

The Origin of Wealth

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HEEDNet Seminar
DEFRA 26 November 2007

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THE ORIGIN OF WEALTH

**Evolution, Complexity and the Radical Remaking
of Economics**



“The ideas of economists and political philosophers, both when they are right and when they are wrong, are more powerful than is commonly understood. Indeed, the world is ruled by little else.”

John Maynard Keynes

Today's discussion

- The three most stunning empirical facts in economics
 - Characterizing the economy – what is it?
 - The evolution of economic design
 - What does it mean?
-

Today's discussion



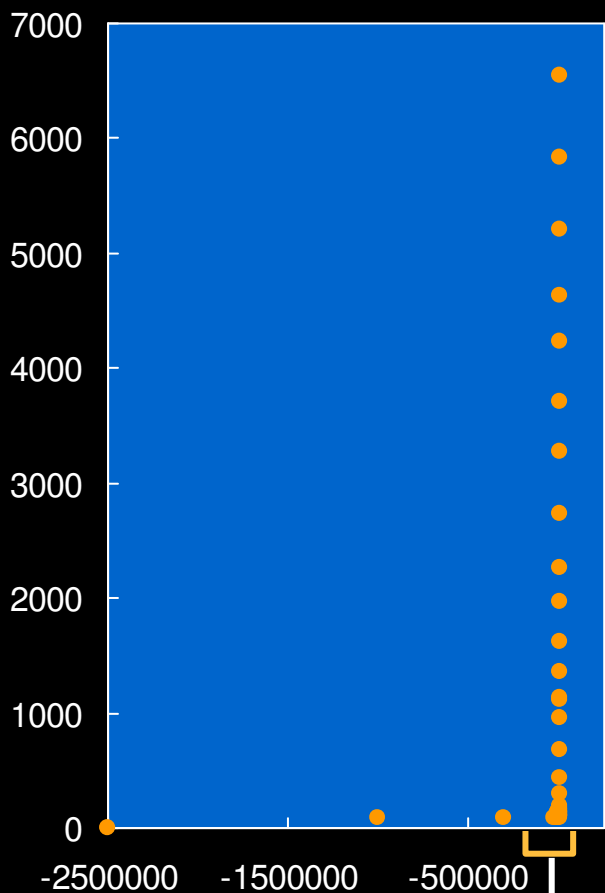
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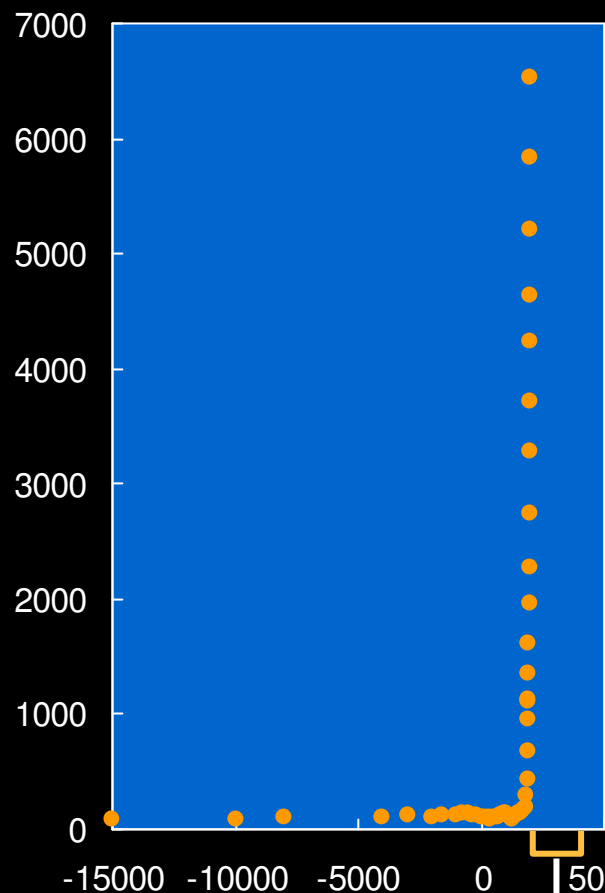
Fact no. 1 – wealth has grown explosively

World GDP per capita, constant 1992 US\$

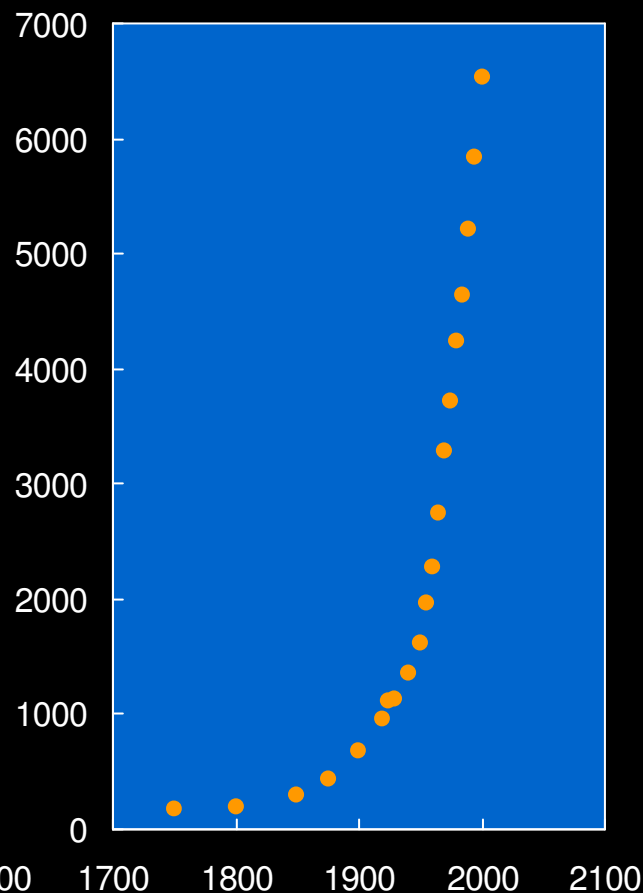
2.5m BC to 2000 AD



15,000 BC to 2000 AD



1750 to 2000



Source: J. Bradford DeLong, U. Cal. Berkeley

Fact no. 2 – complexity has grown explosively

From . . .



