LEVELS OF ORGANIZATION IN THE BIOLOGICAL SCIENCES

Daniel S Brooks, James DiFrisco & William C Wimsatt

Reviewed by Mariam Thalos

Levels of Organization in the Biological Sciences
Daniel S. Brooks, James DiFrisco, and William C. Wimsatt (*eds*)
Cambridge, MA: MIT Press, 2021, £56.00
ISBN 978-0262045339

There is a massive amount of philosophical content in this dense volume of fifteen new pieces plus introduction. The collection results from the Thirty-Sixth Altenberg Workshop in Theoretical Biology, held in 2018 at the Konrad Lorenz Institute for Evolution and Cognition Research. As the editors—and organizers of the original conference—indicate, their guiding motivation throughout was to promote new work and to offer an appraisal of work on the concept of levels, which they felt was under-analysed in the fields of theoretical biology and philosophy of biology. Multiple collaborative efforts among contributors were encouraged, including extensive discussion, revision, and cross-fertilization of one another's work. The result, according to the editors, is a 'coherent vector of ideas' that emerge from this book.

Still, the so-called vector is not pointed in an entirely clear direction. The pieces in this book are not organized into sections. Still, there are reverberating themes. Some of the essays—sadly not grouped together—aim at offering foundations (or, as the editors prefer, 'foundational considerations') for a theory of levels, others are sceptical, and still others aim at fitting a levels ontology into a broader ontology and philosophy of science. Ideally, the volume could have been organized to bring out these themes better, and the authors encouraged to signpost more clearly the directions to which they are contributing.

It would be inappropriate to attempt in a very short space a summary of argumentations or engagement with all (or some of) the authors individually. Instead, I will content myself with providing a roadmap of the outlooks represented in this volume, with an eye to what is left out or looming in the larger philosophical conversations in which these fifteen pieces figure as new contributions.

As one of the editor-authors of this volume points out, there is something 'schizophrenic' in taking very seriously the movements of macro-variables as if they enjoyed an independent reality—which we all do as we encounter and manipulate them in real life and scientific laboratory settings, as well as implicitly in scientific writing—while all the time propounding a doctrine (as was done quite seriously for decades in the second half of the twentieth century, but increasingly more warily) to the effect that these variables play no truly independent role as movers and shakers of the universe. But what exactly is the problem here? And what would it look like, philosophically, if we gave up the pretence of their non-independence? These are the fundamental questions with which the authors in this volume engage, with a particular focus on the biological sphere.

In the 1970s, Herbert Simon ([1973]) presented a bewitching idea to guide engagement with this question. He asked: how does a highly complex world of diverse, self-organizing, and self-replicating things can come to exist? His answer, put roughly, is that it must be the result of 'platforms' or 'arenas' of relative stability in time.

Simon thought that certain important features of certain systems were left unaccounted for in analyses of the physical and chemical features of their building blocks—in accounts of the component parts taken together with the specific and heterogeneous interactions among them. His idea derives from his concern with building systems. The idea is that to build a complex system (as nature does), one proceeds in stages, with the result that at the end of each stage, what is constructed must possess a stable structure (so as to 'hold still' while the next phase of operation is being launched). Without these intervals or layers of stability, Simon thought that complexity is unsustainable. This makes complex systems typically (a) modular, (b) inter-substitutive in their parts, (c) qualitatively similar with a change to their parts or their number, and (d) stable under re-aggregations of parts. Simon is thus reaching for the idea that a system under control has to be governed by high-order structures of stability that are relatively independent of the sorts of interactions (physiological, chemical, mechanical, or what-have-you) that govern their parts more locally. One would therefore have to create a higher-order discipline of these dynamical realities.[1]

Simon was an engineer and not a biologist. But his idea has captured the imagination of philosophers of biology because it lays out a metaphysical insight: A true System, with a capital S—a category that comprehends all living things—is something special indeed, and one subject to higher-order laws regarding control and stability relations among its constituents—laws that are positively not specific to the materials composing it, and that in some regards appear to defy or anyway counter in the short term the edicts of the laws of thermodynamics. Collections of matter that do not hew to these Systems-general laws are collections that come apart in short order.[2]

Simon's bewitching idea seems to suggest that there must have been not just one but a series of such moments of general stasis, and that these are organized in nested or hierarchically related levels of complexity. The authors of the chapters in this collection seek to make sense of the so-called levels of organization in the living world, and to articulate philosophically the principles underlying such an organization, in some cases as they are reflected in the organization of the scientific disciplines. The editors have, in their own words, sought to 'embrace the diversity of usages [of the idea of hierarchy or levels of organization] as aspects of the big picture of levels of organization' (p. 1). And if the diversity of scholarship in this volume is any indication, they appear to have succeeded in this ambition.

A second ambition stated in the introduction is 'to offer foundational considerations for conceptualizing a common context with which to understand the status of "levels" in philosophy and science'. And to the extent that illuminating

diverse examples from the biological sciences can provide a 'common context', they have reached one of their goals. It remains to be seen whether this ambition flounders on the presumption that providing a common shared context is, as such, a win with respect to offering 'foundational considerations' on the subject of levels. Indeed, a systematic and organized discussion of the nature of such 'foundational considerations', and how they are to be aggregated and/or assessed, is nowhere to be found in this volume. Wimsatt's essay gives a catalogue of sorts, comprising a somewhat arbitrarily organized list of what would appear to be foundational considerations about the existence and nature of levels —a valuable inventory, to be sure, partially ordered by biographical notes. But the discussion does not make philosophical progress over and above a laundry list. It does not even rise to the level of providing the sort of taxonomy that Aristotle might have approved, by way of taking first steps.

