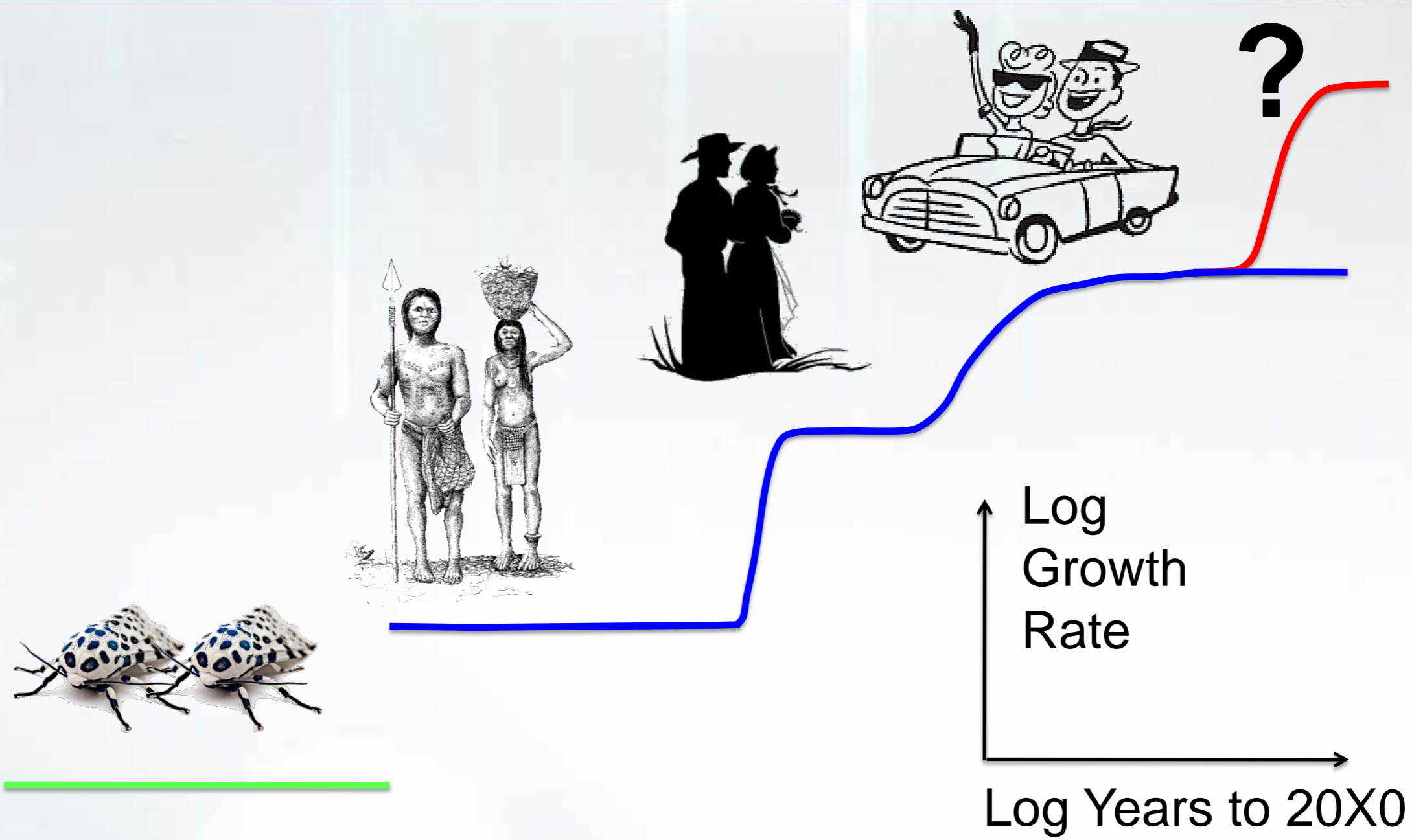


Automation: Recent Determinants & Long-Term Possibilities

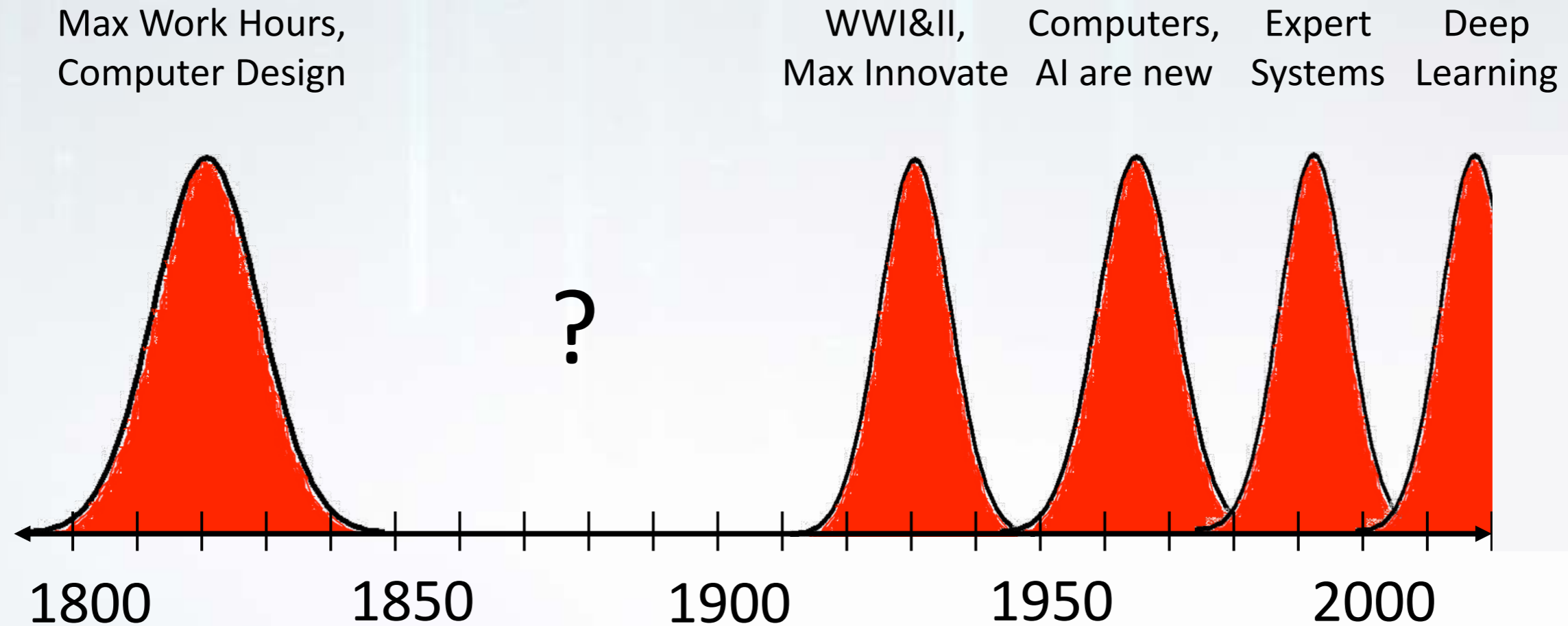
Robin Hanson

Economics, George Mason University
Associate, Future of Humanity Institute, Oxford
Blog: OvercomingBias.com