10^2 SKU economy

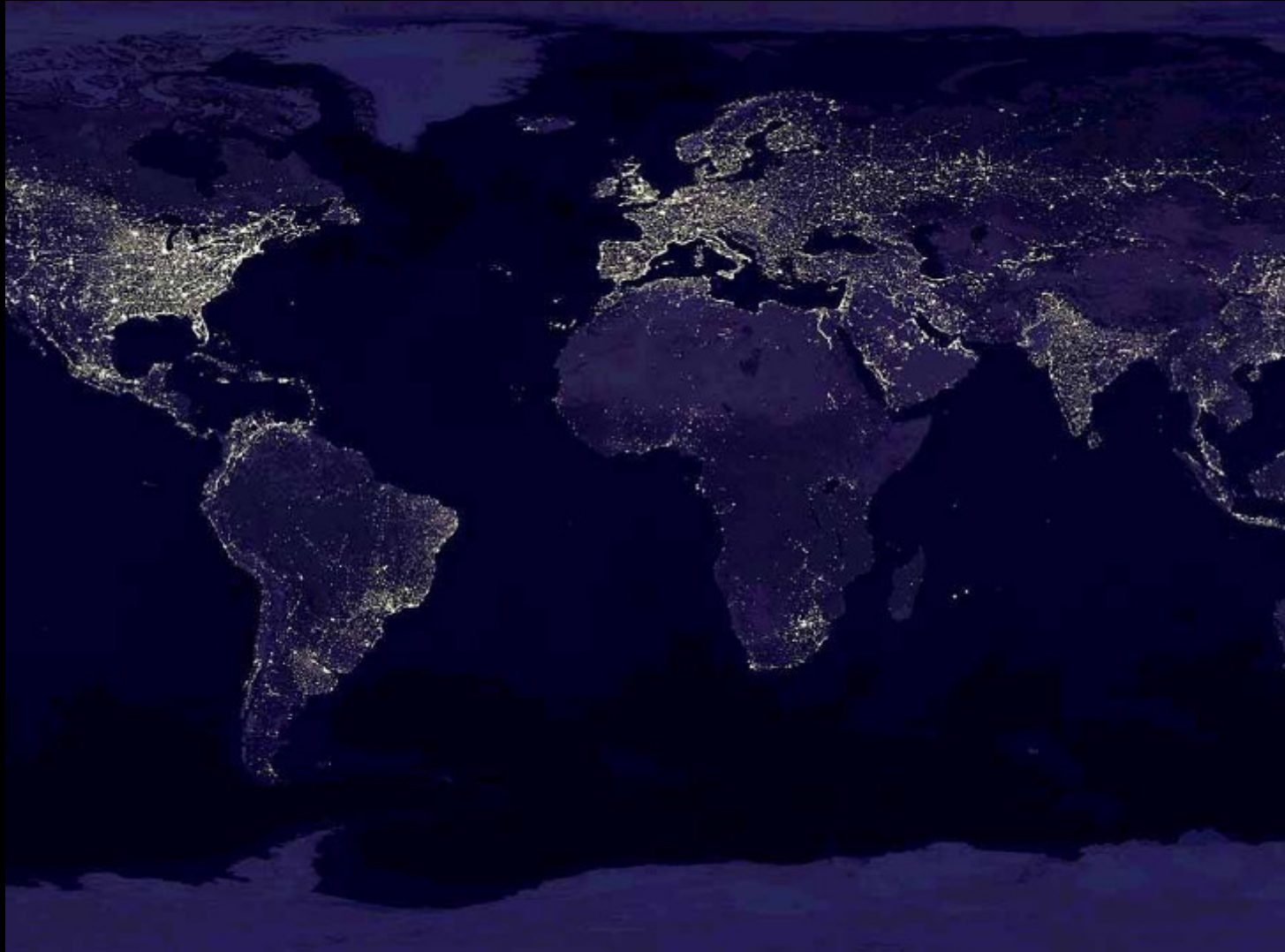
To . . .



10^{10} SKU economy

- Wal-Mart 100,000 SKUs
- Cable TV 200+ channels
- 275 breakfast cereals

Fact no. 3 – no one is in charge



Today's discussion

-
- The three most stunning empirical facts in economics



- **Characterizing the economy – what is it?**

- The evolution of economic design
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-

Traditional economics cannot explain key characteristics of the economy

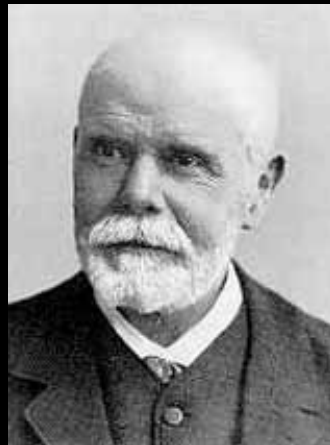
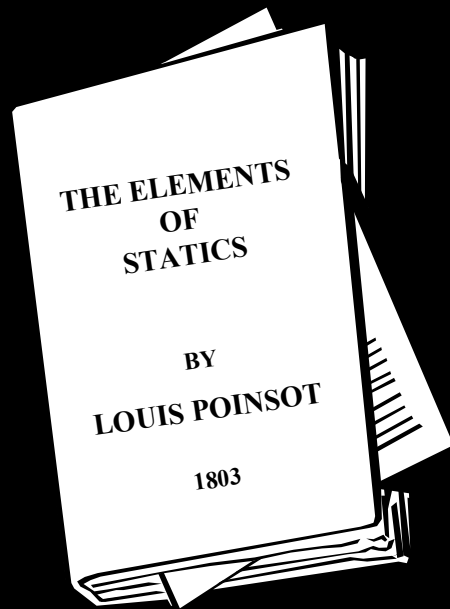
Economy viewed as an equilibrium system . . .



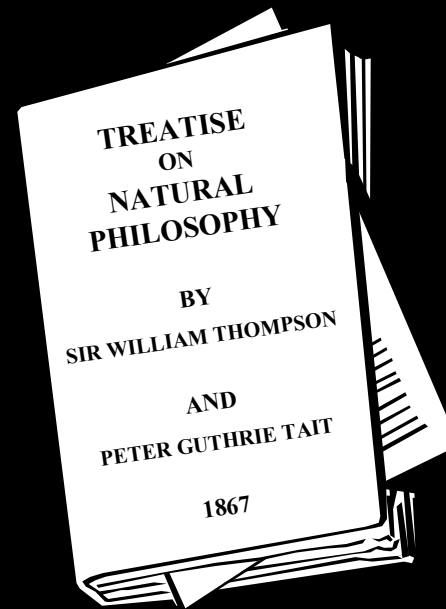
. . . but such a system cannot

- Grow explosively
- Create novelty
- Spontaneously self-organize

The accidental history of equilibrium in economics



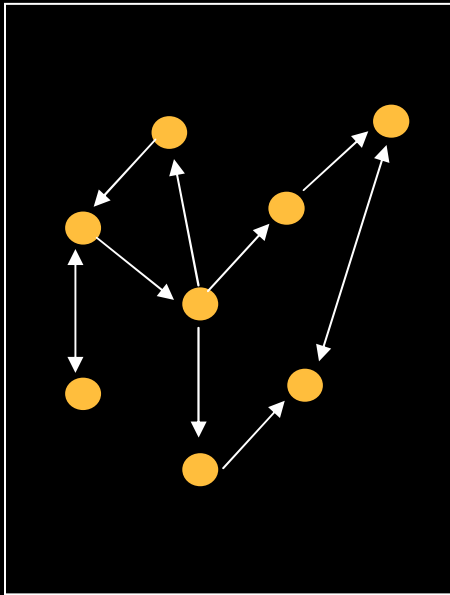
Léon Walras



William Stanley Jevons

A different explanation – the economy is a ‘complex adaptive system’

