A Complexity View of Institutions

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		Player II	
		C	D
Player I	C	(r, r)	(s, t)
	D	(t, s)	(p, p)

Complexity: Best of Both “Worlds”
Logic + Flexibility

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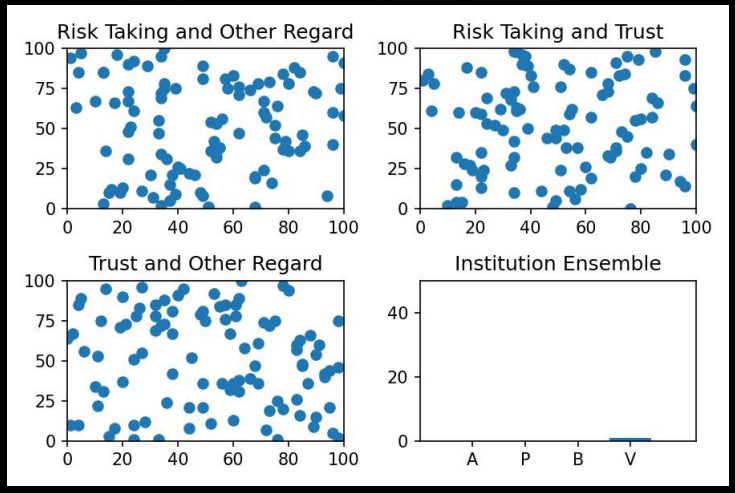


Ken Arrow & Brian Arthur, SFI, 2014

Source: https://sites.santafe.edu/~wbarthur/complexityeconomics.htm

Feature	Neoclassical economics	Complexity economics
Agents	Representative with 1,2,N or distribution of types	Diverse
Organizing principle	Equilibrium: Agent behavior consistent with aggregate outcome	Nonequilibrium: Agent behavior reacts to aggregate outcome
Metaphor	Well-functioning machine	Ecology: of forecasts, actions, strategies
What is faced by agents	Well-defined problem	Ill-defined situation
Behavior	Agents optimize	Agents face fundamental uncertainty, they try to make sense, explore
Structural Change	The equilibrium shifts	Novelty causes endogenous restucturing
Rationality	Perfect and boundless	Rationality usually not defined
Feedbacks	Diminishing returns	Increasing, as well as diminishing, returns
Time	Equilibrium is timeless	History and path taken matter
Dominant Theme	Allocation of resources	Formation of structures
System	Closed to new behavior	Open. System can be exploited
Methods used	Mathematics (quantities, incentives in balance)	Mathematics and computation (algorithmic and event-driven)
Temporary Phenomena	Excluded by equilibrium	Possibly emerge
Interaction	Homogeneous	Channeled by networks
Evolution of the Economy	Outcomes usually seen as in stasis. Not evolving	Economy self-creating. In perpetual novelty

Complexity Science and Institutions

- Elements
- Frames / Questions asked
- Tools
- Dynamic Models / Theories of Change
- Clarity of Prediction or Explanation
- References

Analytical Elements

- North 1990: “the rules of the game … humanly devised constraints that shape human interaction”.
- Analysis includes agents, preferences or goals, information, order of play, relations between agents, payoffs, etc
- May be formal or informal, ie norms
- Contain internal and external elements, ie beliefs and capacities
- Can include: locations / neighborhoods; limited cognitive capacity; heterogeneity / diverse populations;

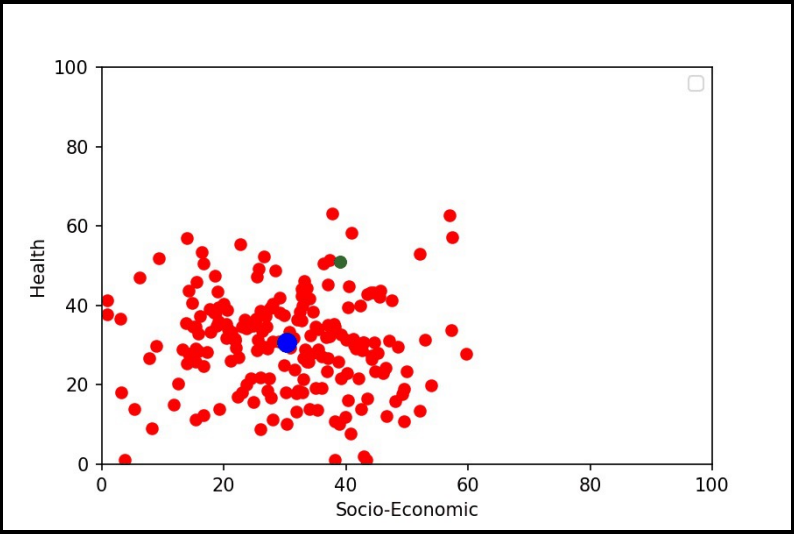
Frames / Questions Asked

- Standard GT fare: ie why do or don't people cooperate? How do you maximize utility?
- But also:
  - How do institutions affect one another's performance, and what is a theory to explain it?
  - What is path dependence? What causes it? What are its effects?
  - How can we understand emergent phenomenon (like culture), and what are the underlying causes?
  - What is the evolvability of an institution?
  - What makes an institutional system robust?
  - How does an institution affect social cohesion? Power?
- Key difference: dynamics, not equilibria / processes, not fixed points