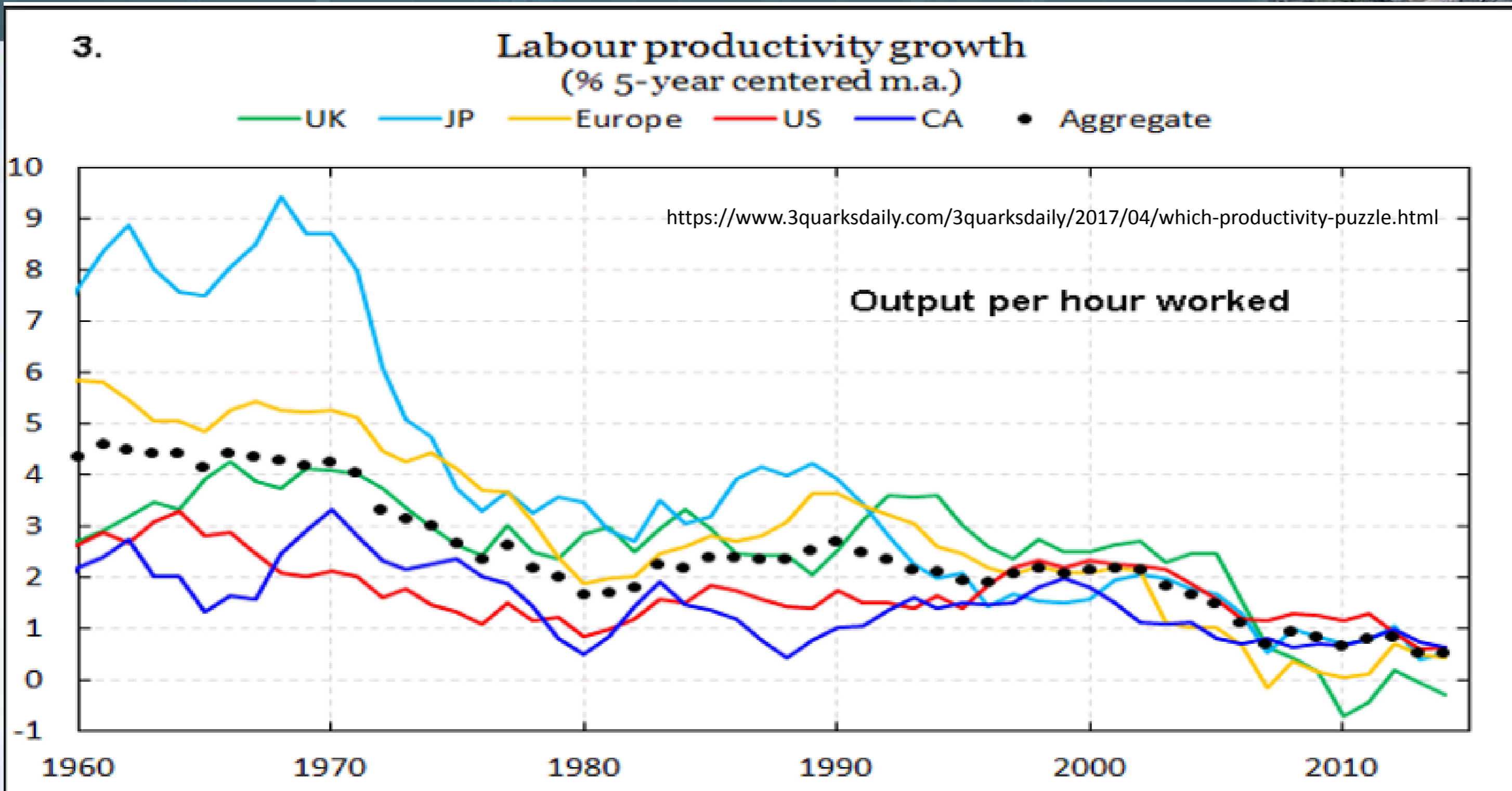
The Great Eras



Robot Concern Booms So Far

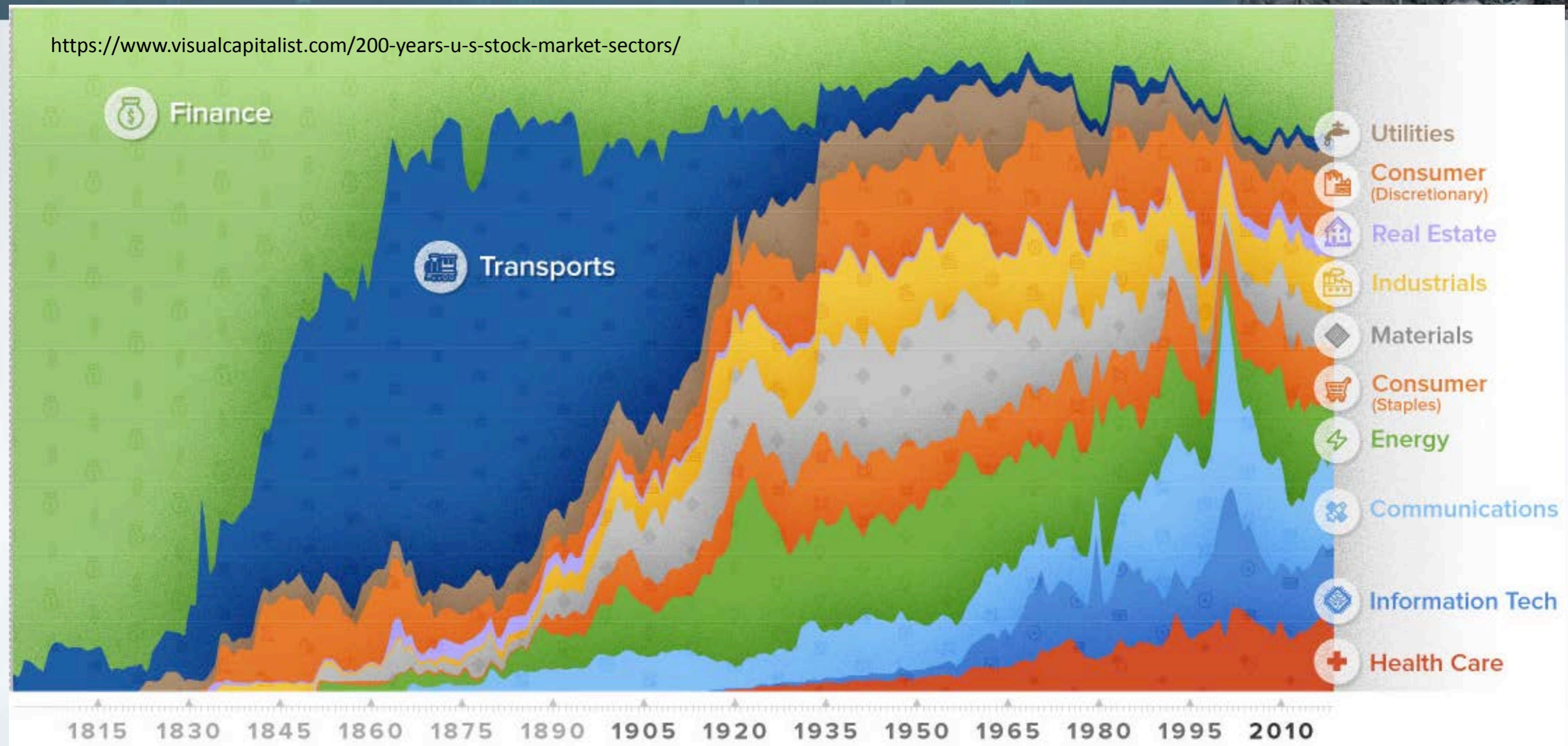


Labor Productivity Growth



Stock Value By Sector

<https://www.visualcapitalist.com/200-years-u-s-stock-market-sectors/>



MIT Technology Review

Every study we could find on what automation will do to jobs, in one chart

There are about as many opinions as there are experts.

by Erin Winick

Jan 25, 2018

FORTUNE

A.I. Expert Says Automation Could Replace 40% of Jobs in 15 Years

By [DON REISINGER](#) January 10, 2019

Forrester: 10% of U.S. jobs will be lost to
automation in 2019

KYLE WIGGERS @KYLE_L_WIGGERS NOVEMBER 6, 2018 7:00 AM

Predicted Jobs Automation Will Create and Destroy

When	Where	Jobs Destroyed	Jobs Created	Predictor
2016	worldwide		900,000 to 1,500,000	Metra Martech
2018	US jobs	13,852,530*	3,078,340*	Forrester
2020	worldwide		1,000,000-2,000,000	Metra Martech
2020	worldwide	1,800,000	2,300,000	Gartner
2020	sampling of 15 countries	7,100,000	2,000,000	World Economic Forum (WEF)
2021	worldwide		1,900,000-3,500,000	The International Federation of Robotics
2021	US jobs	9,108,900*		Forrester
2022	worldwide	1,000,000,000		Thomas Frey
2025	US jobs	24,186,240*	13,604,760*	Forrester
2025	US jobs	3,400,000		ScienceAlert
2027	US jobs	24,700,000	14,900,000	Forrester
2030	worldwide	2,000,000,000		Thomas Frey
2030	worldwide	400,000,000-800,000,000	555,000,000-890,000,000	McKinsey
2030	US jobs	58,164,320*		PWC
2035	US jobs	80,000,000		Bank of England
2035	UK jobs	15,000,000		Bank of England
No Date	US jobs	13,594,320*		OECD
No Date	UK jobs	13,700,000		IPPR