Complex



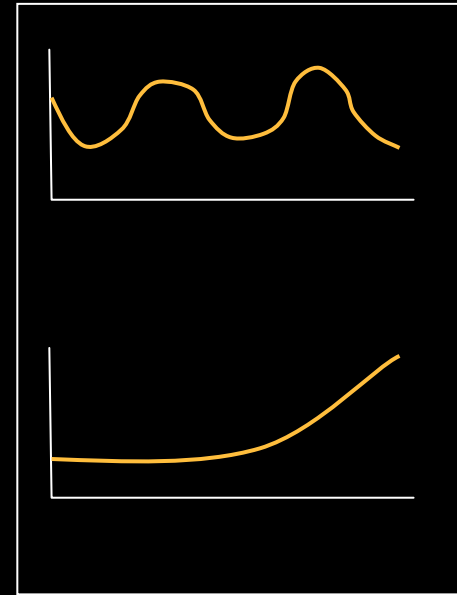
Many interacting agents and organizations of agents

Adaptive



Designs and strategies evolve over time

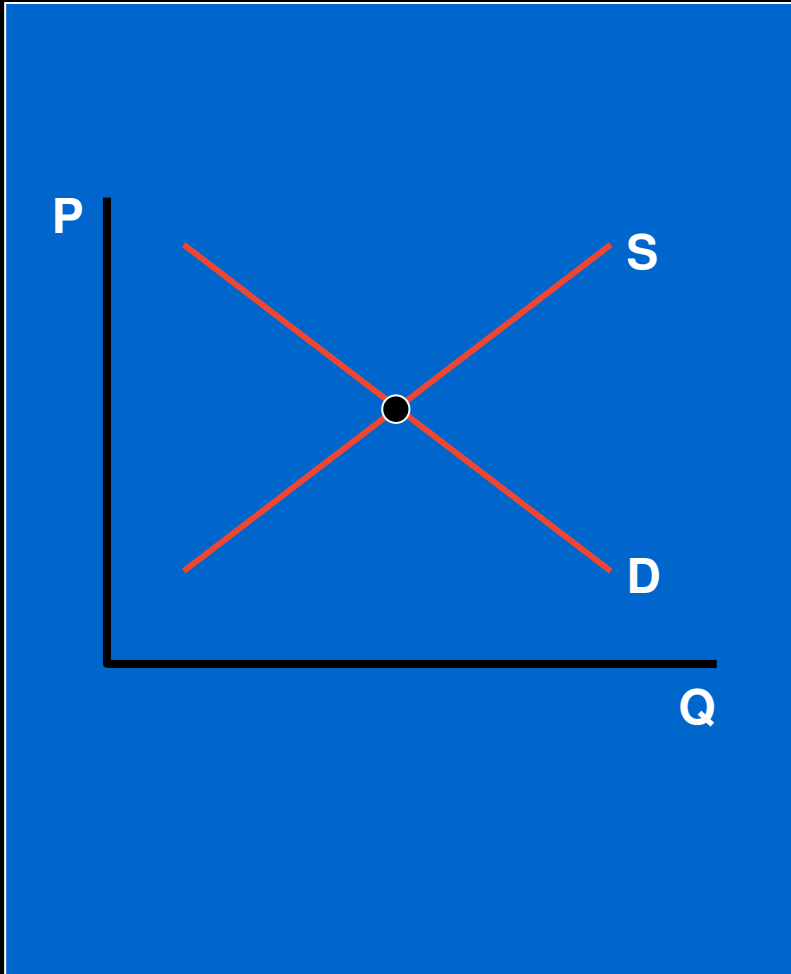
System



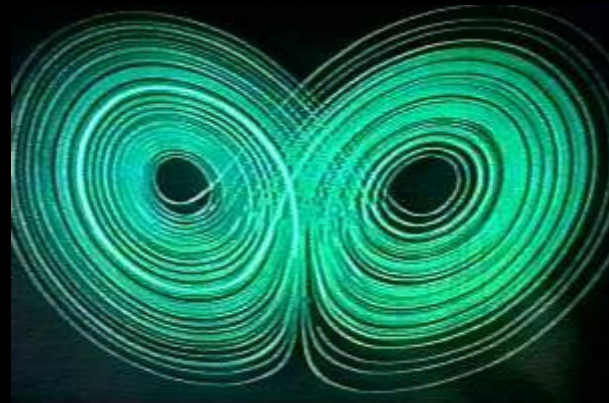
Macro patterns emerge from micro behavior

Dynamics

Traditional – fixed point attractors



Complexity – dynamic attractors



Agents

Traditional – perfect rationality



- Deductive logic
- Self-interest
- Perfect information
- Infinite computational power
- No errors, biases
- No learning

Complexity – realistic rationality



- Inductive rules of thumb
- Strong reciprocity
- Imperfect information
- Finite computing power
- Errors, biases
- Learning over time

Networks

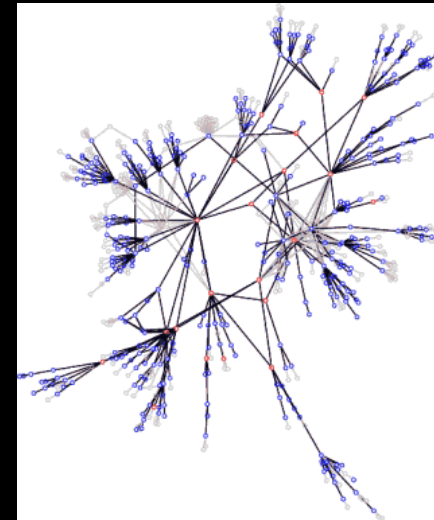
Traditional – networks don't matter

- **Interactions** – only via markets
- **Information** – prices, quantities
- **Institutions** – Walrasian auctions



