

FROM INTEGRALPOST

PART 1: INTEGRAL THINKING

IN CUTTING-EDGE NEUROPHYSIOLOGY | REPRINTED

YES, VIRGINIA, CONSCIOUSNESS DOES



GO ALL THE WAY DOWN!

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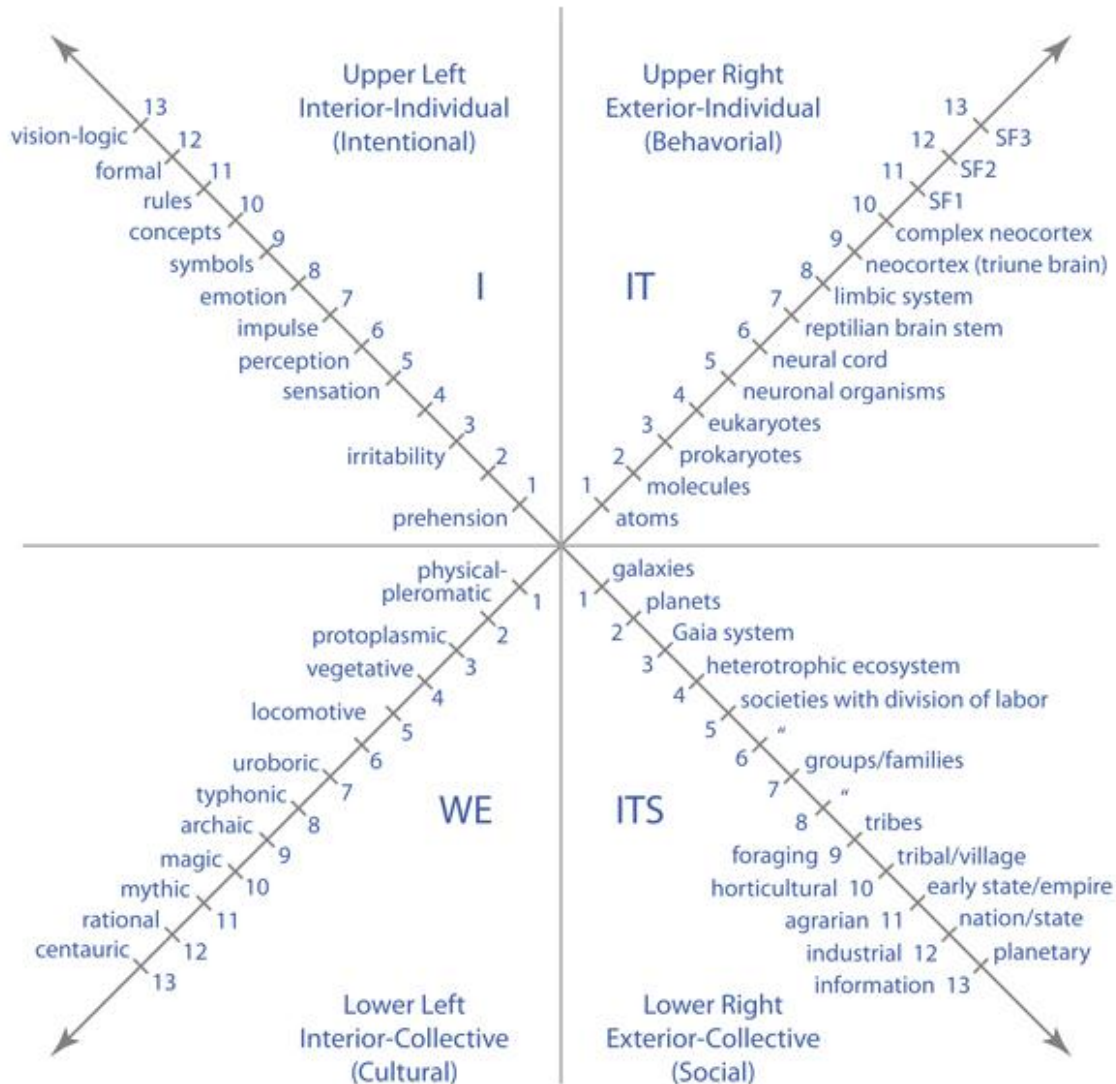
Although the apparent confirmation of the Higgs Boson, the so-called God particle, has been attracting attention recently, the most vexing problem in science and philosophy remains the mind-body problem: What relation is there between material brain states and conscious, first-person experience? In the past few years, as we shall see in a moment, some neurosciences have now arrived at an answer that was anticipated by Ken Wilber's version of integral theory. According to Wilber, meager versions of interiority—the antecedents of consciousness—are found at the atomic level, as Alfred North Whitehead suggested in the early 20th century.

