

How technological evolution happens

Matt Ridley



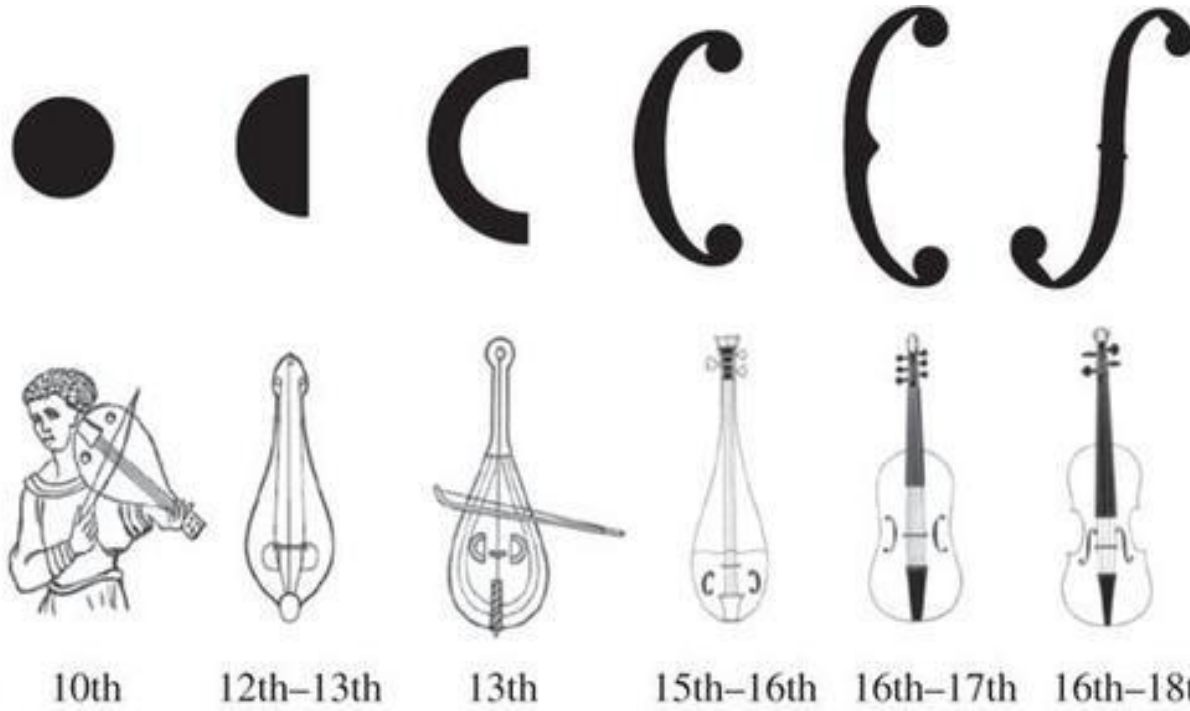




“Every boat is copied from another boat... Let’s reason as follows in the manner of Darwin. It is clear that a very badly made boat will end up at the bottom after one or two voyages and thus never be copied... One could then say, with complete rigor, that **it is the sea herself who fashions the boats**, choosing those which function and destroying the others”.