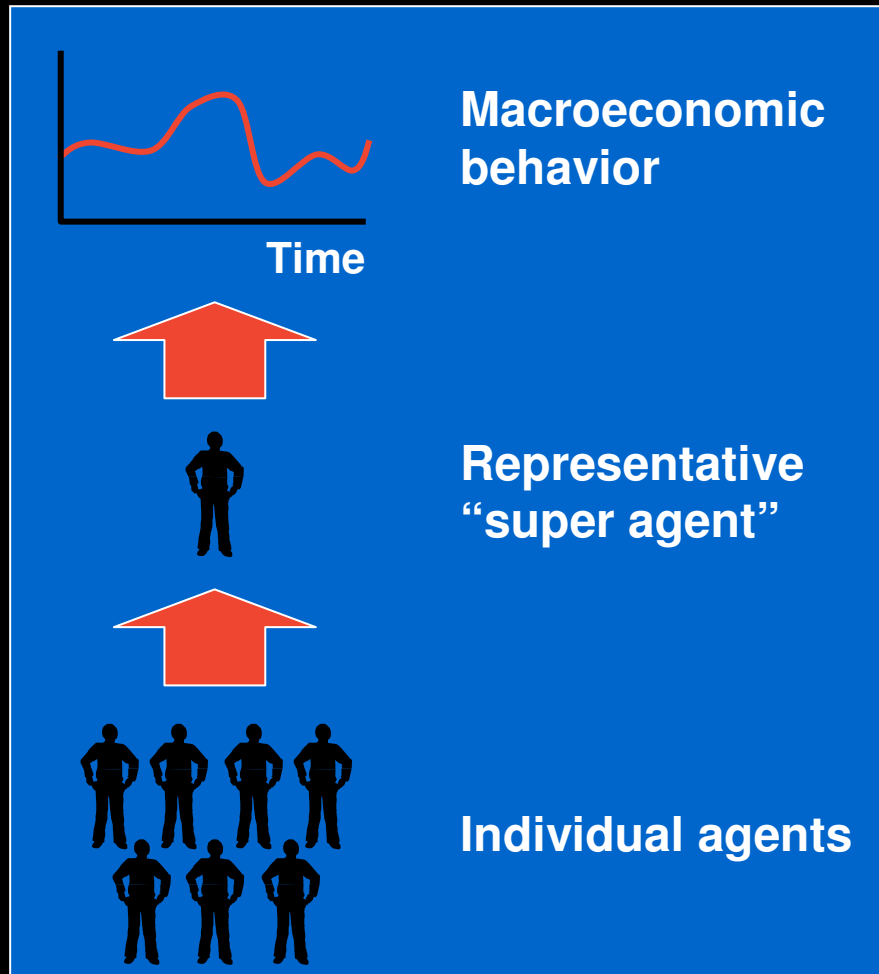
Complexity – network structures matter

- **Interactions** – via networks
- **Information** – anything
- **Institutions** – bilateral trade, posted prices, corporations, etc.

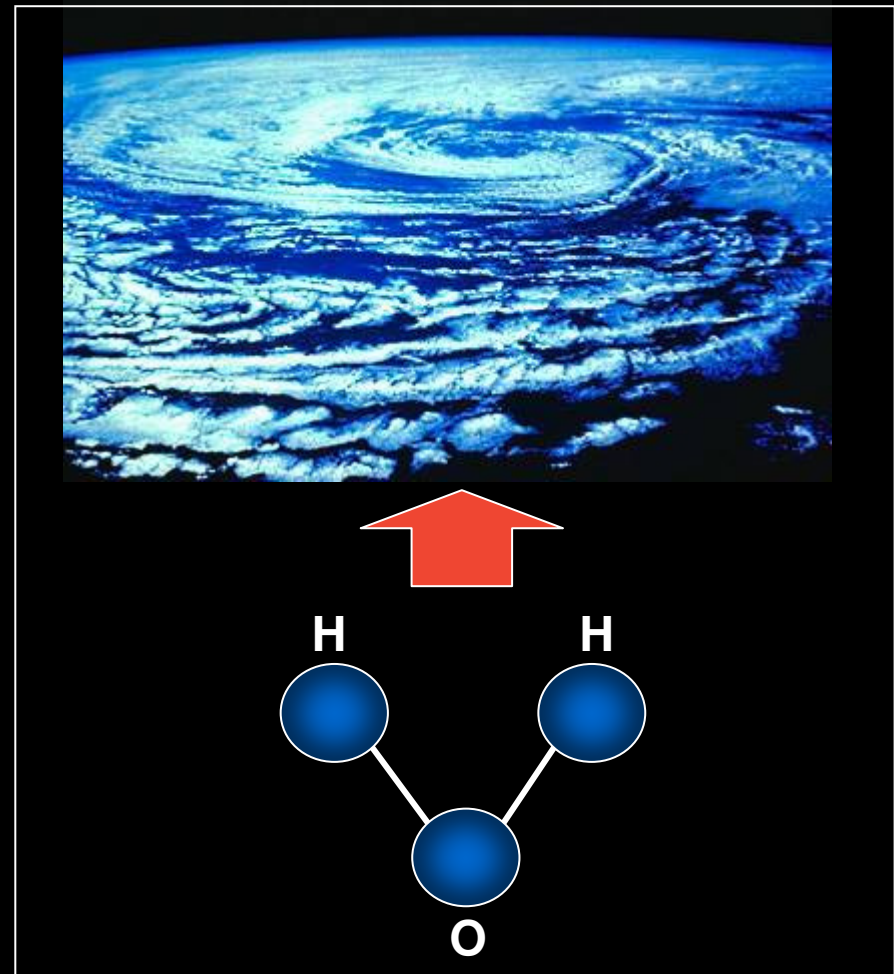


Emergence

Traditional – assumes linear additivity



Complexity – non-linear interactions create emergent patterns



Evolution

Traditional – no endogenous theory of innovation

“Add successfully as many mail coaches as you please, you will never get a railway thereby”

Joseph Schumpeter



Complexity – innovation as evolutionary search



A paradigm shift

Traditional economics



Complexity economics

Dynamics

Economies are closed, static, linear systems in equilibrium

Economies are open, dynamic, non-linear systems far from equilibrium

Agents

Homogeneous agents

- Only use rational deduction
- Make no mistakes and have no biases
- Are already perfect, so why learn?

Heterogeneous agents

- Mix deductive/inductive decision-making
- Subject to errors and biases
- Learn and adapt over time

Networks

Assume agents only interact indirectly through market mechanisms

Explicitly account for agent-to-agent interactions and relationships

Emergence

Treats micro and macroeconomics as separate disciplines

No distinction between micro- and macroeconomics; macro patterns emerge from micro behaviors and interactions

Evolution

Contains no endogenous mechanism for creating novelty or growth in order and complexity

Evolutionary process creates novelty and growing order and complexity over time

Today's discussion

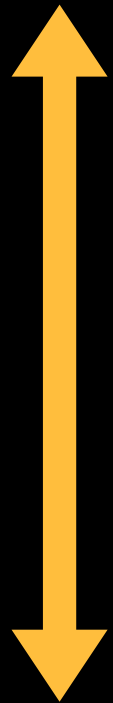
- The three most stunning empirical facts in economics
- Characterizing the economy – what is it?