For much of the 20th century, however, in part because of the enormous influence of behaviorism, consciousness was not even considered a fit topic for natural and social science. Until relatively recently, natural science maintained that consciousness is a late arriving, highly improbable, and accidental phenomenon belonging solely to humans. Animals were not considered conscious. Possession of *self*-consciousness, a trait that humans have developed to an

exceptional degree, is regarded as at best a mixed blessing. While making possible knowledge that allows for some control of nature, consciousness also makes humans aware of their mortality and eventually of their absurdity in a godless universe, bereft of any significance apart from the pathetic prattling of utterly insignificant humans on a tiny planet in the middle of nowhere. In the face of this nihilistic view, we are encouraged to keep a stiff upper lip while leading a life "as if" it really meant anything.

In the past few decades, however, many neurophysiologists have concluded that we can infer that any organism with sufficient neural complexity has some measure of consciousness. Many researchers now believe that no account of human "mind" could be complete without explaining the nature and possibility of first-person experience. This re-awakened interest in consciousness occurred in the context of narratives about cosmic evolution from its birth in the Big Bang. According to the so-called anthropic principle (better put, the life principle), organic life could have evolved only if the basic laws of the universe were extraordinarily finely tuned to be life friendly. Holmes Rolston III has written that if the first Big Bang was the explosion from which space-time and matter-energy emerged, and if the second Big Bang was the emergence of organic life, then the *third* Big Bang was the development of consciousness. More than a few respected scientists and philosophers maintain that perhaps it is no accident that self-conscious life evolved; indeed, perhaps the universe has become conscious of itself through humankind.

Consciousness *may* be an emergent phenomenon that showed up 12 billion years after the first Big Bang. Yet, an even more striking possibility is that proto-consciousness came into being along with other basic cosmic constituents shortly after the Big Bang occurred. Consciousness would then not be an accidental "add on" that never quite fits in a material universe, but instead would be a primary feature of the universe that *occurs at all levels of reality*, right down to that of quarks.



The Four Quadrants

One of the most significant recent contributions to this view of consciousness has been made by Christof Koch and Giulio Tononi. In *Consciousness: Confessions of a Romantic Reductionist* (MIT Press, 2012), Koch lays out the elements of their “integrated information theory” (ITT) of consciousness. Koch, a professor of biology and of engineering at Cal Tech, and chief science officer at the recently established Allen Institute for Brain Science in Seattle, is a world-renowned neuroscientist. For almost twenty years, Koch worked closely with Nobel laureate Francis Crick on the problem of consciousness. Despite coming up with one or another well-grounded account of what neurophysiological structures and

functions were involved in generating consciousness, Koch and Crick were not able to explain exactly *how* the *magi* happened, that is, how first-person conscious experiences arose with or were correlated with those complex structures and functions.