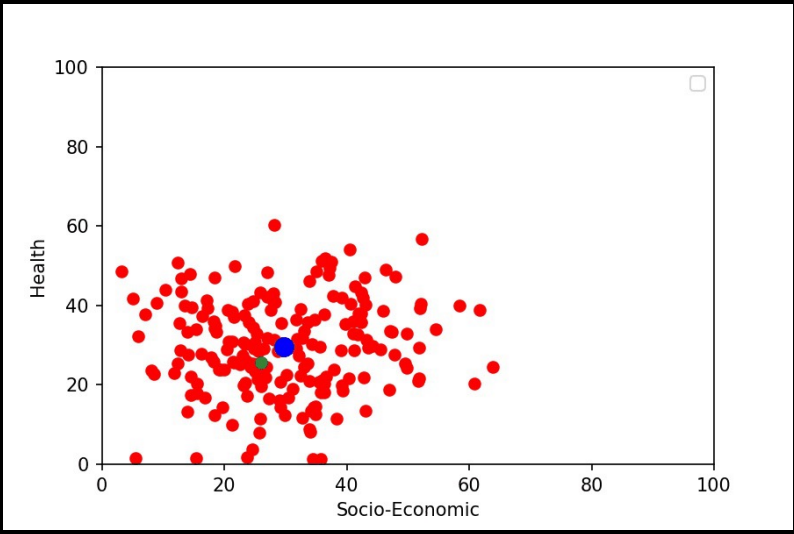
Tools

- All the standard math models
- But also:
  - Network analysis
  - Agent based models
  - Computational models
  - Systems Dynamics
  - Cellular automata / genetic algorithms
  - Biological models: immunology, ecology, genetics