- **The evolution of economic design**
 - What does it mean?
-

Long history of evolutionary ideas in economics (and vice versa)

1838



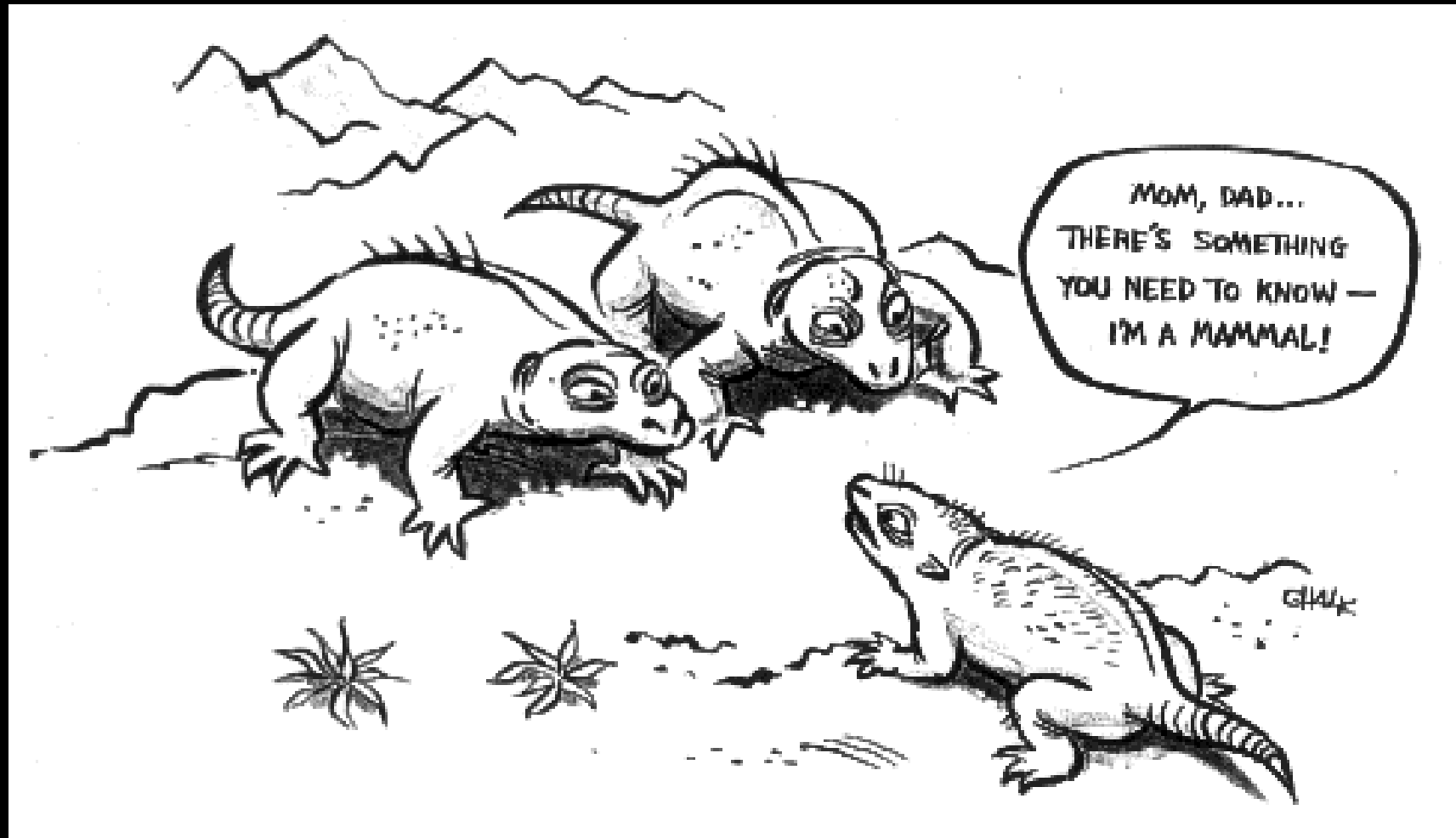
- Malthus
- Darwin
- Mandeville
- Marx
- Spencer
- Marshall
- Menger
- Veblen
- Schumpeter
- Hayek
- Nelson and Winter

1982

Problem

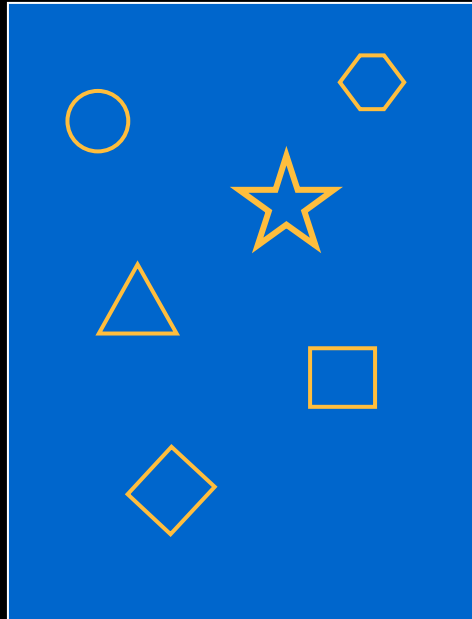
- Driven from a metaphor with biology
- Not built on a general computational view of evolution

We are accustomed to thinking of evolution in a biological context



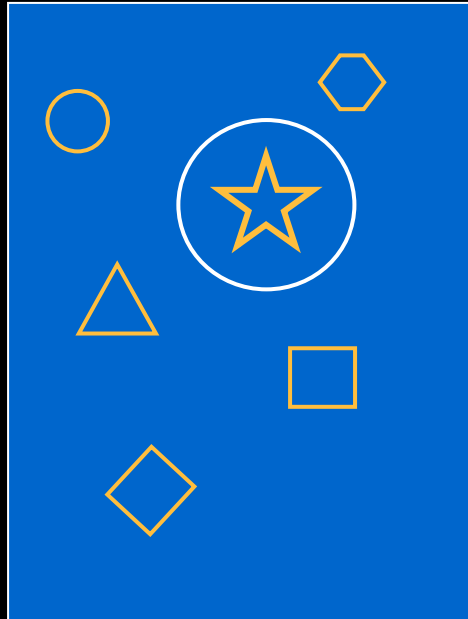
Evolution is a search algorithm for 'fit designs'

Create a variety of experiments



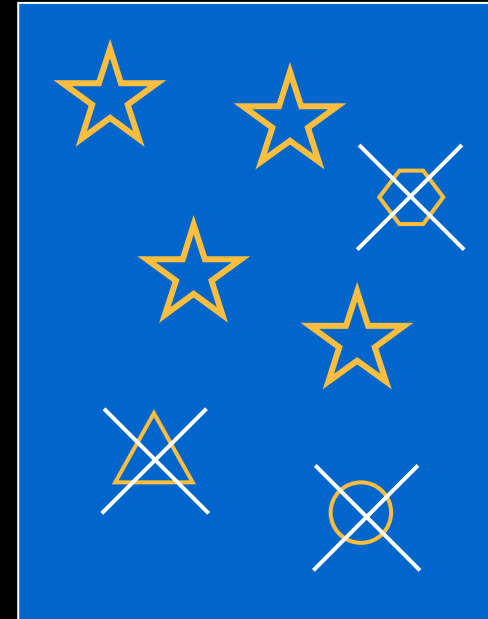
Variation

Select designs that are 'fit'



