions suggests caution in applying semantic constructs of serial formal systems such as "optimality" to the veridical world.