PHILOSOPHICAL IMPLICATIONS OF EMERGENCE

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Is there nothing new under the Sun? Consider the great variety of complex structures and patterns of activity that have appeared over time within the 13.7-billion-year-old universe – physical, chemical, and (much later) biological and psychological. Is there reason to say that all such systems are, at bottom, nothing more than atoms in motion? This question has been with us, unresolved, ever since the seventeenth century, when the strongly anti-reductionist philosophy of nature handed down from the ancient Greek Aristotle was displaced by the successes of the new mechanical philosophy. Aristotle theorized that plants and animals are irreducible wholes whose behavior is governed in part by organizing principles wholly separate from those governing inanimate matter. By contrast, according to the mechanical philosophy, all physical processes (whether in or out of living systems) are describable and predictable, in principle, in terms of laws of motion governing their basic parts.

Obstacles to simple versions of the mechanical philosophy soon became apparent, but the basic “reductionist” vision of the natural world as fully describable and explainable solely by reference to the properties and forces that govern the world’s most elementary constituents was embraced (and continues to be embraced) by many thinkers. Physics Nobel laureate Steven Weinberg (1993) is the most prominent contemporary scientific advocate of reductionism. In contemporary philosophy, advocates of a generally reductionist conception are David Armstrong (1997) and David Lewis (1986: Introduction). Alexander Rosenberg (2006) and Jaegwon Kim (1998) defend reductionist views with respect to biology and the mind, respectively. Opposition to this vision was generally rooted in its perceived inability to explain the human mind. The proposed alternatives to austere reductionism were often equally extreme. In the mind–body dualism of Descartes and his followers, minds are wholly distinct substances from bodies, possessed of their own causal powers, which include the power to affect and be affected by bodies (more specifically, the brains that inhabit the bodies that “belong to” individual minds in a happy but theoretically strange “monogamy”). Others, unsatisfied with the bifurcation of the
world into two radically distinct kinds of substance, which have seemingly inexplicable tendencies to interact in such monogamous pairings, ran the reduction in the opposite direction: It is the category of body that is reducible in the end to that of mind (more exactly, to collections of “ideas” or particular perceptual states, such as your present visual state as you read this text). Such was the famous proposal of the eighteenth-century “idealist” philosopher George Berkeley and then, in more radical guise still, David Hume.

As the “special” sciences of chemistry, and later biology and psychology, began to develop and mature, it became clear that the structures and processes that are the focus of these domains could be rigorously studied in terms having nothing to do with those of basic physics. Purely biological concepts and laws could powerfully describe biological processes completely independently of any appeal to physics. Beginning with John Stuart Mill, the sensible middle-ground position came to be occupied by those adopting the general philosophy of “emergence,” according to which “new” properties and laws “arise out of” certain types of physical arrangement, something that could not have been predicted in advance on the basis of the more fundamental physical principles, but instead must be accepted “with the natural piety of the investigator.” Important philosophical emergentists in this mostly British tradition up through the first third of the twentieth century were Samuel Alexander, C. Lloyd-Morgan, and C. D. Broad.

Two factors were central to the demise of this robust scientific–philosophical tradition: First, there was no shared precise concept of emergence. Instead, different thinkers gave their own gloss to it, in ways that weren’t obviously mutually consistent. As a result, it seemed to be a rather vague philosophical viewpoint rather than a concept that could be made rigorous and potentially tested in relation to quantified theories. (It didn’t help that the notion of emergence these thinkers were attempting to articulate was a species of a more general stance of “holism” that was developed in an anti-scientific direction in the philosophy of Hegel and the Absolute Idealists of the late nineteenth century.) Second, and even more importantly, a couple of spectacular scientific successes of the twentieth century seemed to provide direct evidence against emergence as these thinkers conceived it. Common to all the emergentist views of this era was a neatly “layered” understanding of nature: There are discrete and isolated strata or levels within the most complex systems found in the natural world; each level features a unified system with its own same-level properties and special laws governing their co-evolution over time. The first major blow to this picture came in the 1920s with the advent of quantum mechanics, which was able to explain the basic properties of hydrogen, the simplest chemical atom, in terms of the arrangement and properties of its sub-atomic constituents. And in the 1950s, Watson and Crick uncovered the double-helix structure of DNA, a key part of a successful program of analyzing the phenomena of life in more fundamental electro-chemical terms. In each case, properties of a special science were seen to encompass complex phenomena involving “lower-level” entities, thereby puncturing the hermetically sealed “layers of nature” postulated by the British emergentists.