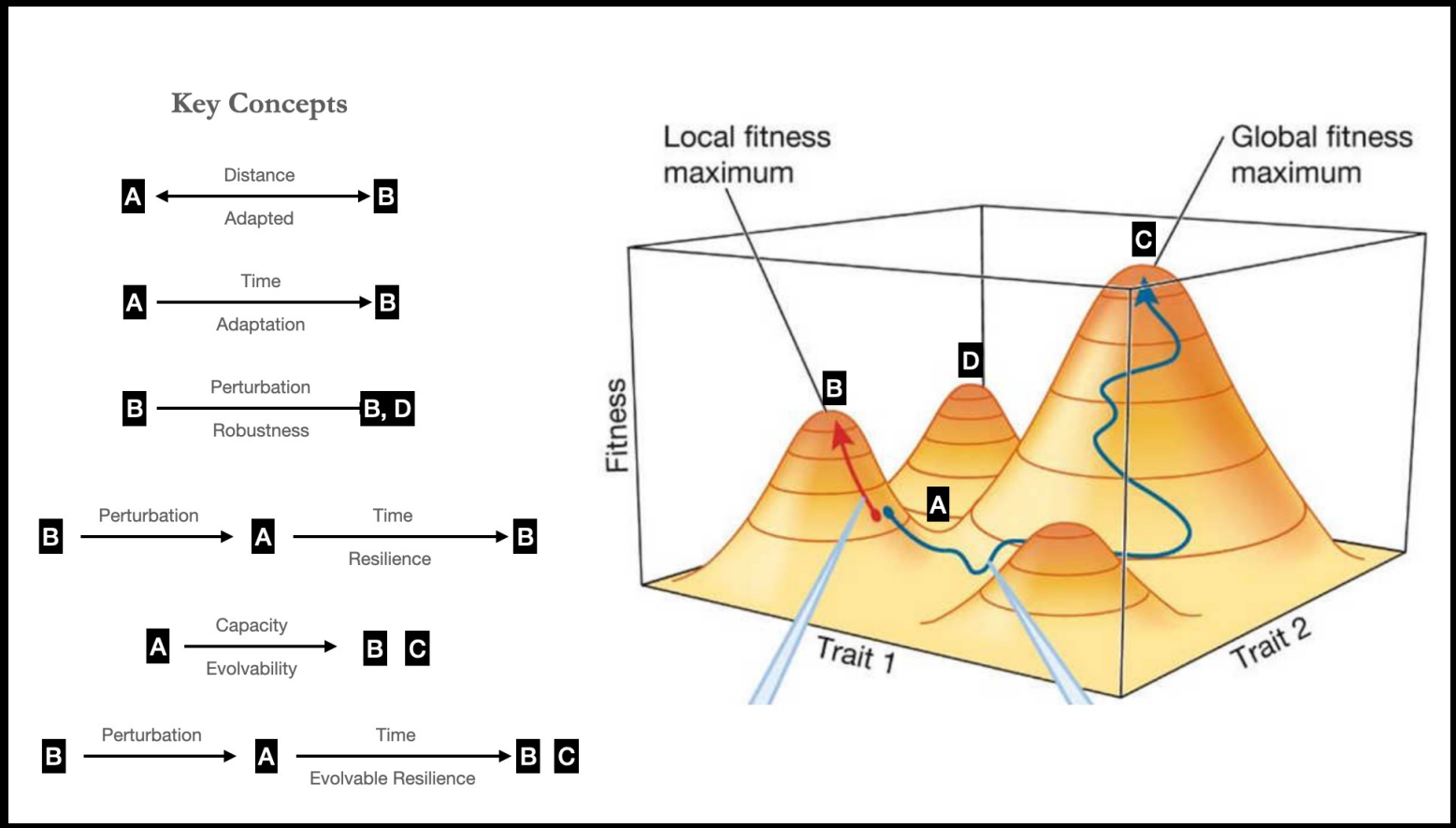
Dynamics / Theories of Change



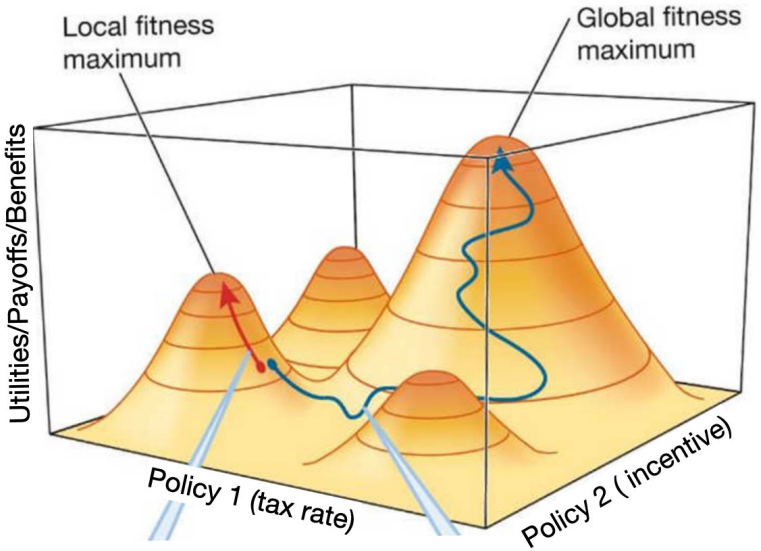
Linear



Complex

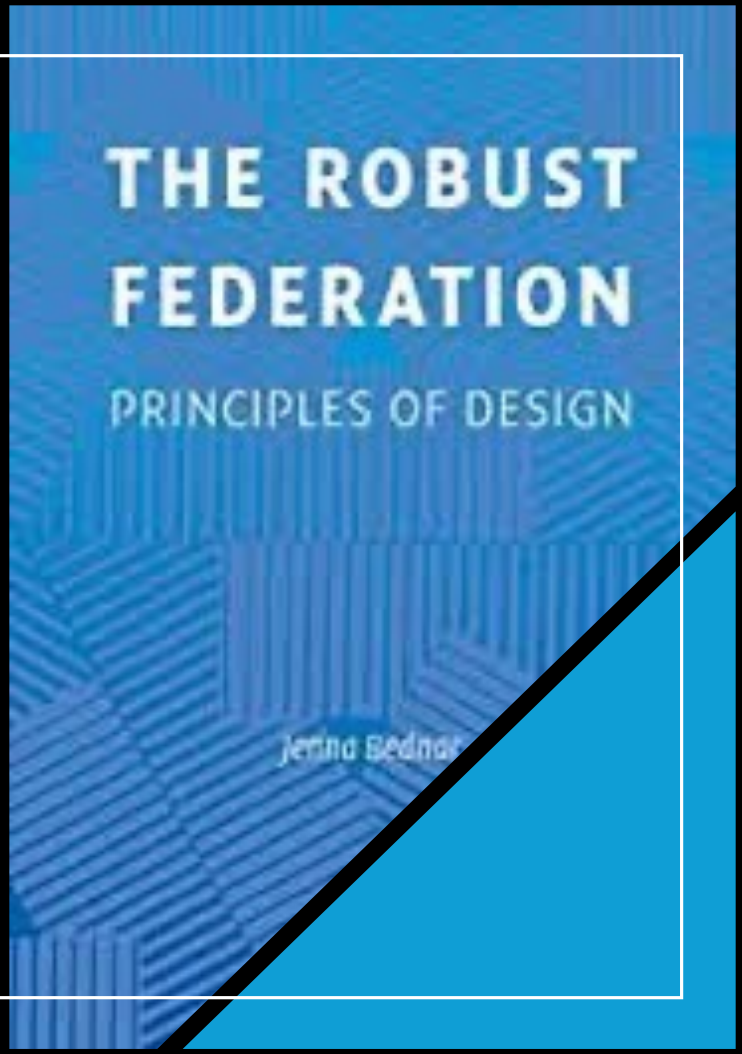


Source: Krakauer


Local fitness maximum
Global fitness maximum
Utilities/Payoffs/Benefits
Policy 1 (tax rate)
Policy 2 (incentive)

Ex: The Robust Federation

- Question: How are federal constitutions both strong enough to be meaningful and flexible enough to adapt to changing circumstances over time?



Robustness

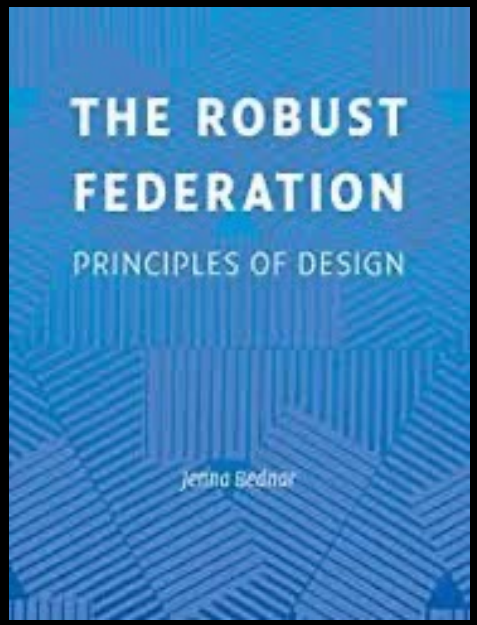
- Focus on functional continuity, minimize risk of functional failure
- Implies ability to recover from stress
- Functional continuity may mean structural adaptation
- Adaptation requires a means of exploration of alternatives and a method of change
- Interconnected systems prone to nonlinear effects including tipping and collapse

Robust System Design

- Principles: enable search, minimize / manage interconnectedness, facilitate adaptation
- Qualities: Redundancy, Modularity, Diversity
- MUST manage failure by managing the interconnectedness: the components of the system should fail for different reasons

