

Consciousness and emergence

An introduction to Roger Sperry's Emergentism

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If no new phenomena emerged in large systems out of the dynamics of systems working at a lower level, then we would need no scientists but particle physicists, since there would be no other areas to cover. But then there would be no particle physicists.
— Per Bak

Introduction

Roger Wolcott Sperry (1913 to 1994) was a ground-breaking neuroscientist who won the 1981 Nobel Prize in Medicine for split-brain research that revealed functional specialization in the cerebral hemisphere¹. Sperry spent the major part of his academic career at Caltech in the field of psychobiology at the intersection of biology, zoology, psychology, and neurology, but also teaching and conducting research at leading institutions throughout the world. He received his doctoral degree in zoology at the University of Chicago in 1941, studying under the preeminent Austrian/American biologist Paul Weiss who became well-known for his early forays into organicistic or “holist” systems biology.

Among his many accomplishments, Sperry put forward one of the first proposals arguing for consciousness as an emergent phenomena². He was drawn to emergence as the basis of a theory of mind-brain interactions because he believed it offered a way to get around the many conceptual problems plaguing mind/brain dualism, epiphenomenalism, radical behaviorism, reductionism, materialism, identity theory, panpsychism, and Gestaltism. Sperry's work was no doubt a major influence of more recent interest in emergence-based theories of consciousness³. Sperry's classic paper is being republished in *E:CO* since, although it is of fairly recent vintage—1993—it recapitulates his earlier work on emergence from at least a quarter of a century before.

Subject experience, interaction, and emergence

Sperry's road to emergence was initiated by his early interest in subjective experience or consciousness; his first major paper on consciousness *per se* was published as early as 1965¹. He made it, thereafter, a recurring point to incorporate subjective experience into theory in opposition to most neuroscientists who tended to avoid the issue altogether. Subjective experience today is more typically known under the labels of “qualia”, “first person consciousness” or “awareness”). Voneida¹ pointed out that the topic “What is the purpose of consciousness” appeared in Sperry's teaching notebooks during the early years of his career.

Sperry conceived subjective experience in terms of *interaction*, specifically, the interactions between brain or nervous system functioning on the one hand and mentation (“mentalism”) or consciousness or subjective experience on the other. Emergent interactionism was not dualistic since it bridged over any gap between the nervous system and consciousness. According to Voneida's¹ interpretation of Sperry's emergentist approach, consciousness emerges from the action of cerebral networks as an independent entity although obviously closely related to these networks. The newly emerged property of consciousness feeds back continuously with the central nervous system resulting in a dynamic view of consciousness. Sperry also believed emergence was key to explaining how human values arose via an interactional nexus within social systems.

Emergence and mental interactionism

For Sperry, mentation was emergent from those cerebral processes whose specific configurational properties were yet to be discovered. Since this configurational unity was a matter of the *interaction* of brain circuits and related processes, there need not be a one-to-one correlation between mental properties and their neural substrates: rather “than being identical to neural events, as is generally understood...[mental properties] are *emergents* of these events” (my emphasis) and “A cerebral process acts as a conscious entity, not because it is spatially set apart from other cerebral activity, but because it functions organizationally as a unit. Presumably the conscious process may be interwoven with, and may share active components with, other brain processes that do not reach conscious awareness”⁴.

This was a crucial point since Sperry had it that to say mentation was identical to neuronal activity was like saying a wave was nothing but the uplift and fall of H₂O and other molecules. Here, Sperry was stressing the *collective* nature of mentation as an emergent phenomenon, a collectivity that was more than a universal in relation to a particular, or an inductive generality over the facts on which induction takes place. Contrasting his views with that of Karl Popper’s emergentist embrace of indeterminism (which Sperry thought anti-science), Sperry went out of his way to emphasize the deterministic foundation of his own approach: *In contrast to Popper, I hold that every time the elements of creation, whether atoms or concepts, are put together in the same way under the same conditions, that the same new properties would emerge and that the emergent process is, therefore causal and deterministic*⁵. This was an important qualification of emergent novelty for it suggested that emergents were not radically new every time they appeared. Sperry insisted, however, that novelty comes about by way of the *macro-determination* of higher level emergent mental properties onto lower level brain processes, emergent wholes operating as causal agents (we’ll return to the important issue of macro-determination below). Holding macro-determination to be an obvious and undeniable feature of consciousness, Sperry placed it as the rallying cry of his brand of emergentism.

