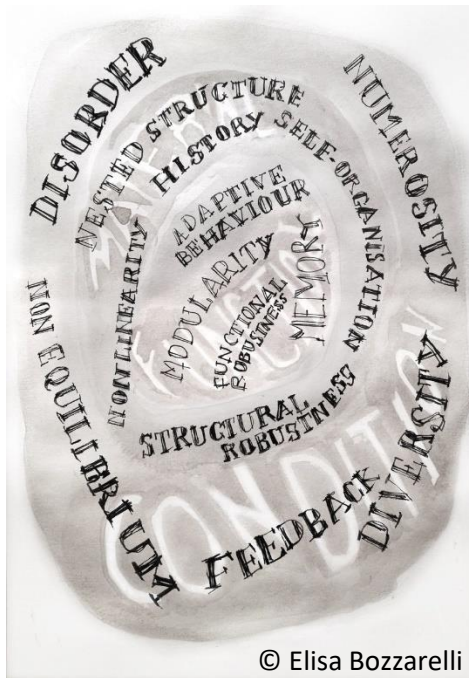


Understanding Complex Systems

Description

Prof. Karoline Wiesner's research focuses on the development of information theory to study the dynamics of complex systems. These systems are driven by stochastic internal dynamics and feedback and by external forces. The challenge is to understand and predict the self-organising structures that emerge from these microscopic, often unobservable multitude interactions. The discovery of universal mathematical laws, which are ubiquitous in physics, is now also possible in the non-physical sciences. Prof Wiesner's research is concerned with shaping the tools, from information theory and other areas of applied mathematics, to study the dynamics of natural and social complex systems.



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The research is rooted in the philosophy of science and complexity. A precise definition of terms such as self-organisation, emergence, and robustness make much of the research transferable to the social sciences.

Current topics

- Philosophical and mathematical foundations of complexity
- Information-theoretic measures of stability
- Information-theoretic tools for detecting critical transitions
- Complexity science framework to support climate change adaption and mitigation efforts
- Dynamics of democracy

Literature

- J. Ladyman, K. Wiesner, What is an complex system? *Yale University Press*, 2020
- K. Wiesner, J. Ladyman, Complex systems are always correlated but rarely information processing, *J. Phys. Complex.* **2021**, 2, 045015.
- T. Eliassi-Rad, H. Farrell, D. Garcia, S. Lewandowsky, P. Palacios, D. Ross, D. Sornette, K. Thébault, Karoline Wiesner, What science can do for democracy: a complexity science approach, *Humanit. Soc. Sci. Commun.* **2020**, 7, 30.

Applications

- System models
- Stability of social systems
- Climate crisis
- Evaluation
- Critical transistions
- Probandns

Keywords

- Complexity
- Mathematical foundations
- Information theory

Interest in cooperation

- Research-based collaboration
- Contract research
- Industry-sponsored research

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