Moving deeper into the volume, and still with regard to foundational considerations, the enthusiasts for levels in this volume fall into roughly three camps: (1) those whose considerations around levels are methodological and practice-oriented (Wimsatt, Brooks), (2) those whose considerations are broadly logical in nature (Woodward, aspects of Batterman, Love, and Baedke), and (3) those whose considerations are drawn specifically from biological sciences (Griesemer, DiFrisco, Gillett, aspects of Love, Baedke, and Umerez). A separate tranche of authors belong in what may be called the 'levels sceptic' camp. In this camp are authors whose estimation of the prospects of a useful shared common understanding of levels is very low (Potochnik) or whose evaluation of the prospects of any successfully consistent concept is very low (Eronen).

Returning to the levels enthusiasts in this volume, there is an apparently shared presumption among them that the concept of levels, despite challenges posed by lack of clarity, non-univocality, and the absence of other virtues befitting a philosophical concept, is ultimately productive for illuminating a certain idea: that the complexities of the world deserve better than a reductionist dogma. But what the volume as a whole fails to take seriously is the idea that levels may not be the only way of doing justice to those complexities. One cannot get all one's wishes granted by one genie; still, this bottle could have contained some gesture at (or simply mere mention of) alternative ways of doing justice to the complexities of the world without an explicitly levels-oriented conception. There are such non-reductive alternatives on the market: (Thalos [2013]) and (Wilson [2010]) are just a couple of prominent examples. Both employ the ('foundational considerations'-relevant) idea of 'degrees of freedom'.[3] Both offer rich foundations on which someone with instincts for declining levels might appeal to make sense of the complexities of living organisms, as well as the complexities of materials within a strictly physical science. (To be more specific, both speak of a core idea of reductions in overall degree of freedom as the key to understanding how macro-variables come themselves to number among the degrees of freedom in a complexly organized system.)

The editors also claim to have achieved a sort of consensus on the question of downward causation, particularly evident in Woodward's contribution. They declare a common perspective among the levels enthusiasts, endorsing the Woodward account of the legitimacy of so-called downward causation when articulated in terms of interventionist independence. Woodward's chapter argues that this version of downward causation does not fall afoul of any good causal reasoning. And, in particular, it does not imply the forbidden doctrine of 'parts' acting causally upon wholes. Of course, one may object in a variety of different ways to Woodward's account of interventionist causation, or to the idea that what is forbidden about downward causation is that it entertains positively the idea that parts may act on the wholes of which they are part. The population of scholars with one or both of these two reservations is surely quite vast. So it is not clear just how much of a win this is. It might perhaps have been more prudent for the editors not to have declared so soon a victory in this regard.

These points aside, the collection makes for a fresh engagement with the questions around reduction and emergence, with special focus—as one should most certainly exist—on biological systems.

Mariam Thalos
University of Tennessee Knoxville
m.thalos@gmail.com

Notes

[1] To be sure, Norbert Wiener ([1948]) had already advanced elements of such a discipline, but he had not done so specifically to solve the evolution of complex systems. A similar point may be made with regard to Howard Pattee's 1960's contributions to the idea of control hierarchy, on which Umerez builds in this volume.

[2] In numerous publications, I have referred to this idea as amounting to saying that a System is one in which the aggregation of the parts has undergone a reduction in degrees of freedom. Wilson ([2010]) uses similar language.

[3] To be sure the notion of degree of freedom, and even reductions in degrees of freedom, appear in Umerez's chapter, but no connections are drawn to attempts by these authors to do justice to complexity without levels. There is a reference to (Thalos [2013]) in the references section, but no mention of the work appears in the body or footnotes of the article. Wilson ([2017]) has some choice words about progress in philosophy that may be applicable to this 'oversight'.

References

Pattee, H. [1969]: 'Physical Conditions for Primitive Functional Hierarchies', in L. L. Whyte, A. G. Wilson and D. Wilson (*eds*), *Hierarchical Structures*, New York: Elsevier, pp. 161–77.

Simon, H. [1973]: 'The Organization of Complex Systems', in H. Pattee (*ed.*), *Hierarchy Theory: The Challenge of Complex Systems*, New York: Braziller, pp. 1–27.

Thalos, M. [2013]: *Without Hierarchy: The Scale Freedom of the Universe,* New York: Oxford University Press.

Wiener, N. [1948]: *Cybernetics, or Control and Communication in the Animal and the Machine*, Paris: Hermann.

Wilson, J. [2010]: 'Nonreductive Physicalism and Degrees of Freedom', *British Journal for the Philosophy of Science*, **61**, pp. 279–311.

Wilson, J. [2017]: 'Three Barriers to Progress in Philosophy', in R. Blackford and D. Broderick (*eds*), *Philosophy's Future: The Problem of Philosophical Progress*, Hoboken: Wiley, pp. 91–104.