Again, holding to what he thought was a strictly scientific use of the idea of emergence, Sperry was not only cautious to distinguish his own species of emergence from Popper’s, he also denied one of the main tenets of the various spiritualized versions of emergence: “Consciousness in my view is strictly a property of brain circuits specifically designed to produce the particular conscious effects obtained from different brain regions. On these terms I see no way in which the consciousness of individuals could become coalesced into a metaconscious experience of humanity as a whole”⁴. Sperry was here rejecting those spiritualized interpretations of emergence found the Emergent Evolutionist John Boodin’s emergent harmony of the spheres or Pierre Teilhard de Chardin’s omega point.

Nevertheless, a distinctly spiritual perspective can indeed be detected in Sperry’s emergentist perspective since, very much like the spiritual side of the Emergent Evolutionists, Sperry believed that evolution involved a gradual emergence of “increased directedness or purposefulness and meaning” among the laws that guide living organisms. Sperry saw his view of emergence as bringing about a compromise between materialism and mentalism, and between determinism and free will. We can see that Sperry here was following the classic emergentist position of steering between mechanism and vitalism. Indeed, there was a lot at stake in his doctrine of emergence just as there was for Whitehead: a revolutionary way of thinking that would insure meaning, purpose, dignity, and choice, values not given adequate credit in a purely mechanistic framework.

Downward causation/macro-determination

Sperry’s emergentist neuroscience addressed the issue of *downward causation*, the notion that the higher emergent level has causative or determinative effect on the dynamics of the lower level. This claim of downward causal efficaciousness was one of the arguments which emergentists turned to in order to answer their critics’ disparagement of emergents as mere epiphenomena. For instance, the emergentist metaphysical system of Whitehead held (in Whitehead’s recondite way of putting it), “[because of the] generic morphology of the internal relations which bind the actual occasion into a nexus and which bind the prehensions of any one actual occasion into a unity, influence seems to propagate downward in levels...a modification of a descending series of parts”⁶.

Downward causation was not offered as a magical, emanationist type of influence downwards, instead what the idea of emergence brought into the picture was the need to be cautious when evoking causation, remaining cognizant of the conceptual difficulties that arose when dealing with levels and directionality of influence. It is assumed in downward causation that there is a clear enough distinction between levels that it can be claimed the higher one can be causally determinative of a lower level. However, in the case of complex systems, levels may not be prone to such crisp distinctiveness after all⁷.

According to the emergence oriented chemist and philosopher Michael Polanyi⁸, downward causation was also thought to be a property of individual minds in the sense that the mind could supposedly interfere with the motions of molecules such as when a mental state could evoke a physical state as in a male’s sexual fantasy leading to an erection—for Polanyi this potency of the mind was a case of the need for new laws of nature that would eventually reveal how consciousness could do such things. Employing his own argument from Gödel and Turing, Polanyi⁸ contended that mentation was *sui generis* above and beyond mere mechanical explanation but nevertheless could influence material objects, e.g., mind capable of sorting out random impulses of “ambient thermal agitation”.

For the action of downward causation, Sperry preferred the term, “macro-determination” of the emergent mental on the physical. Mental states, from their perch on a higher, macro-level could, like an eddy channeling water molecules, causally affect the “flow

pattern of neural excitation” at the lower, micro-level. An example was the phenomenon of subjective pain on the part of a rat which caused it to raise its right foot and lick the painful areas where there’s a cross union of sciatic nerves and branches. For Sperry, it was specifically the new way in which the emergent whole was now organizing its parts that conferred on this whole its special causal potency. For Sperry, macro-determinism thus began to be superimposed upon micro-determinism from the earliest stages onward and grew by a compounding process into increasing prominence as evolution progresses. Micro-determinism is retained but is held to be incomplete, insufficient and thus needed to be encompassed and superseded.