Selection

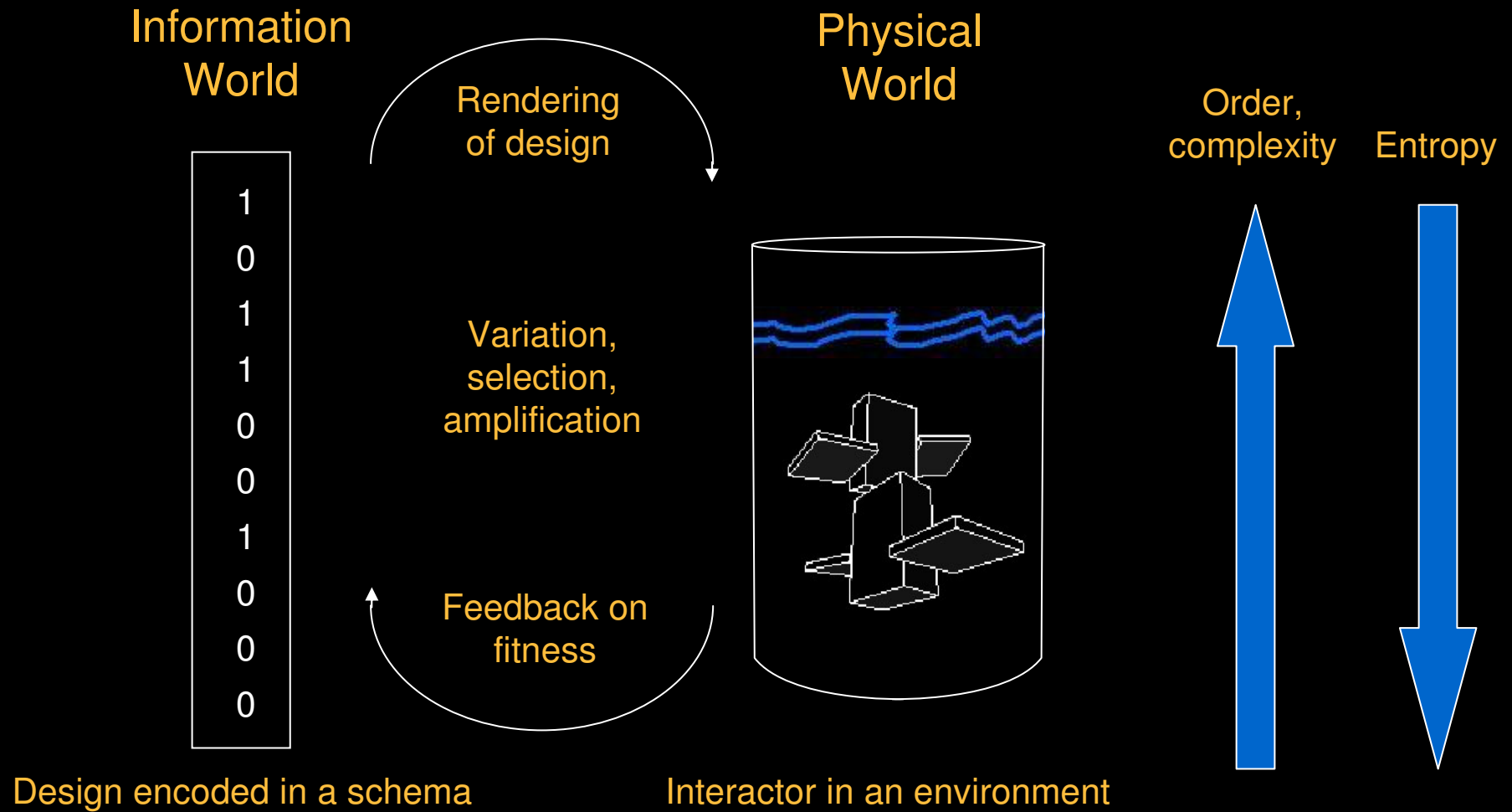
Amplify fit designs, de-amplify unfit designs