After Crick's death, Koch began working with Tononi, another brilliant brain-consciousness researcher, who postulated that information theory could shed light on consciousness. In their accessible co-authored essay, "Can Machines Be Conscious?" Koch and Tononi write: "Information is classically defined as the reduction of uncertainty that occurs when one among many possible outcomes is chosen." Relatively simple systems can be in an astonishing number of states, but such systems do not achieve consciousness because those states are not *integrated*. "According to IIT, consciousness implies the availability of a large repertoire of states belonging to a single integrated system. To be useful, those internal states should also be highly informative about the world." Achieving high levels of integration in neural networks is difficult.¹ "The more integrated *and* differentiated the system is, the more conscious it is."²

IIT "not only specifies the amount of consciousness, Φ , associated with each state of a system. It also captures the unique *quality* of that experience." Hence, "A nervous network in any one particular state has an associated [correlated] shape in qualia [experiential] space." For humans, the neural network state and the correlated experiential state are extraordinarily complex, as they would have to be in order to account for the manifold ways in which people can be conscious. Koch uses the term "crystal" to describe a physical system that is "mapped onto a shape in this fantastically multidimensional qualia space." Each conscious experience involves its own topology, which allows for different experiences: seeing green vs. seeing red.

Although *correlated* with neural (that is, material) states, consciousness is not *reducible without remainder* to such states. Eliminative materialism is the term of art for the kind of reductionism that says there are *only brain states* and thus that

consciousness is *nothing but* brain states. In contrast, Koch adheres to a sophisticated version of what philosopher David Chalmers has called the dual-aspect theory of reality. There are material phenomena and conscious phenomena, neither of which can be reduced to the other, although they are closely correlated. Corresponding to the mathematical complexity of the material system is the geometrical complexity of the experiencing crystal. "The crystal is the system viewed from within. It is the voice in the head, the light inside the skull."

The [experiential] crystal is not the same as the underlying network of mechanistic, causal interactions, for the former is phenomenal experience whereas the latter is a material thing. [ITT] postulates two sorts of properties in the universe that can't be reduced to each other—the mental and the physical. They are linked by way of a simple yet sophisticated law, the mathematics of integrated information.

According to Koch, this law will make possible development of a "consciousness-meter."

This gadget takes the wiring diagram of any system of interacting components, be it wet biological circuits or those etched in silicon, to assess the size of that system's conscious repertoire. The consciousness-meter scans the network's physical circuitry, reading out its activity level to compute Φ and the crystal shape of the qualia that the network is momentarily experiencing. A geometrical calculus will need to be developed to determine whether the crystal has the morphology of a painfully stubbed toe or of the scent of a rose under a full moon.

As indicated by his reference above to circuits in wetware or silicon, Koch adheres to a kind of functionalism with regard to consciousness. That is, what counts is not what the system is *made of*, but whether it *functions* in a way that makes possible integrated information. Always arising with such integrated information is some measure of interiority. That is to say, *the universe is constituted by a hierarchy of integrated systems that not only have an exterior but an*

interior as well. The universe is conscious—that is, has some measure of experience or interiority—*all the way down.* According to Koch,

Any system whose functional connectivity and architecture yield a Φ value greater than zero has at least a trifle of experience. This holds not only for the biochemical and molecular structures of organic cells, but “also encompasses electronic networks made out of solid-state devices and copper wires.

No matter what a thing is composed of, whether it is an organism or rolls on wheels:

If it has both differentiated and integrated states of information, it feels like something to be such a system; *it has an interior perspective.* The complexity and dimensionality of their associated phenomenal experiences might differ vastly, but each one has its own crystal [interior] shape.

[...] Even simple matter has a modicum of Φ . Protons and neutrons consist of a triad of quarks that are never observed in isolation. They constitute an infinitesimal integrated system.

With the rise of digital artifacts in the past few decades, vast numbers of low-level centers of interiority were added to that of trillions of organisms on planet Earth. When isolated computers and smart phones are tied together in the Internet, the level of integrated complexity attained suggests that the Internet is already conscious at some level. Koch and Tononi are confident that humans will eventually be able to create conscious artificial intelligence (AI), although AI consciousness will not necessarily have all the features associated with and required by the human form of consciousness.