Job Automation Data

Joint work w/ Keller Scholl, funded by Open Philanthropy

- Re 534 (of 872) job types at 6-digit SOC-code level. *Misc. vars*:
 - *Computerisable* in “decade or 2.” (Frey & Osborne ‘13)
 - *Machine Learning Suitability*. (Brynjolfsson & Mitchell ‘18)
 - *#Workers, Pay, Education*. from B.L.S. Occup. Empl. Stat.
- Also 238 (of 270) O-Net vars, job-var scorings in 1999-2018
 - Each scored in 2-4 random years, on 1-5 scale, log to get $\sim N(0,1)$
 - Key var: *Automation (A)*, N=1867 scorings, up ~ 0.36 s.d. over period
- Regress *A* on Misc. + all O-Net, get max t-stat 25
 - For top 25 regress *A* on Misc., top O-Net, top O-Net*time
- Regress $\Delta\#Workers, \Delta Pay$ on $\Delta A, A_0^* \Delta A,$

OLS: Misc. + Time Interactions



Dep. Variable: Automation R-squared: 0.145
 No. Observations: 1867 Df Model: 12

	coef	std err	t	P> t
Intercept	-0.1564	0.036	-4.358	0.000
Time	0.2508	0.090	2.782	0.005
Education	-0.1293	0.064	-2.013	0.044
Pay	0.2974	0.056	5.348	0.000
Employees	0.0892	0.037	2.424	0.015
FreyOsborneP	0.2533	0.045	5.590	0.000
ML Susceptibility	0.2075	0.035	5.983	0.000
Time Time	-0.0833	0.140	-0.595	0.552
Education Time	0.2756	0.124	2.226	0.026
Pay Time	-0.1238	0.107	-1.154	0.249
Employees Time	0.0391	0.072	0.544	0.586
FreyOsborneP Time	0.0276	0.087	0.317	0.751
ML Susceptibility Time	-0.0121	0.068	-0.178	0.859

Routes To A.I.



1

*Accumulate
Software*



2

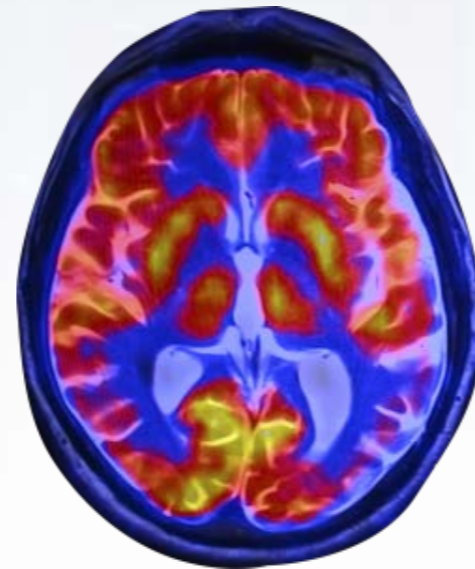
*New Super
Theory*



3

*Port Brain
Software*

Need To Emulate Brains



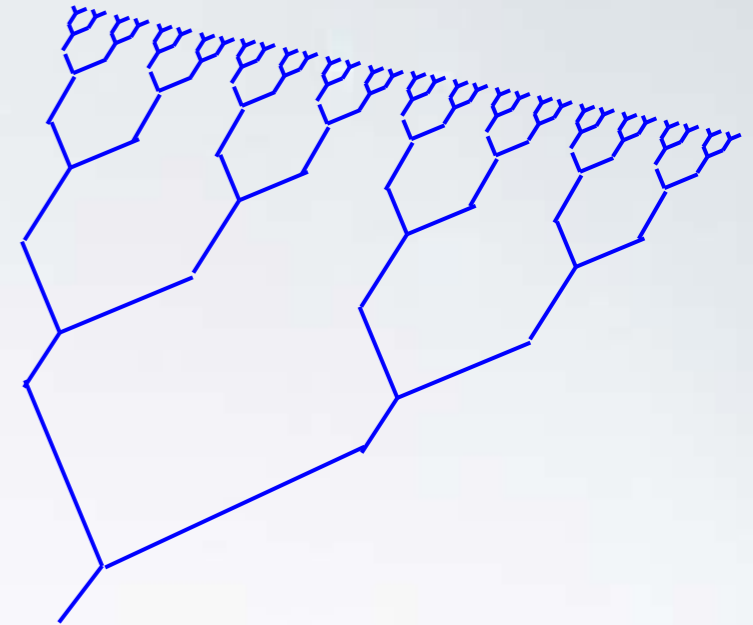


An “Em” is:

A computer model that **Emulates** a particular human brain's cell interactions so well that it responds to input signals with almost the same output signals.

