



# CoCo Seminar Series Fall 2023

## Heterogeneity Extends Criticality

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Engineering, Binghamton University**

**Wednesday August 30, 2023 12:00-1:00pm EDT**  
**Hybrid (EB-T1 & Zoom; meeting link available on**  
**<http://coco.binghamton.edu/>)**



While studying rank dynamics, we have found a universal pattern across a broad variety of phenomena: more relevant elements change their rank slower than the majority of elements. Our hypothesis was that this temporal heterogeneity provides a balance between robustness (slow) and adaptability (fast) similar to criticality, but without the need of fine-tuning parameters. With this motivation, we have studied the effect of different types of heterogeneity (structural, temporal, and functional) in complex systems, and shown that each of these "extend" criticality. We have also used heterogeneity as a simple strategy to improve search algorithms. A question remains open: how to find "optimal" heterogeneity?

Carlos Gershenson is a SUNY Empire Innovation Professor at the Department of Systems Science and Industrial Engineering at Binghamton University. He is also an affiliated researcher at the Center for Complexity Sciences and Instituto de Investigaciones en Matemáticas Aplicadas y en Sistemas at the Universidad Nacional Autónoma de México (UNAM), where he was a research professor until 2023. He was a Visiting Scholar at the Santa Fe Institute, a Visiting Professor at MIT, Northeastern University and ITMO University. He was a postdoctoral fellow at the New England Complex Systems Institute. He holds a PhD summa cum laude from the Vrije Universiteit Brussel, Belgium, an MSc degree in Evolutionary and Adaptive Systems from the University of Sussex, and a BEng degree in Computer Engineering from the Fundación Arturo Rosenblueth, México. He also studied Philosophy at UNAM. He has more than 150 scientific publications in books, journals, and conference proceedings, which have been cited more than 7,000 times. He has a wide variety of academic interests, including artificial intelligence, complex systems, self-organization, artificial life, and philosophy of science, with applications to healthcare, transportation, governance, education, cybersecurity, and more. He is Editor-in-Chief of Complexity Digest, Associate Editor for the journal Complexity, and member of the Board of Advisors for Scientific American. He has received numerous awards, including a Google Research Award in Latin America and the Audi Urban Future Award. He is a member of the Mexican Academy of Sciences and the Mexican Academy of Informatics. He has worked in consulting, software and web development, teaching at undergraduate and graduate levels, science communication, and journalism.

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