Does this kind of evidence from twentieth-century science – the two mentioned are merely prominent instances of a whole raft of confirmed data pointing in the same general direction – decisively or strongly confirm the reductionist view? Many
suppose so, but this judgment rests on a conflation of the general concept of emergence with the particular account of emergence proposed by the British emergentists, an account that appears unnecessarily crude in hindsight. They thought in terms of relatively insulated layers in nature, whereas we now know that “lower-level” processes often directly impinge upon, and partly regulate, those at higher levels. (One need think only of the subtle chemical influences on mood and cognition that the work of recent decades has revealed.) But emergence need not be yoked to the simple picture of earlier theorists: It is quite possible that higher-level features of a system have a “downward” causal influence on the evolving microstructure that sustains them, even as the lower-level processes play a vital dynamical role in the way emergent processes themselves unfold. In other words, we should replace the picture of mostly horizontal, or same-level, causal patterns within each level with one in which there is a complex web of myriad upward and downward causal influences that jointly determine the system’s evolution through time (for a defense of this view, cf. O’Connor and Wong 2005 and Murphy et al. 2009). Nothing in the successes of the more fundamental sciences in illuminating some higher-level phenomena precludes the applicability of this more subtle sort of emergentist framework.

There is a tendency, especially for scientists, to conflate what we have reason to believe is the case with what we have methodological reason to take as the most fruitful starting hypothesis. Even if the mental is emergent from the physical, if you wish to understand the details of just how mental features emerge, and the difference they make to the overall functioning of the organism, you must have a thorough understanding of the purely physical processes from which they emerge. Thus, in practice, you should push a reductionist approach as far as you can, thereby isolating any emergent features there may be, allowing for highly specific descriptions of their character and function. But your typical scientist, unlike the philosopher, does not spend much time thinking about what will turn out to be true at the end of scientific inquiry. (Terrence Deacon, co-author of Chapter 18 in this volume, is one of several exceptions to this broad generalization.) Rather, she is thinking about what working hypotheses are most useful in advancing current understanding of a specific domain.

Furthermore, it seems to many of us that emergence is no mere theoretical possibility: The nature of animal consciousness and, perhaps, mentality more generally appear to be spectacular counter-instances to the program of reductive analysis. Despite the enormous strides in neuroscience since its infancy in the 1950s, no-one has a clue when it comes to understanding these mental phenomena in reductive physical terms. It remains a mystery how our highly structured neural architecture gives rise to subjective experiences, thoughts, and feelings. The situation seems unlike that facing biologists in the early twentieth century. Lacking a good understanding of the biochemical mechanisms that sustain life, some scientists of that time were willing to countenance the idea that some or all biological properties are not reducible to anything more fundamental. At the present time, there is a great deal of information concerning basic neural mechanisms underlying the complex operations of the human brain. And the obstacle to reduction of psychological phenomena is not our relatively impoverished understanding of how low-level mechanisms together give rise to more complex functions directly tied to subjective experience. It is that (ignoring the eliminativist’s radical suggestion that we lack direct acquaintance with
our own experiences) the development of increasingly sophisticated models of more complex functions doesn’t seem to take us any closer to the goal. Conscious experiences continue to appear to be altogether different kinds of phenomena, intrinsically, from those of electrochemistry. I join some other philosophers in suggesting that it’s time to abandon that reductionist dream in favor of an emergentist understanding, on which the appearance of new basic properties within certain neurally complex physical systems must be accepted, as Samuel Alexander put it, “with the natural piety of the investigator.” It is a fundamental fact, which may nevertheless be fruitfully studied and eventually explained in detail in non-reductive fashion – by spelling out the basic inventory of emergent properties, detailing the precise conditions under which physical systems give rise to them, and isolating the precise behavioral impact their presence has on the system.

As noted, there are a variety of ways in which people have sought to characterize emergence (see O’Connor and Wong 2006 for a survey.) Philosophically, the most significant understandings are those that challenge the claim that the micro-physical realm is “causally closed” or “complete,” with no high-level properties directly affecting micro-physical phenomena. On closure-denying emergentism, emergent properties are basic properties no less than are negative charge or mass (if current physics holds up). As such, they make a non-redundant causal difference to how the world unfolds. Only this strong conception of emergence can underwrite certain metaphysical claims about the reality of (at least some) composite systems and the explanatory significance of the laws that appear to regulate them, including especially the complex systems that are human persons. (For discussion see O’Connor and Wong 2005; O’Connor and Churchill 2010.) This understanding of emergence is different from that of Deacon and Cashman, who propose that we think of emergence not in terms of the addition of basic laws or propensities, but rather in terms of specific forms of absence – increasing systemic constraints that preclude many forms of physical possibility present in unorganized matter, possibilities that would lead to systemic dissolution. There can be no question that this alternative perspective captures something important, even revolutionary, to our modern understanding of complex systems. But one may well question whether the reality of “increased constraints” emergence in nature will suffice for addressing every sort of philosophical concern.