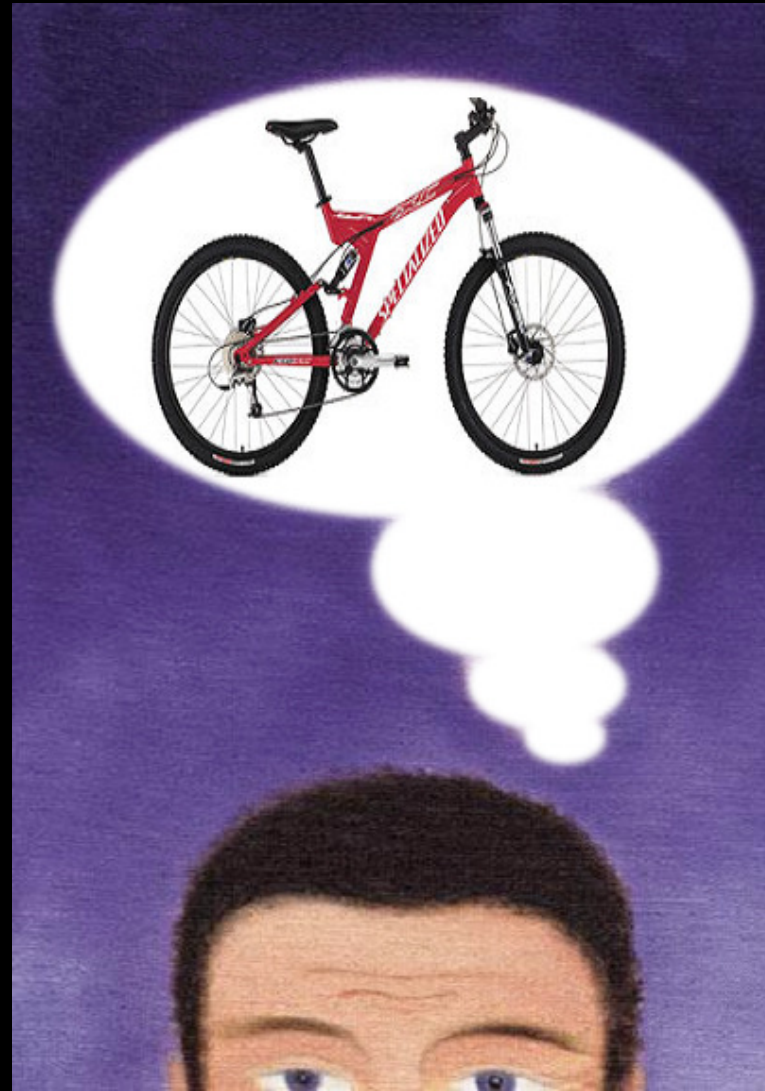
Amplification



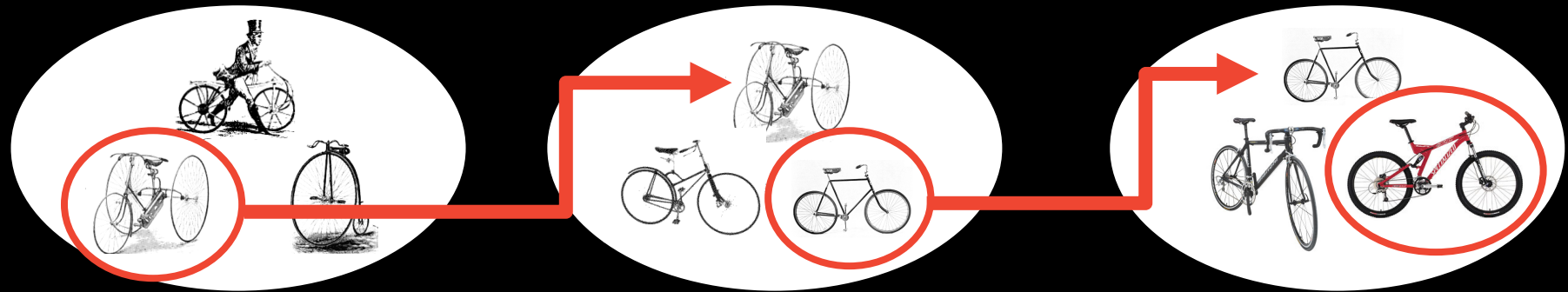
Evolution creates complexity from simplicity



Who designed the modern bicycle?



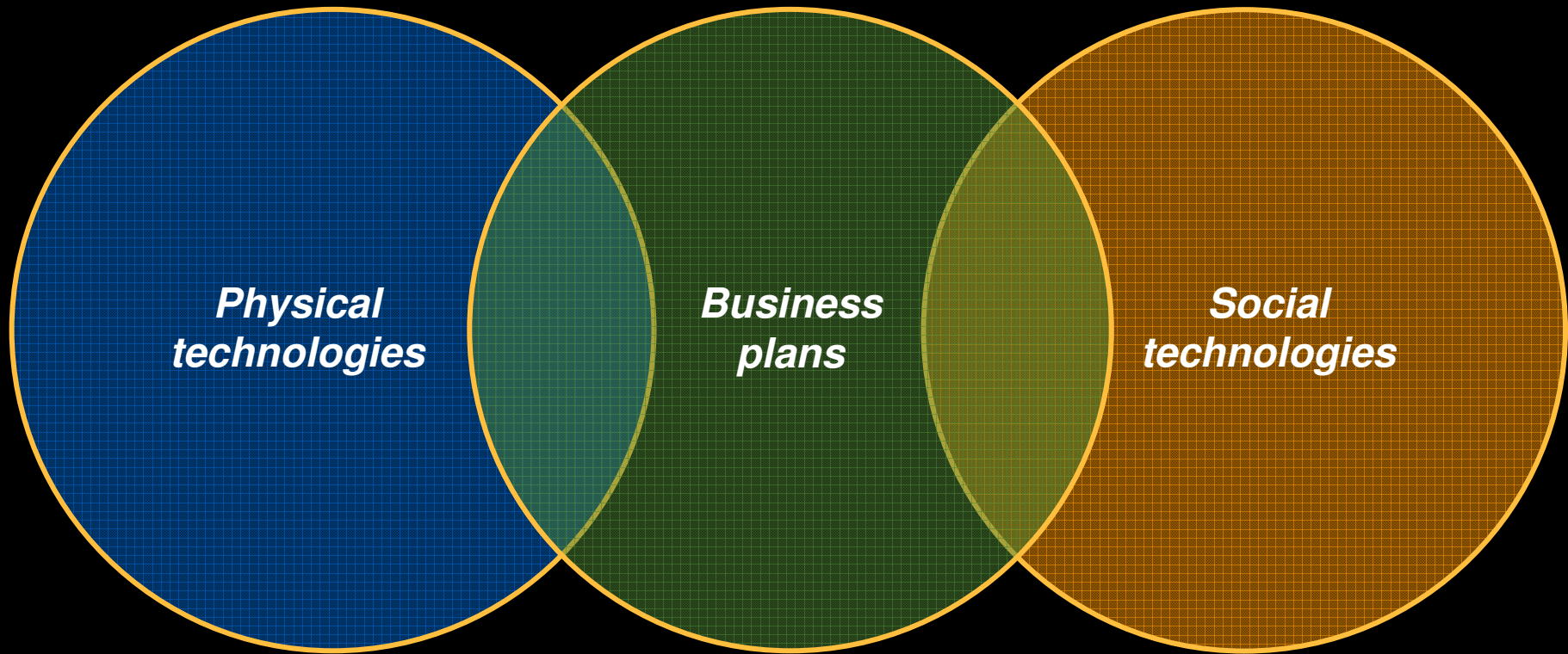
The reality – evolution through ‘deductive-tinkering’



Technologies evolve



Economic evolution occurs in three 'design spaces'



Business plans are a form of economic 'design'



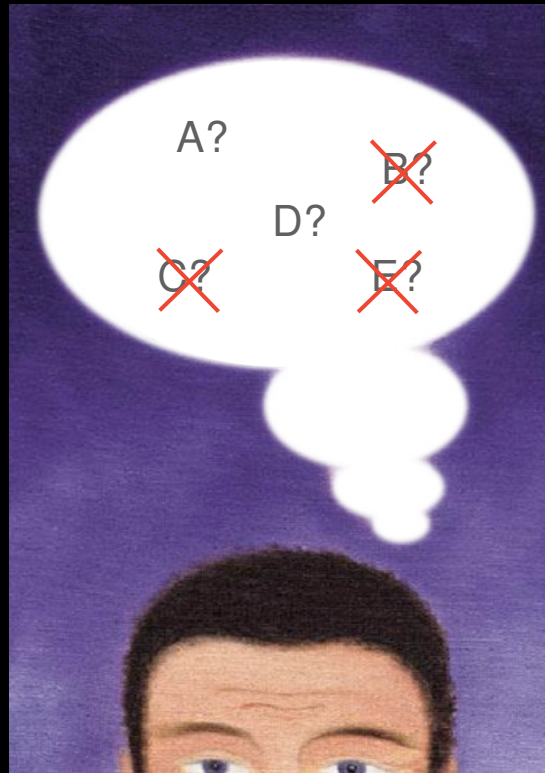
- **Strategy**
 - High-end microprocessors
 - Integrated chip sets
 - Communications chips/components