The US Constitution created a robust institutional framework

- Robustness (not optimality): adaptive, maintain functionality
- Robust system design: redundancy, modularity, diversity
- Democratic system of safeguards:
  - Redundancy from overlapping instits, ie sep of powers, bicameralism, staggered elections, etc
  - Diversity from different aggregations of voters, sequential elections
  - Modularity from state and local authority



Bednar (2009)

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If the anti-tyranny system isn't robust the democracy will fail.

Sources of Failure / Correlation of Vulnerability

- Overly aligned party system
- System of personal loyalty
- Lack of adaptive mechanisms, including diverse input and exploration

- Diversity protects against these failures
- Federalism is a double security against these flaws

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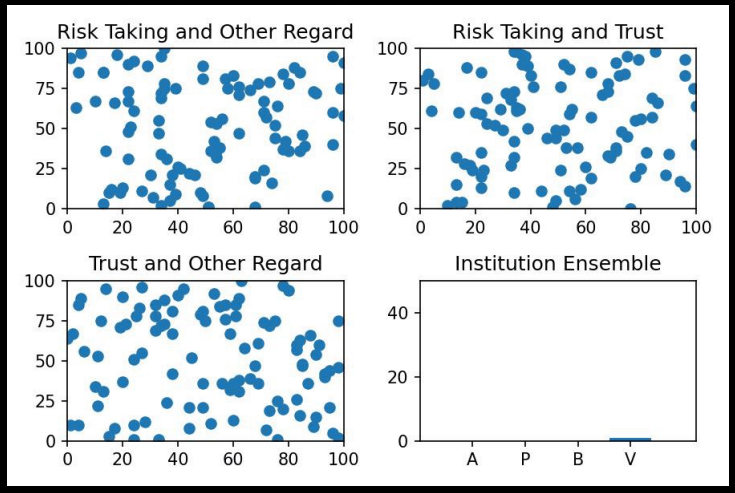

Want to dive in? Start here....

- Melanie Mitchell Complexity Explorer
- Model Thinker Coursera & Book
- Complex Adaptive Social Systems
- Harnessing Complexity
- Micromotives and Macrobehavior