For example, a basic metaphysical question that philosophers ask concerns the relationship of parts and wholes. Do wholes really (fundamentally) exist at all, or is our reference to them a mere convenience, a useful fiction for referring to what is but a swarm of particles obeying completely general laws of physics that have led them to collate in a stable bonding relationship? Look down at this book. Is there really a composite object in addition to all the sub-atomic particles “arranged book-wise”? Why should we say that if everything concerning the trajectory those particles trace through space and time can be fully accounted for without mentioning any composite object that is [allegedly] the book? Of course, looking at the world in a less fine-grained way – those of chemistry, biology, and psychology and other social sciences – is useful, indeed necessary, to beings like us and discloses interesting patterns that one can’t see when peering at the behavior of fundamental particles and fields. Not seeing the forest for the trees, and all that. It’s just that, strictly speaking,
it appears to be dispensable. Another way to get at what’s behind the question is this: when God (a being not subject to our rather severe limits of perspective and computation) counts up all the physical objects in the universe, does he have to count the book in addition to all the particles that at any time have constituted the book? If you say yes, why should he not also count the book-plus-your-right-ear? That sounds absurd, of course, but wherein lies the difference, exactly? Some simple answers may occur to you, but careful reflection shows that it is very hard to draw a relevant distinction between the book and such arbitrary “scattered” objects as the book-and-right-ear – unless there is reason to suppose that the book, unlike the other candidate object, does fundamental causal work, that is, unless the book “earns its keep.” I don’t see that this condition is satisfied by Deacon and Cashman’s increasing-constraints analysis of complexity generally. That may well be a necessary condition on a complex system’s earning its keep, but it does not suffice.

The need for a stronger variety of emergence is even clearer when we move from the general case of parts and wholes to the particular case of human beings and the ever-changing parts that compose us. We see human beings as having a special dignity in nature as autonomous (self-directed) agents; as being properly subject to moral appraisal; and as having moral worth, such that imposing harm or death on human beings is, in most circumstances, a grave moral wrong. Again, it is very hard to see, from a clear-eyed metaphysical point of view, why these things should be true if human persons do not, in the final analysis, make any fundamental difference to how the world unfolds. Our authors contrast freedom of agency with unrestricted causal possibility. But this is a false choice: freedom of choice does indeed require the ability to harness physical forces in specific directions, but it also requires the openness of the future to real alternatives. We need the right kind of causal indeterminacy and the ability to exploit the opportunities it presents in a goal-directed way (cf. O’Connor 2000 for my own views on the subject).

A third way in which emergent properties are relevant to the concerns of philosophy is one we noted at the outset: Emergence provides a satisfying way to underwrite the fundamental unity of the universe, avoiding the extremes of reductionism and mind–body dualism. Both extremes have long seemed philosophically unsatisfactory: reductionism, because it appears to be inconsistent with the distinctive character of our mental life – the qualities of mental experience seem quite unlike physical qualities as disclosed by science, and there is an irreducible subjectivity, or point of view, associated with being a subject of experience – and the special significance we attach to humans and other conscious animals; mind–body dualism, because it seems incongruent with facts about the deeply embodied nature of animal mentality, as reflected, for example, in the way that psychological maturation is tied to the process of gradual biological development. On closure-denying emergentism, as on increasing-constraints emergentism, there is no distinct entity which is the human or animal mind. Instead, we are complex biological systems that undergo processes that are partly distinct from, though causally sustained by, the biological, and specifically neurobiological, processes of the living organism.

Finally, I note that an emergentist vision of human beings has relevance to the philosophical–religious question of the possibility of survival of death. If reductionism were true, survival of death is hard to envision: When I die, my body will decay and
my constituting particles will scatter throughout the biosphere, possibly entering other human beings. Emergence (like mind–body dualism) opens up some possibilities concerning survival of death, though it takes a bit of imagination (cf. O’Connor and Jacobs 2010).

At the same time, adopting an emergentist perspective (as opposed to a stronger sort of mind–body dualism) further enables a conciliatory attitude between science and religion. On the one hand, it avoids positing a this-far-and-no-further attitude to the attempt to attain a thorough scientific understanding of the fundamental processes that make up the ongoing lives of the remarkable animals that are human beings. On the other hand, it also serves to remind one of the very partial and ongoing nature of scientific inquiry, encouraging the humility and open-mindedness characterizing the scientific spirit at its noblest. There remain wide-open, religion-friendly possibilities concerning the nature of the human mind, and any conclusive scientific pronouncements on them are likely a long way off.

References


Further reading

Jordi Cat gives a masterful, detailed overview of issues and perspectives concerning the relationship among the sciences in “The Unity of Science,” Stanford Encyclopedia of Philosophy, 2007, http://plato.stanford.edu/entries/scientific-unity/. There are three excellent collections of contemporary essays on philosophy of mind that explicitly treat reductionist and emergentist themes: Carl Gillett and Barry Loewer, Physicalism and Its Discontents (Cambridge University Press, 2001); George Bealer and Robert Koons (eds), The Waning of Materialism:
New Essays (Oxford University Press, 2010); and Graham and Cynthia Macdonald (eds), Emergence in Mind (Oxford University Press, 2010). For a representative collection of essays on the general topic of emergence over the past three decades, see Mark Bedau and Paul Humphreys (eds), Emergence: Contemporary Readings in Philosophy and Science (MIT Press, 2007). A good collection of new essays reflecting current debates is Antonella Corradini and Timothy O’Connor (eds), Emergence in Science and Philosophy (Routledge, 2010). For a wide-ranging mix of essays by scientists and philosophers addressing the theme of emergence in thinking about human action and moral responsibility, and doing so in the concrete terms of contemporary research in neuroscience and social psychology, see Nancey Murphy et al. (eds) Downward Causation and the Neurobiology of Free Will (cited above).