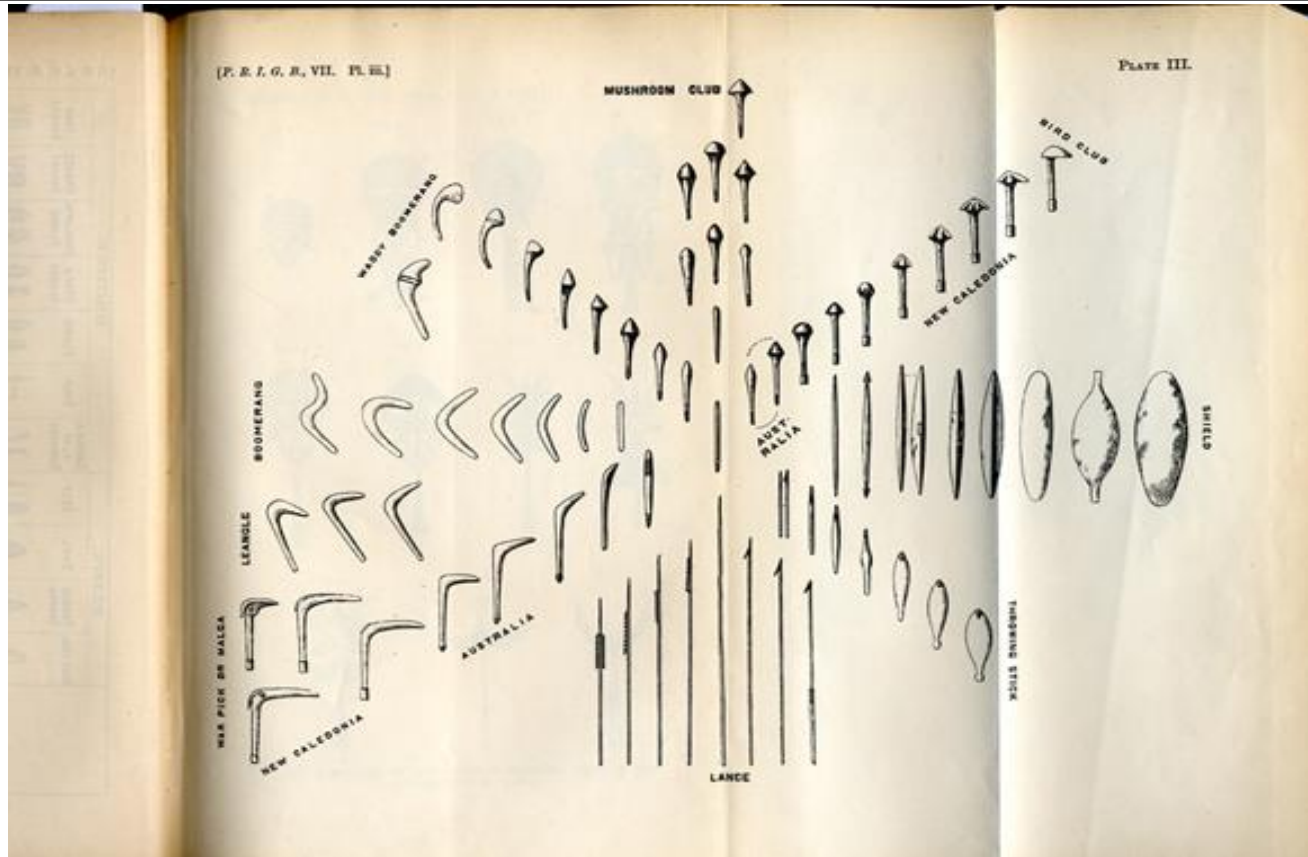
“Alain” (Emile Chartier), 1908

The evolution of the violin



“Peculiarities in the design and shape of instruments, transmitted luthier-to-apprentice, would arise, not unlike *genetic drift*. The process of creating the outline, whether adhering strictly to a preexisting mold or pioneering a new shape, is not unlike *inheritance and mutation*”

Descent with modification

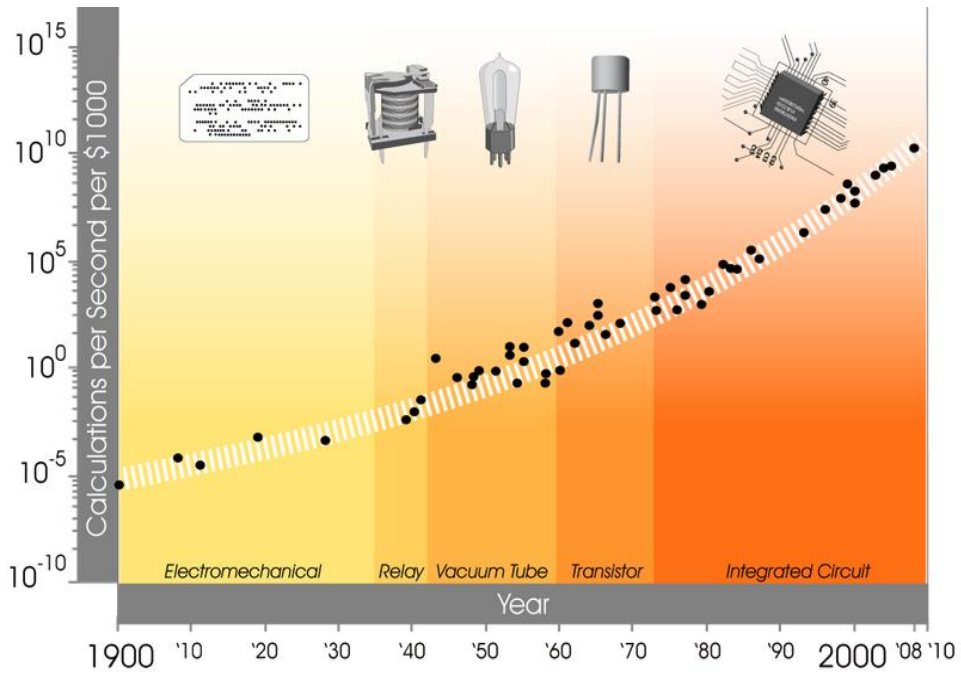


“The result of human
action, but not the
execution of any
human design”

