

The Science of Consciousness: Where It is and Where It Should be

A review of Antti Revonsuo's *Inner Presence
Consciousness as a Biological Phenomenon* (MIT Press, 2006)

By Arnold Trehub

This excellent book is aptly titled. It presents a closely argued analysis of the current state of consciousness studies and suggests a strategy of investigation, which the author believes is necessary to establish a robust science of consciousness. Before he introduces the details of his framework for a unified science of consciousness, Revonsuo makes the following broad assertions:

1. The field of consciousness research is far from being a true science because it lacks a unified research program.
2. A proper unified research program should fall within the conceptual and procedural framework of *biological realism* wherein explanations of conscious phenomena are expressed mainly in the terms of cognitive neuroscience.
3. Understanding of consciousness must be based on understanding the multilevel biological *mechanisms* which explain how conscious phenomena work.

Revonsuo conceptualizes consciousness as the phenomenal level of organization in the brain. The fundamental questions to be answered by a proper science of consciousness are best stated in his own words.

"How does the phenomenal level relate to other levels of organization in the brain? How could the phenomenal level be measured or observed empirically? How could it be conceptualized or modeled theoretically? What are the causal powers of entities and properties residing at the phenomenal level of organization?"

Moreover, lest there be any doubt about his commitment to a completely biological explanation of conscious content, he makes the following statement.

"According to biological realism, since consciousness is a biological level of organization in the brain, it follows that the structure of neurobiological phenomena, at some higher level of physiological organization and description, corresponds to the structure of the phenomenal level or consciousness itself. Thus, for example, a visual experience consisting of complex patterns of form and color necessarily implies a phenomenon of corresponding complexity and organization in the brain."

If we take his statement at face value, it appears that Revonsuo agrees with the strong claim that the contents of consciousness can only exist as manifestations of their corresponding physiological *analogs* in the brain. Notice that this, contra the mainstream paradigm, rules out mere neuronal *correlates* as candidates for the phenomenal level of organization in the brain.

The first three sentences in the summary at the end of Chapter 9, provide the essence of Revonsuo's claim that a simulation within the brain of the space around us creates the setting for the inner presence which, in his view, constitutes our phenomenal experience. These sentences deserve to be quoted directly.

"Empirically based phenomenology should be built on a model that takes the spatiality and centeredness of consciousness as its fundamental structural and organizational property. The phenomenal level is based on an egocentric, bounded coordinate system whose regions can instantiate qualitative features. When that coordinate system is present in the brain, the brain is in the conscious state (i.e., capable of realizing phenomenal contents); when it is absent, the brain is in an unconscious state (i.e., incapable of realizing phenomenal contents)."

After setting these minimal requirements for the evocation of the phenomenal level, Revonsuo next addresses the kinds of processes needed to provide the brain's egocentric spatial coordinate system with its properly bound, segregated, and synchronized feature-rich contents. He believes that the major aspects of phenomenal consciousness such as selective attention, feature integration and, most important, the simulation of a world and a self, may depend on neuronal synchronicity but that investigators have yet to offer a clear picture of what might be going on in the brain when this happens. From a neuroscience perspective, we should go beyond the search for neural correlates of consciousness and look for the constitutive *mechanisms* of consciousness. According to Revonsuo, we should seek brain mechanisms that can provide a coherent master gestalt composed of what he calls "Gestalt windows" within an egocentric spatial coordinate system that can be independently accessed, tagged, and interactively coupled with "semantic windows" (semantically categorized Gestalt windows). Although these essential processes are only nominally described black boxes,

this is the general scheme of what he believes we should be looking for. The task is to specify the brain mechanisms that can do the job. While Revonsuo argues that the explanation of consciousness requires theories developed within the framework of a biologically naturalized mechanistic approach, he claims that there are no such theories to be found today. In my view, Revonsuo is absolutely correct in his call to develop theories of the biological mechanisms that are *competent* to generate the brain events that constitute our phenomenal experience, but I do not agree with his contention that no such theory exists today. I will return to this point later.

Because sensory input does not modify phenomenal consciousness during sleep, for Revonsuo, the content of dreams is, in effect, an existence proof that consciousness is encapsulated within the brain. He therefore stresses the dreaming brain as particularly important for the study of consciousness, and buttresses this claim by his conjecture that dreaming has evolutionary utility as a biological defense system in which the dreaming brain simulates threatening situations in order to enhance survival.

Returning to the overarching theme in *Inner Presence*, if we are to explain consciousness we must expose the neuronal mechanisms which *constitute* consciousness rather than the mere neural correlates of consciousness. Features at the phenomenal level -- the patterns, organization and dynamics of subjective experience -- are to be explained by the structure and dynamics of their underlying constitutive biological mechanisms and systems. According to Revonsuo, the brain mechanisms of consciousness must possess at least the following characteristics:

1. Integration into one overall coordinate system
2. Rapid temporal reorganization
3. An internal center-surround structure, involving the interplay between phenomenal consciousness, selective attention, and reflective consciousness
4. A vast combinatorial capacity

What would a proper brain model of the phenomenal level look like? Here is Revonsuo's criterion: "A model of the phenomenal level is a model of a system in the brain that *itself* models or images the world, by constructing organized patterns of phenomenal features and by opening the corresponding semantic windows. A mechanistic model of the phenomenal level is, therefore, *a model of a world-modeling system in the brain* ." Moreover, he claims "It is possible to observe or model the phenomenal level *only from the egocentric perspective from which it is experienced*."

If we grant the cogency of Revonsuo's criteria for a model of the phenomenal level (which I do) then the challenge is to explicate the minimal design of biologically plausible brain mechanisms and systems that can do the job. Is there a current theory that meets his demands? Namely, do we now have any mechanistic models of an egocentric world-modeling system in the human brain?

I think *The Cognitive Brain* (TCB), MIT Press, 1991, provides such a model. In this book, I have presented a large-scale neuronal theory of the cognitive brain that includes, as an essential mechanism, what I have called the *retinoid system*. The structural and dynamic properties of the retinoid system enable it to register and appropriately integrate disparate foveal stimuli into a perspectival, egocentric representation of an extended 3D world scene including a neuronally-tokened locus of the self. The self-locus serves as the neuronal origin of phenomenal (retinoid) space (see TCB, Ch. 4 "Modeling the World, Locating the Self, and Selective Attention: The Retinoid System"). In addition, the extended TCB model includes specified mechanisms for learning and recalling images of objects and their spatial layouts as organized patterns of features ("gestalt windows") within the egocentric coordinates of retinoid space. Moreover, interactive semantic processing mechanisms are described in detail (see for example TCB, Ch. 6 "Building a Semantic Network"). These are capable of evoking what Revonsuo calls "semantic windows" in proper relationship to their corresponding gestalt windows. In my opinion, the close agreement between the neuronal models detailed in *The Cognitive Brain* and the recommendations in *Inner Presence* gives added weight to Revonsuo's proposals.

In summary, Revonsuo offers us an admirable book, not only in its comprehensiveness and careful analysis of the current field of consciousness studies, but also for its emphasis on what I concur are the core criteria of conscious experience, as well as presenting a promising strategy for future exploration. I believe *Inner Presence* should be on the reading list of anyone interested in phenomenal experience as a scientific problem.

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