My Methods

- Academic consensus
- What is, not should be (not story)
- Focus on robots, not humans
- Next big era, not eras after
- After transition, once things settle down
- Competition, low-regulation (= supply & demand)
- Mostly-opaque ems:
 - No merge, splice, partial, or big changes in psychology
- **Rest of Talk: Many Implications**





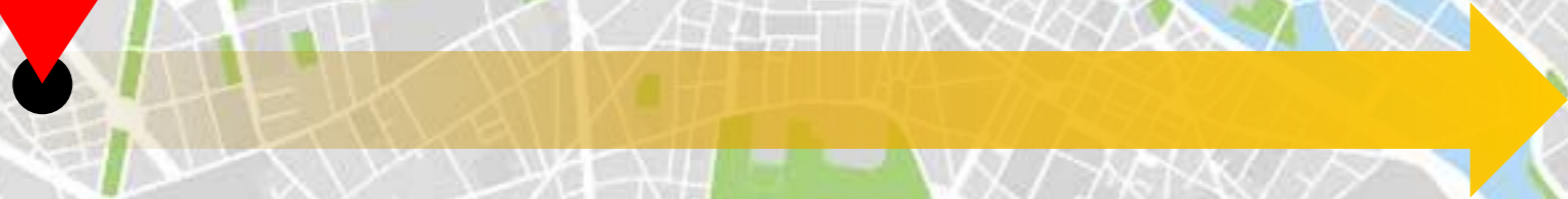






You Are The Copy

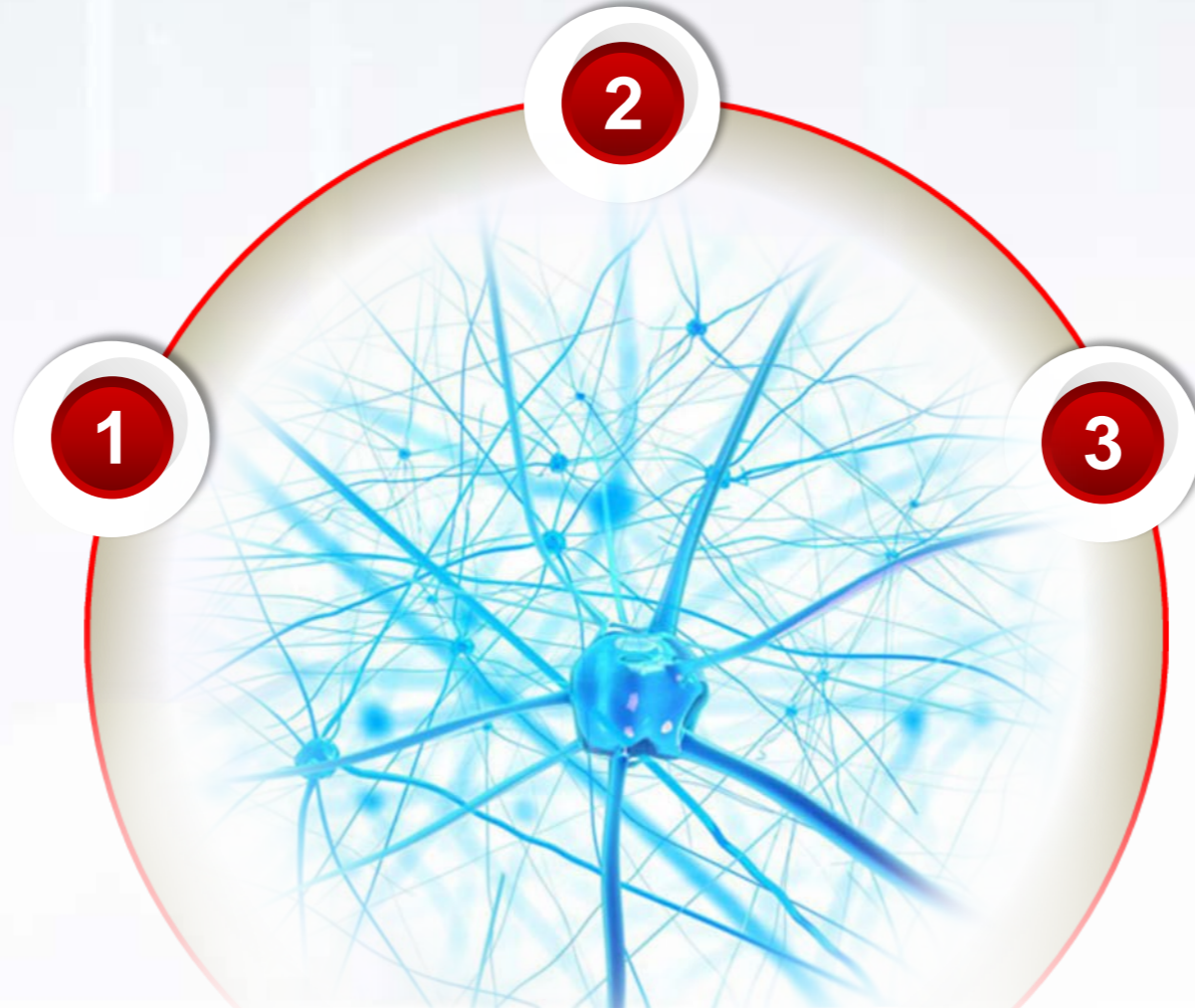




Key Facts @ Ems



*Need Real
Resources*



*Do What
Humans Would*

*Poor, Work
Most of Time*



Em World



*Economy
Grows ~x100*



*Mind Speed
~1000x*

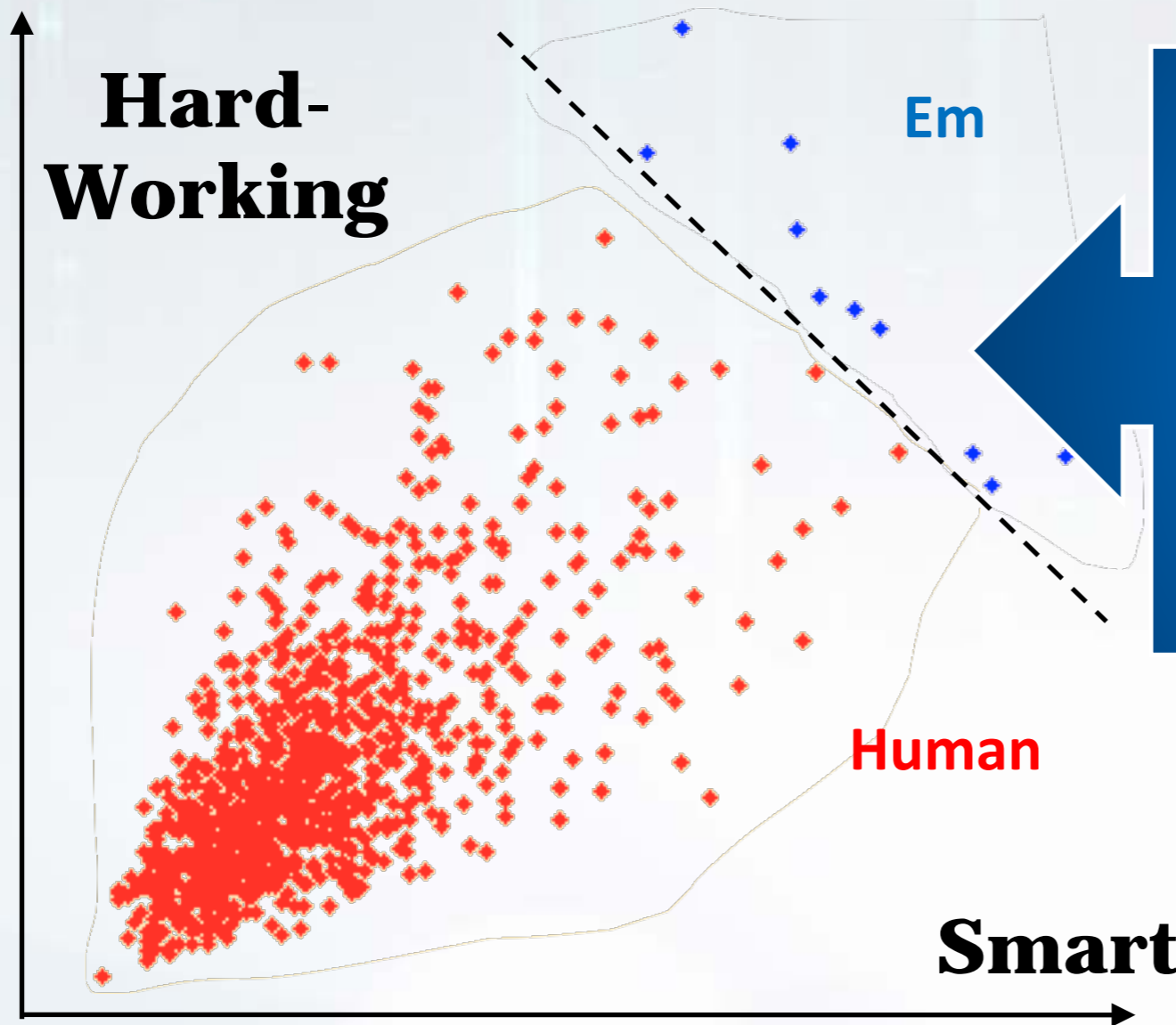


*Most in Few
Huge Cities*

Humans Retire



Ems Are Elite



Smart, conscientious, extravert, agreeable, gritty, non-neurotic, work-oriented, focused, sleepless, larks, cooperative, middle-aged, patient, married, religious

Em Variety

Human: gender, personality, subjective age, wealth, train vs. work vs. retire, city center vs. periphery, which city, team size, human ethnicity/culture of origin, hobby, religion, *industry, profession*

Industry: security, emergency, train, law, finance, news, recreation, politics, telecom, software, hardware, energy, cool, transport, construct, mine

Job Task: design, market, sell, buy, deal, account, manage, administer, research, monitor, test, diagnose, repair, drive, sort, clean, build, pack, install, mix, fit.