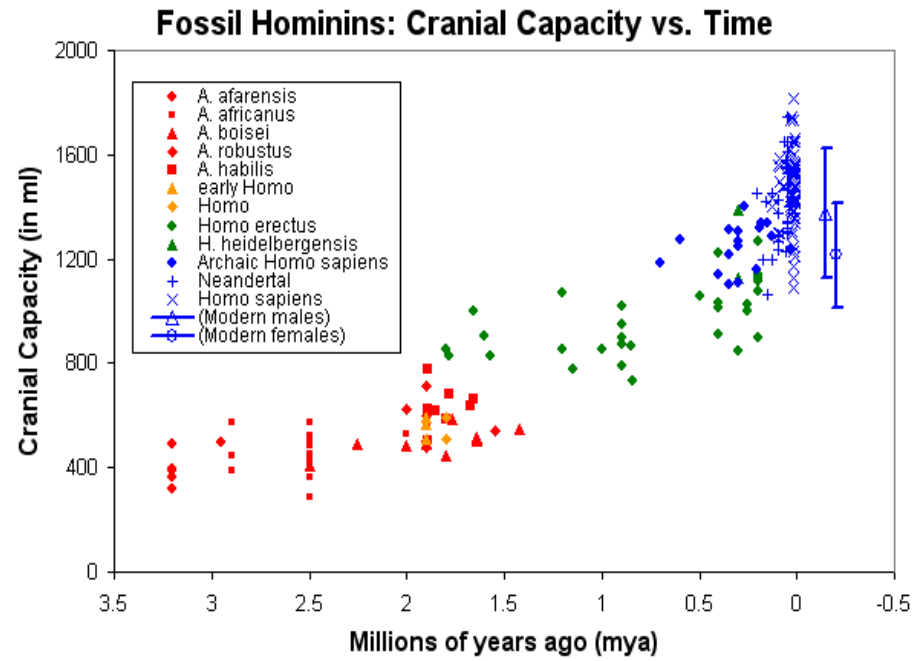
Adam Ferguson, 1767



Kurzweil's version of Moore's Law



Human brain size



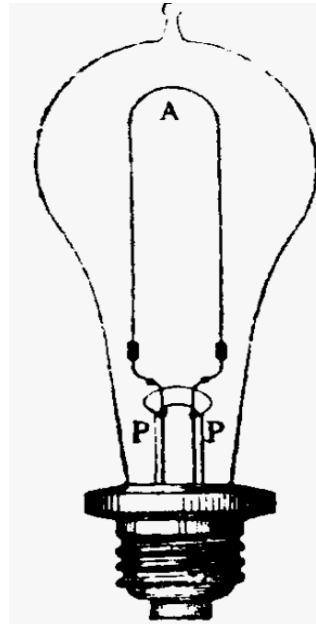
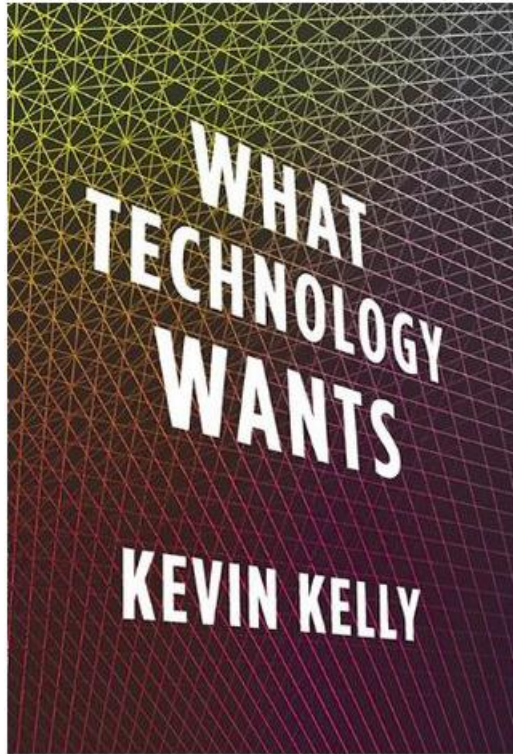


Fig. 9. Lampa
żarowa Edisona.

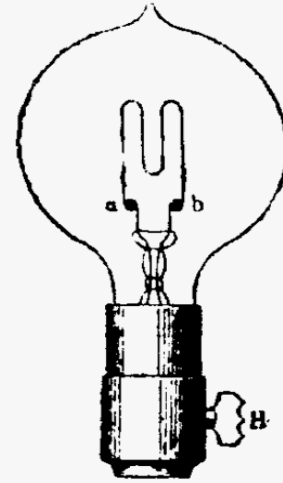


Fig. 10. Lampa
Maxime'a.