Two things are worth emphasizing about Sperry’s formulation of macro-determination. The first is that the novelty of the macro-level was defined, *temporally* in relation to what “previously did not exist”; thus it was diachronic emergence Sperry was theorizing about. Sperry, though, was careful to warn that the macro-determinative influence did not so much disrupt or intervene as *supervene* on the micro-level⁷.

The philosopher William Hasker has pointed out an apparent contradiction in Sperry’s warning: how can the macro-level determine the lower ones if it does not intervene on them as such? To address how such a thing was possible, Sperry offered the example of a rolling wheel in which a molecule of metal within the wheel retains its “usual inter-molecular relations within the wheel” yet from the standpoint of an observer this same molecule is being carried along a particular pattern traced by the moving wheel although there is no “reconfiguring of molecules relative to each other within the wheel itself”. Hasker argues this wheel analogy was particularly unenlightening for two reasons. The first is that if consciousness was to make a difference on the micro-level, it would necessarily have to make this difference in the internal functioning of the brain, i.e., the internal relatedness of the parts which was quite different than what occurred in the case of the rolling wheel. The second is that the macroscopic movements of a wheel are entirely explicable in reductionist terms.

Although Hasker’s points are well-taken, it appears to me that the real problem had more to do with Sperry’s overly simplistic example of the rolling wheel. Sperry himself was cognizant of the complexity of the mind and brain, seeing the latter as a hierarchy of nested parts and wholes, “...the nuclear and other subatomic elements are pushed and hauled about in chemical interactions by the enveloping molecular properties. In the same way the properties of the brain molecules are enveloped by the dynamics of the cellular organization, and the properties of the brain cells are in turn superseded by the larger network properties of the circuit system in which they are embedded”⁴. Moreover, top level cerebral processes and properties can supersede those of the various subsystems they embody, and only *some* of the dynamic holistic properties that emerge in the higher levels of cerebral activity are conscious phenomena. Many others are not, even though the unconscious activities may in some cases be equally or more complex. Complexity alone is not, in our scheme, the source of the complex qualities. It is the operational function rather than the complexity of any given cerebral process that determines its conscious effect⁴. A mutual interdependence or feedback was recognized to exist between neural events and emergent mental phenomena, another factor muddying the waters against a too simplistic account of what Sperry was up to.

Mario Bunge¹⁰, otherwise sympathetic to, in fact, even a proponent of his own variety of emergentism, has contended that talk about downward causation or macro-determination makes a category mistake by thinking wholes could act on their parts while in actuality, a level “is not a thing but a set and therefore a concept...levels cannot act on one another. In particular the higher levels cannot command or even obey the lower ones. All talk of inter-level action is elliptical or metaphorical”.

Juarerro⁸, though, points out that biologists with a system orientation can disagree with Bunge on this point such as Howard Pattee’s Hierarchy Theory which holds that if one thinks of causal influence in terms of one system acting on another then Bunge’s point is well-taken. If that was what Sperry meant, it could easily lead to a kind of science fiction scenario something like brains in vats where consciousness has some kind of weird occult force on the enthralled technicians attending to their needs. However, Sperry was too sophisticated a thinker than that, and, notwithstanding certain of his less-than-apt metaphors to describe what he was getting at with macro-determination, there may be more cogent ways of understanding this aspect of his thought. For Sperry, the cognitive revolution in psychology and neuroscience was to be taken as evidence that a macro-determinative approach would all but supplant the old micro-deterministic approach although some elements of micro-reductionism would be retained. In Sperry’s emergentist metaphysics.

Conclusion: What is consciousness that it can be emergent?

