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[Review of] *What Is a Complex System?* By James Ladyman and Karoline Wiesner. New Haven (Connecticut): Yale University Press. $35.00 (paper). xi + 169 p.; ill.; index. ISBN: 978-0-300-25110-4. 2020.

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What Is a Complex System?

By James Ladyman and Karoline Wiesner. New Haven (Connecticut): Yale University Press. $35.00 (paper). xi + 169 p.; ill.; index. ISBN: 978-0-300-25110-4. 2020.

The study of complex systems is relatively young but growing. And for good reason. Some of the most pressing fundamental and applied questions—from self-organizing swarms and galaxies to neural networks and pandemics—transcend scientific boundaries. Important topics spanning science, engineering, medicine, and public policy require complex systems thinking to understand interacting and emergent system properties and how to manage them. Yet, despite its obvious importance and utility, a formal curriculum in complex systems is not a part of traditional undergraduate or graduate training in the natural or social sciences.

This book is an excellent introduction to the topic. It is readable and accessible to college-level science education. Supplemental mathematical examples are available but not required. It provides a necessary overview and guidance toward important themes and tools in the study of complex systems that are not often offered to college students.

What is a complex system and how do we study it? This was the objective of this volume by science philosopher, James Ladyman, and physicist, Karoline Wiesner. In my opinion, they succeed in providing an excellent overview and introduction to the transdisciplinary study of complex systems by underscoring simple tools to study a diversity of complex systems.

"Measures of complexity are meaningful but measure different features of complex systems that manifest themselves in different ways" (p. 130). Importantly, Ladyman and Wiesner's approach to studying complex systems is focused not on the "complexities" of billions of interacting parts. Instead, they highlight principled approaches to study seemingly very different complex systems using relatively simple tools. Doing so can reveal striking similarities among systems offering ripe interdisciplinary transferability.

The authors suggest certain "truisms" of complexity:

1. More is different.
2. Nonliving systems can generate order.
3. Complexity can come from simplicity.
4. Coordinated behaviour does not require an overall controller.

5. Complex systems are often modelled as networks or information processing systems.
6. There are various kinds of invariance and forms of universal behaviour in complex systems.
7. Complexity science is computational and probabilistic.
8. Complexity science involves multiple disciplines.
9. There is a difference between the order that complex systems produce and the order of the complex systems themselves (p. 9).

Interestingly, they end with the "different conceptions of complexity of physicists, biologists, social scientists and others cannot be brought to a single framework, because the features of complex systems are many and take different forms" (p. 130). This is somewhat in contrast to the universal scaling framework by Geoffrey West and colleagues at the Santa Fe Institute, which sought to unify the study of diverse complex systems—from organisms to cities to the biosphere—using power law scaling, fractals, and metabolism. Yet, Ladyman and Wiesner suggest that "there are multiple frameworks, such as information theory, network theory and the theory of critical phenomena, that can be applied across the sciences" (p. 130). Understanding the practicalities and limitations of using these frameworks to highlight unique characteristics of particular systems (e.g., climate, pandemics, misinformation) may be key for policy solutions to our most pressing complex problems.

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