- **Physical technologies**
 - Semiconductor design
 - Testing
 - Fabrication

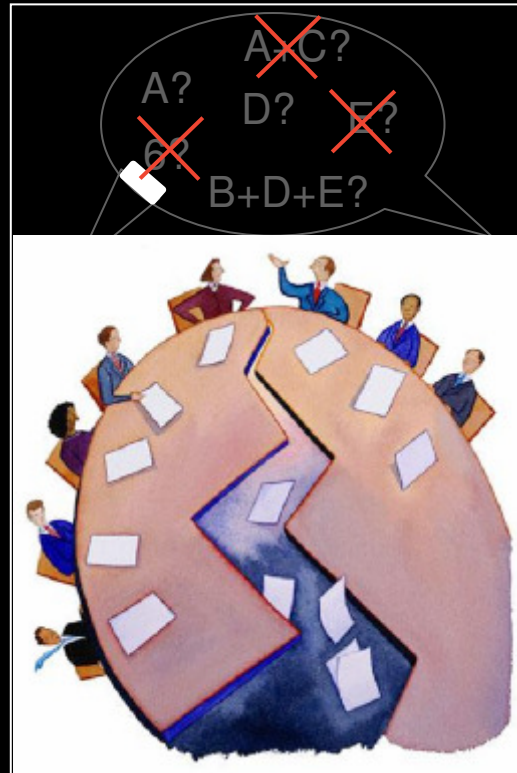
- **Social technologies**
 - Innovation processes
 - Direct sales
 - Brand
 - Competitive culture

Business plan evolution works at three levels

Individual minds



Organizations



Markets

BORDERS.

~~**Waldenbooks**~~

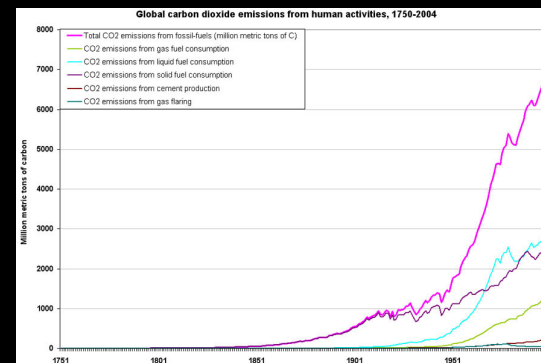
BARNES & NOBLE



~~Independent
booksellers~~

What would economic evolution look like?

- Bursts of innovation/
punctuated equilibrium
- Spontaneous self organization
- Decreasing local entropy/
increasing order



Today's discussion

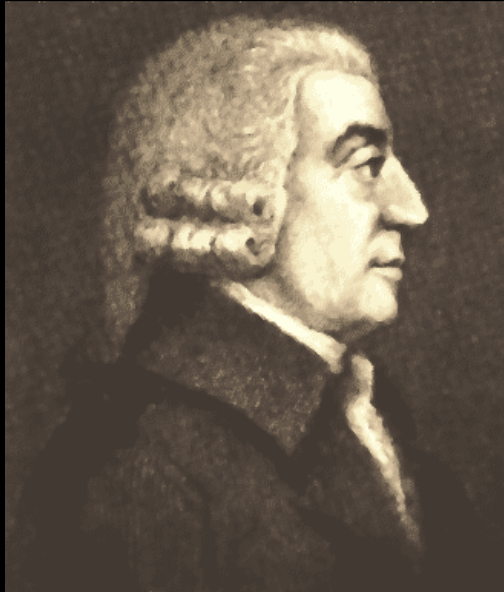
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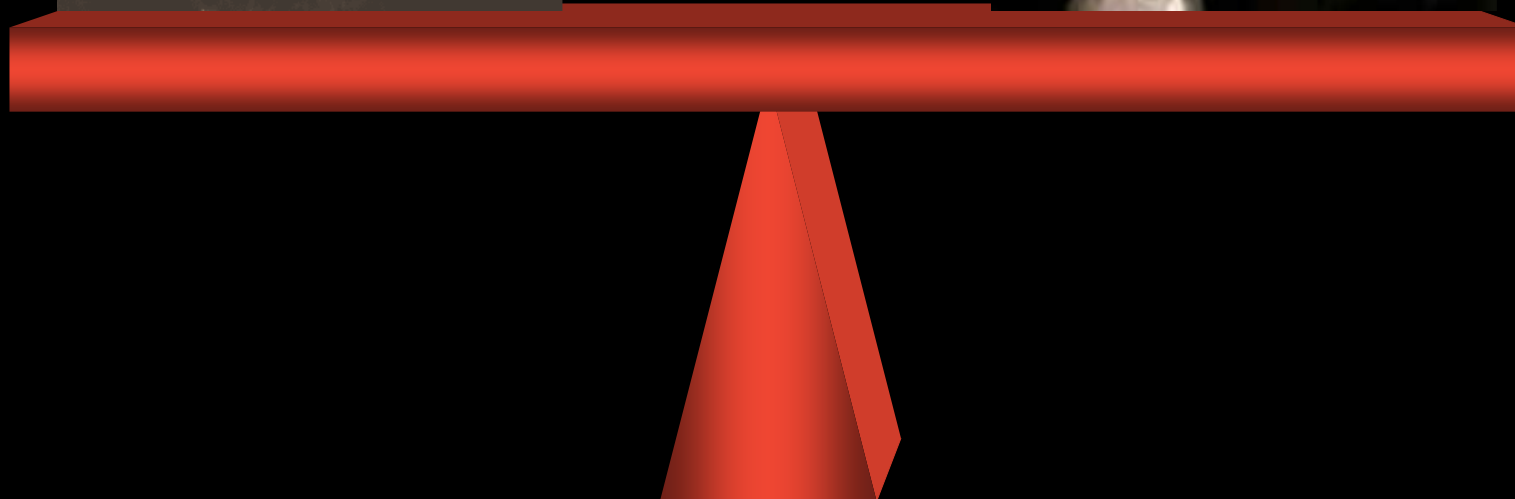
- **What does it mean?**
-

The end of left vs. right?

Adam Smith



Karl Marx



A new view of human nature

Right

- Humans are inherently self-regarding
- Markets channel this instinct to positive social ends
- Hume, Locke, Hobbes

Left

- Humans are inherently cooperative and altruistic
- Markets encourage greed, state can make society more just
- Rousseau, Marx

Complexity

- Humans are conditional cooperators and altruistic punishers
- Institutions should mobilize strong reciprocity
- Bowles, Gintis, Fehr, Boyd



A new view of markets vs. states

Right

- Markets are most efficient mechanism for allocating resources
- States distort market outcomes thus state interference should be minimized



Left

- Markets may be a necessary evil, but do not produce just outcomes
- States are an essential mechanism for ensuring social justice and protecting people from market failures



Complexity

- Markets are not perfectly efficient at allocation, but are highly effective at evolutionary wealth creation
- States create institutional conditions for economic evolution
- Democratic societies have a right to use states to shape economic fitness function

New approaches to public policy?

- Giving up the illusion of prediction and control
- Realistic view of human behavior
- Focus on creating institutional conditions for economic evolution
- Evolving portfolios of “policy experiments”?
- Emphasis on empiricism and data - do more of what works less of what doesn't



Example issues

- Healthcare reform
- Environmental policy
- Pensions
- Tax policy
- Education

Final thought...

“Evolution is cleverer than we are”

Orgels' second law

Eric Beinhocker

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