Holding consciousness to be an emergent phenomena has not become an uncommon tenet in neuroscience and philosophy at least since Sperry first proposed it. As we’ve seen, Sperry theorized that mental states were organized into unified “configurations”, “synthetic wholes”, analogous to an eddy channeling water molecules, which bestowed the property of “downward causation” from higher to lower levels^{11,5}. This is not a surprising theoretical move given the putative *sui generis* and irreducible nature of consciousness, a point of view which has received a great deal of brouhaha lately. The Australian philosopher David Chalmers refers to this state of affairs as the “hard problem of consciousness”, that is, how qualia or “raw feels” are apparently not explicable by appeal to third person, non-experiential constructs¹².

No doubt the awareness that we are aware or having any experience at all can stun with a sense of wonder or awe. Just a moment’s reflection on the matter though can soon yield to another puzzlement: what exactly is this consciousness or sense of qualia that we are experiencing? This becomes an even larger quandary when we add emergence into the mix and claim

consciousness is emergent. What exactly is it that we are supposed to imagine as being emergent and what does it add to the picture to say it is emergent?

We must possess some common understanding of what consciousness is if we are to understand what this consciousness is that is said to be emergent. Do we need to move beyond the everyday usage of consciousness when we investigate consciousness as emergent. For that matter what exactly is this everyday usage? One way to understand consciousness refers to each momentary awareness or each instance of qualia. But some commentators on the nature of consciousness have held the position that consciousness is not just that kind of “bare” awareness of qualia but is more plausibly that awareness which “accompanies” each instance of qualia. However, this way of putting it only serves, at least to me, in rendering things even more obscure for what does “accompanies” signify here; does it mean there is some ethereal “transcendental ego” hovering over or behind all acts of experience?

Or, maybe, consciousness is the sum total of all such states of awareness. But how should this be taken? Are we here talking about the very tricky issue of a continuing sense of personal identity or that enduring self which somehow “contains” all the instances of states of consciousness? If we are out paddling a canoe on a beautiful mountain lake, just how different will our state of consciousness be in five minutes from now? Won't our identity persist while canoeing? Or are we and our consciousness just a little bit different than before the experience? But if different, what does that do to the exclamation that consciousness is emergent?

Is what is supposed to be emergent, our sense of *self-consciousness*, i.e., the awareness we have of being aware when we are experiencing qualia? An awareness of awareness? Or, an awareness of awareness of awareness? (That this kind of recursive “reflexivity” seems to never end was actually used by the great German mathematician Richard Dedekind to illustrate and “prove” a sense of infinity¹³).

But then what about the “pure consciousness” that meditators claim to experience?. What about the meditative traditions in Hinduism and Buddhism such as several of the eight consciousnesses found in the Yogacara school of Buddhism; or the nature of the true Self, the Atman, the “pure consciousness” found in Advaita Vedanta)? Is this putative “pure consciousness” what is emergent? But then what does it emerge from? Ordinary consciousness? But what is that, and around and around we go.

We are forced into the question: is consciousness, whatever it is, even the kind of thing that it makes sense to say is emergent? I don't think it is because whatever consciousness may be taken as being, isn't it just too encompassing, too ubiquitous in scope in the sense of always being present when I or you are experiencing, thinking, whatever, that the label of emergent or non-emergent just don't seem appropriate? For if we grant that consciousness is emergent, why should we also at the same time not claim that being, or “being-itself” (a phrase apparently much preferred by existentialists, along with Medieval Scholastic metaphysicians, but which I personally don't see how adding “itself” as a suffix helps in any way for illuminating what being is supposed to be) is emergent?

Maybe it makes more sense to conclude that instead of being emergent, consciousness is somehow foundational, the expression of an Ultimate Reality since consciousness is ever present whenever we are existing. In that way, consciousness is identical to just our state of beingness. As far as I can tell, all the talk about consciousness being emergent is a futile exercise not because its purported profundity confounds our merely mortal minds but instead because it includes terms, relations between terms, and assumptions that are simply too riddled with ambiguity, equivocalness, and possibilities of conceptual contradictions. It is only if these issues about consciousness can be settled (which I doubt), would it make sense to even consider entertaining consciousness as emergent.

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