New: clan size, clan wealth, spur vs. mainline, spur-mainline ratio, virtual vs. physical job, team copy ratio, *mind speed*

Speed Variety



Fast



Slow

Mega-ems

Kilo-ems

Human Speed

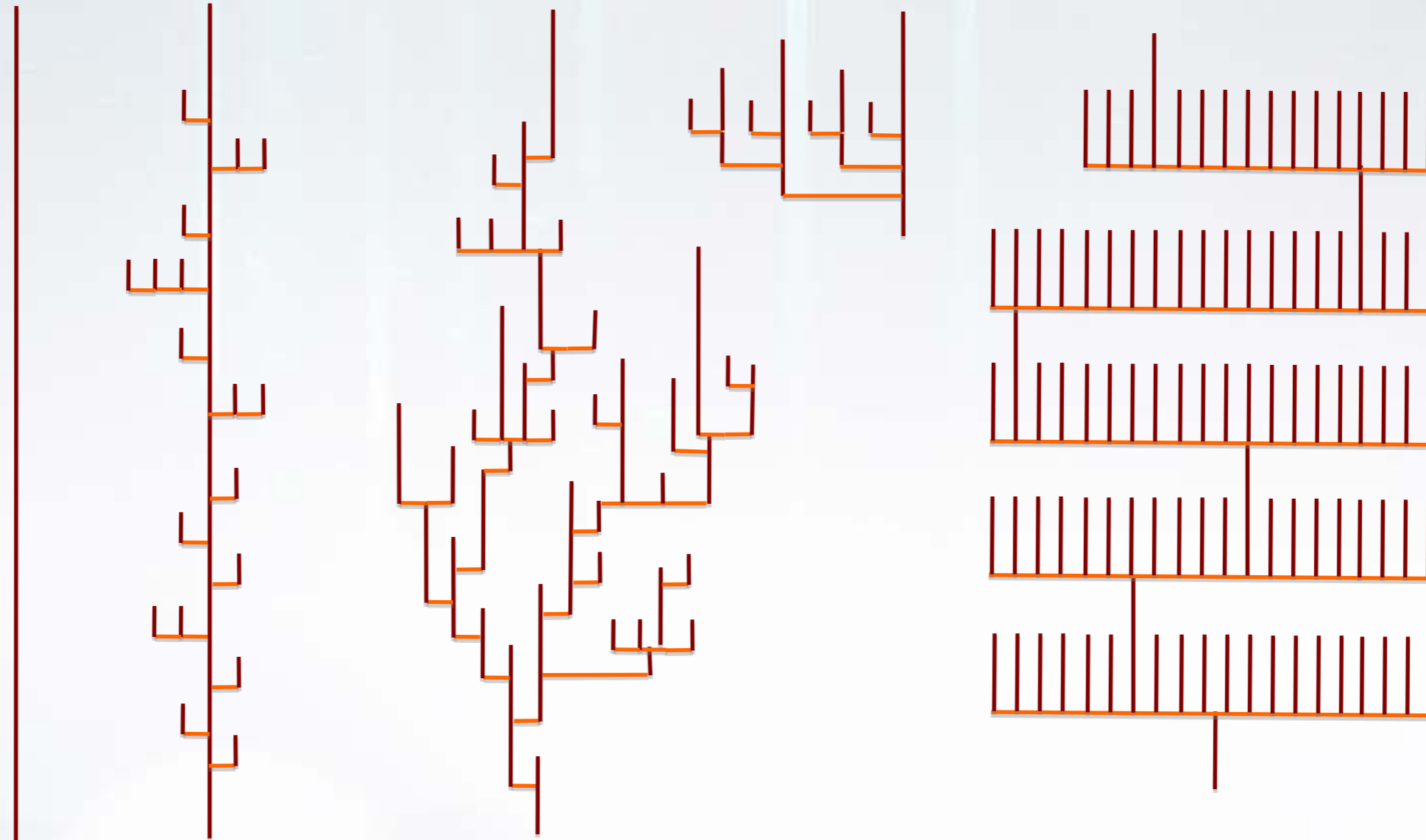
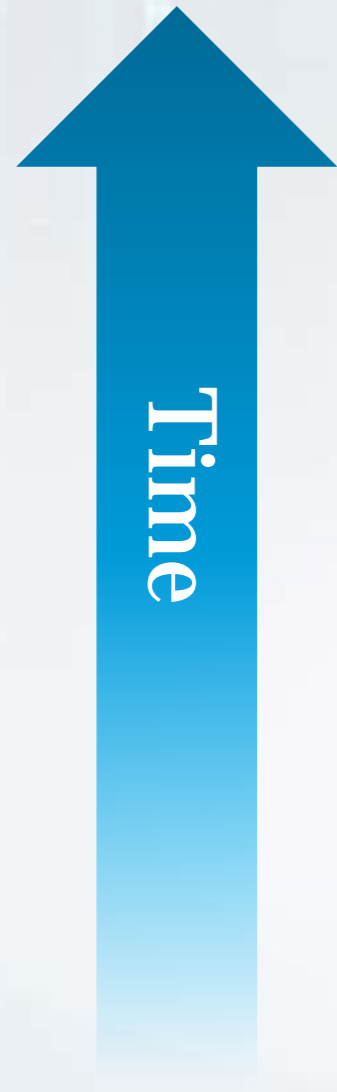
Milli-ems