In his book, Koch bravely steps out in a way rarely done by many neuroscientists. He asserts that he adheres to a version of panpsychism, because he holds that consciousness is “a fundamental feature of the universe, rather than emerging out of simpler elements....” (132) Koch praises Pierre Teilhard de Chardin, a name that rarely appears in the context of neurophysiology (!), for having affirmed a version of panpsychism in his famous book, *The*

Phenomenon of Man. The evolution of humankind makes possible the rise of the noosphere, a new layer of reality that covers planet Earth with “incandescence,” Teilhard writes. Koch takes seriously Teilhard’s speculation that the Omega Point will be achieved “when the universe becomes aware of itself by maximizing its complexity, its synergy.” At this point, Koch notes that ITT goes beyond panpsychism in attempting to specify the causal processes involved in integrating information. Moreover, he concedes that ITT has a long way to go before being considered a “final” theory of consciousness, but it is a good start in that direction.

Koch is a reductionist because he believes that science will ultimately comprehend what gives rise to consciousness and will be able to create machines that are conscious. Consciousness does not come from some otherworldly source. He is a *romantic* reductionist because of his on-going interest in the spiritual dimensions of reality. He writes: “I’m optimistic that science is poised fully to comprehend the mind-body problem. To paraphrase from Corinthians: ‘For now we see through a laboratory darkly, but then we shall know.’”

Raised Roman Catholic, Koch took his faith seriously for many years, although he finally abandoned it because he could not square Christianity’s mythic content with scientific knowledge. In the final chapter of his book, Koch respectfully explores the limitations of Biblical religion and theism in general, but he is unwilling to surrender his surmise that there is something profound at work in the cosmos, something signifying more than the intense interactions of matter-energy. In effect, Koch is his way to being an integral theorist. In affirming the interiority of all levels of reality, he wants to leave open the possibility of a mysterious depth to the origins and consequences of the universe. Just before concluding his book with a psalm from the Dead Sea Scrolls, Koch waxes philosophically:

I do believe that some deep and elemental organizing principle created the universe and set it in motion for a purpose I cannot comprehend. I grew up calling this entity God. It is much closer to Spinoza’s God than to the God of Michelangelo’s painting. The

mystic Angelus Silesius, a contemporary of Descartes, captures the paradoxical essence of the self-caused Prime Mover as “*Gott ist ein lauter Nichts, ihn rührt kein Nun noch Hier.*” (God is a lucent nothing, no Now nor Here can touch him.)

Koch’s religious roots must have played some role in his openness to developing a sophisticated version of panpsychism. Nevertheless, he arrived at this position by way of lengthy, careful scientific research. This fact indicates that the integral *Zeitgeist* is gaining in influence, if by “integral thinking” we mean the view that consciousness starts all the way down and then proceeds to go all the way up via cosmic evolution.

The title of this essay promises a lot: There is consciousness all the way down. Koch has not proven this, as he is well aware. In Part Two of this post, I take a more critical look at current developments in AI and consciousness research. In his excellent new book, *You Are Not a Gadget*, Jaron Lanier—a key player in development of virtual reality in the 1980s—warns that researchers in Silicon Valley are redefining AI in a way that both changes and lowers the bar for what counts as machine “consciousness.” In the process, those gurus are encouraging us to lower our own mental capacities to comply with what all those seductive (but limited) gadgets can do. According to Lanier, leaders in Silicon Valley are using their profits not merely to line their pockets or to invest in better digital consumer goods, but primarily to enable the emergence of a self-conscious Internet via hive mind or to bring about some other form of AI that goes well beyond human intelligence. Here, we may ponder the adage: Be careful of what you wish for!

¹ <http://spectrum.ieee.org/biomedical/imaging/can-machines-be-conscious/>

² According to Koch, “Leibniz would have been very comfortable with integrated information.” Leibniz, the 17th century German polymath and co-inventor (with Newton) of the calculus, postulated that the world is constituted by complex and integrated matrices of monads, or centers of experience. In human beings, a dominant monad integrates the contributions of countless other monads operating at various levels.