Commentary on Professor Stachurski's Lecture

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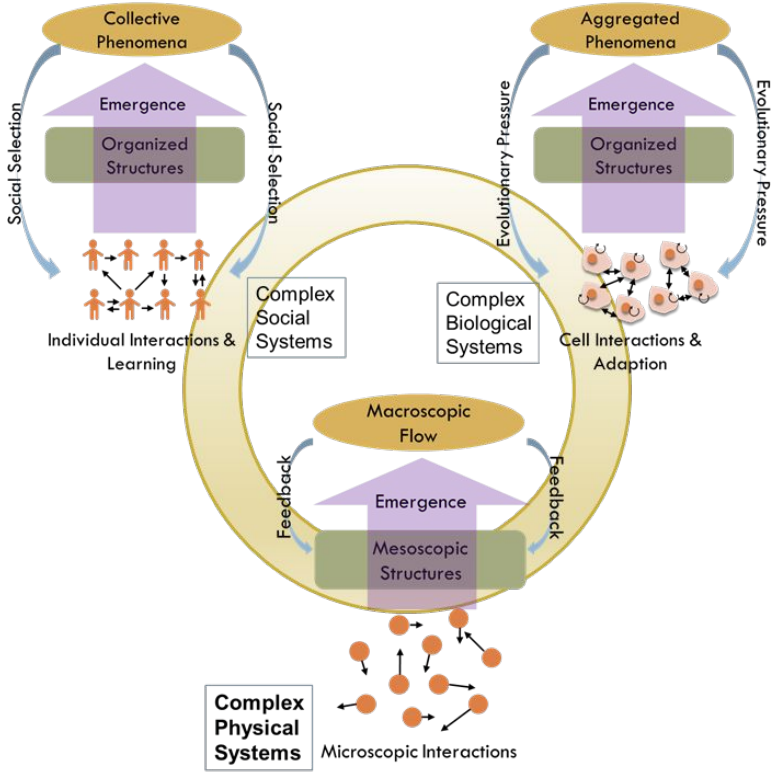
My Research Background

- Research field
  Simulation of Complex Systems
- Target systems
  - **Complex Physical Systems**
    Liquid-vapor flows, Leidenfrost boiling, Self-assembly of colloids
  - **Complex Biological Systems**
    Tumorigenesis, Aging, Wound healing
  - **Complex Social and Economical Systems**
    - Financial markets: Price fluctuations, Order book dynamics
    - Macroeconomic systems: Crises, Cycles, Growth of firms
    - Social and technological transitions: Low-carbon transition



Common hierarchical structures among different complex systems

One Comment: Economists' Pioneering Role in Science

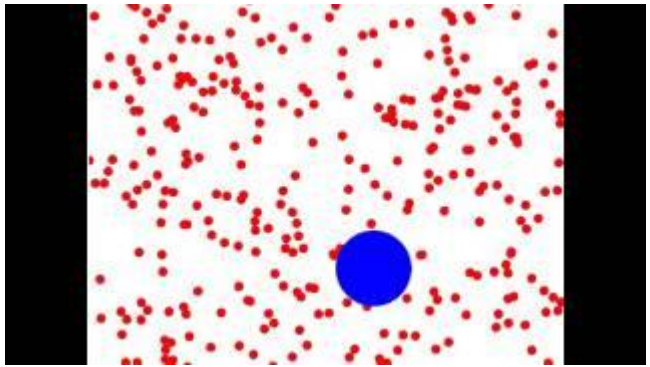
Louis Bachelier (1870-1946)

Inspired by Brownian motion he introduced the idea of "random-walk" to model the price of what is now called a barrier option
Ph.D Thesis (1900): "Théorie de la Spéculation"

Albert Einstein (1879-1955)

Worked out a quantitative description of Brownian motion based on the Molecular-Kinetic Theory of Heat
A Published Paper (1905): Investigation on the Theory of the Brownian Movement

*From Wikipedia



Simulation of the **Brownian motion** of a large particle, analogous to a dust particle, that collides with a large set of smaller particles, analogous to molecules of a gas, which move with different velocities in different random directions.

*From Youtube

Q1: On the Role of Scientific Computing in Economics

- Messages from Professor Stachurski
  - What are economists studying
    Booms and busts, Long run growth, Distribution of wealth, … etc.
  - Why economic studies need scientific computing
    Because economic problems are **inherently quantitative**, mathematical and computational modeling are **essentially required**
- My first question
  Could you please provide one or two examples of how large-scale scientific computing has been successfully employed to address a particular challenge in the fields of economics or finance?

Q2: On the Prediction of Economy

- Messages from Professor Stachurski
  - A successful **quantitative prediction** of a phenomenon, including those in economics or finance, demonstrates the **effectiveness** of the underlying mathematical model
  - The classic **Cobweb model**, when properly accounting for **human expectations**, can replicate fluctuations in hog prices within the U.S. market
  - Incorporating "adaptive expectations" into the model may help reduce price fluctuations
- My second question

  Is it possible that incorporating a more realistic representation of human expectations could push the Cobweb model into a chaotic regime? Given that chaotic systems are highly sensitive to initial and boundary conditions, would this make long-term predictions using economic models less reliable?

Q3: On Application of AI to Economics

- Messages from Professor Stachurski
  - Through a simple optimization example, we can observe the **limitations of computation** despite significant advancements in hardware, algorithms, and programming packages
  - Although artificial intelligence may not be able to solve most economic problems, it can still prove **helpful** to economists in tasks such as summarizing information (typically by using ChatGPT), **identifying patterns** in large datasets, and writing code efficiently
- My third question

  In computational fluid dynamics, emerging research is exploring the replacement of robust computations with surrogate AI solvers. Can we anticipate that AI might provide answers to complex economic problems if we forego understanding the mechanisms of economic phenomena?