Micro-ems

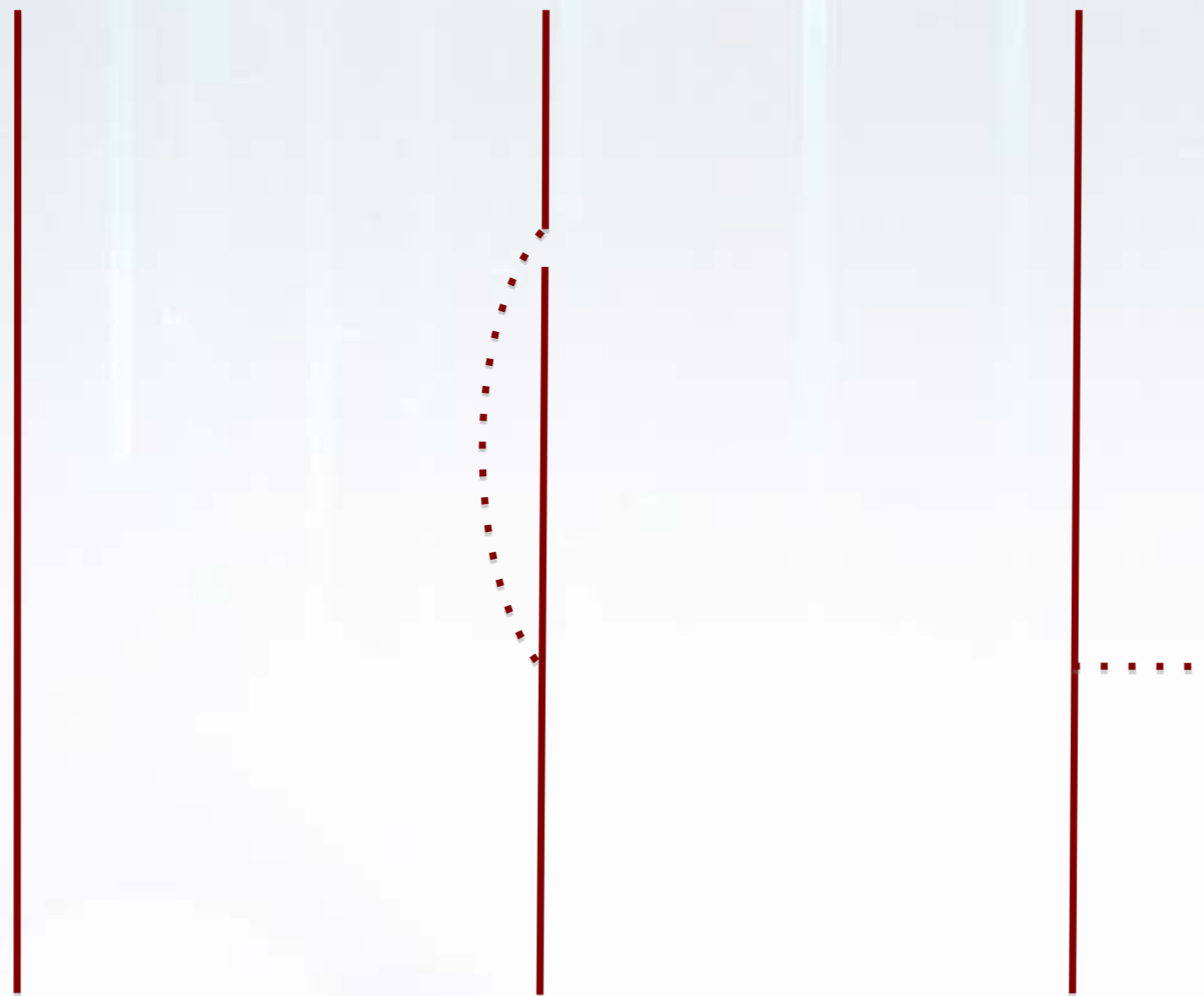
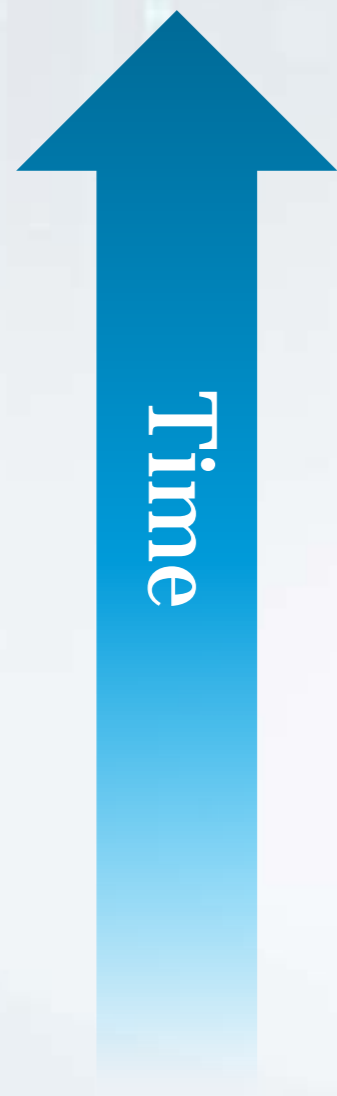
Nano-ems



Varieties of Lives



Is Forgetting “Death”?



Safes Keep Secrets



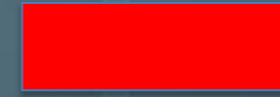
Citizen



*"Why Must We
Invade Iraq?"*

Leader





- No pain, hunger, grit, disease, aged bodies
- Less death terror
- Vast fast population
- Huge intricate cities
- Great art, story, drugs
- Extreme ability, virtue
- More stable world

- Subsistence wages, long work hours
- Easy spur "ends"
- \neq wealth, speed class
- Big bureaucratic firms
- Little nature, space
- More rulers, less vote
- More religion, ritual