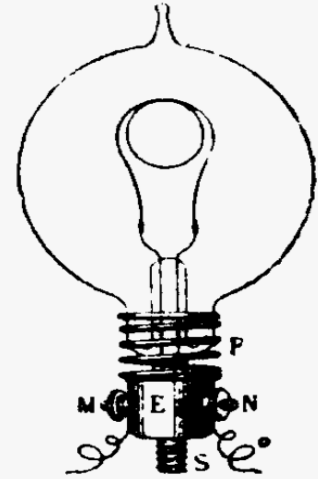


Fig. 11. Lampa
Swana.

1759

The
General
Theory
Of
Evolution

THE
THEORY
OF
MORAL SENTIMENTS.

By ADAM SMITH,
PROFESSOR of MORAL PHILOSOPHY in the
University of GLASGOW.



LONDON:
Printed for A. MILLAR, in the STRAND;
And A. KINCAID and J. BELL, in EDINBURGH.
MDCCLIX.

1859

The
Special
Theory
Of
Evolution

ON
THE ORIGIN OF SPECIES

BY MEANS OF NATURAL SELECTION,

OR THE

PRESERVATION OF FAVOURED RACES IN THE STRUGGLE
FOR LIFE.

By CHARLES DARWIN, M.A.,
FELLOW OF THE ROYAL, GEOLOGICAL, LINNEAN, ETC., SOCIETIES;
AUTHOR OF 'JOURNAL OF RESEARCHES DURING H. M. S. BEAGLE'S VOYAGE
ROUND THE WORLD.'

LONDON:
JOHN MURRAY, ALBEMARLE STREET.
1859.

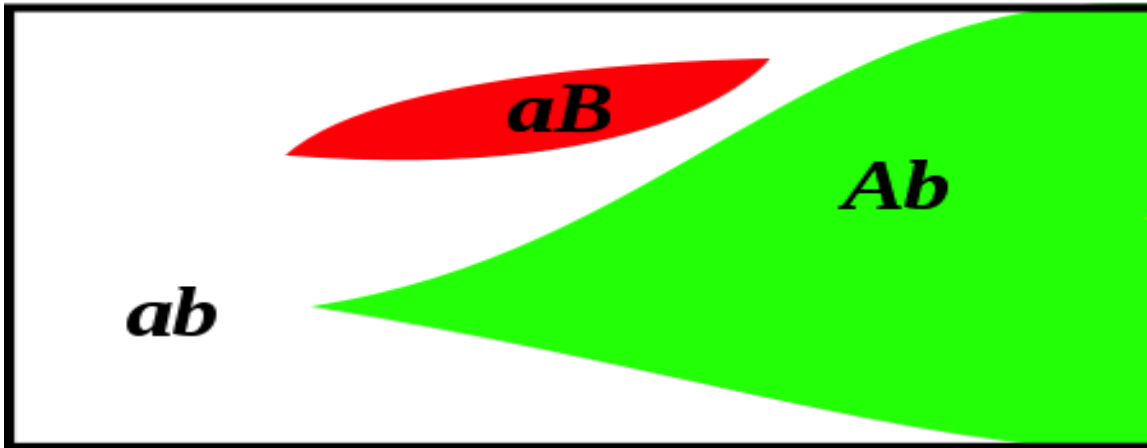
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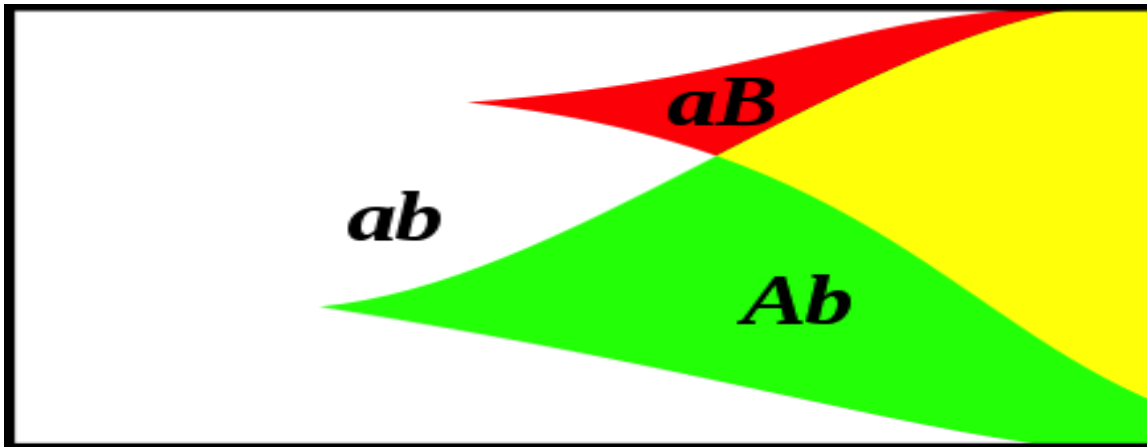


Recombination fuels cumulative evolution

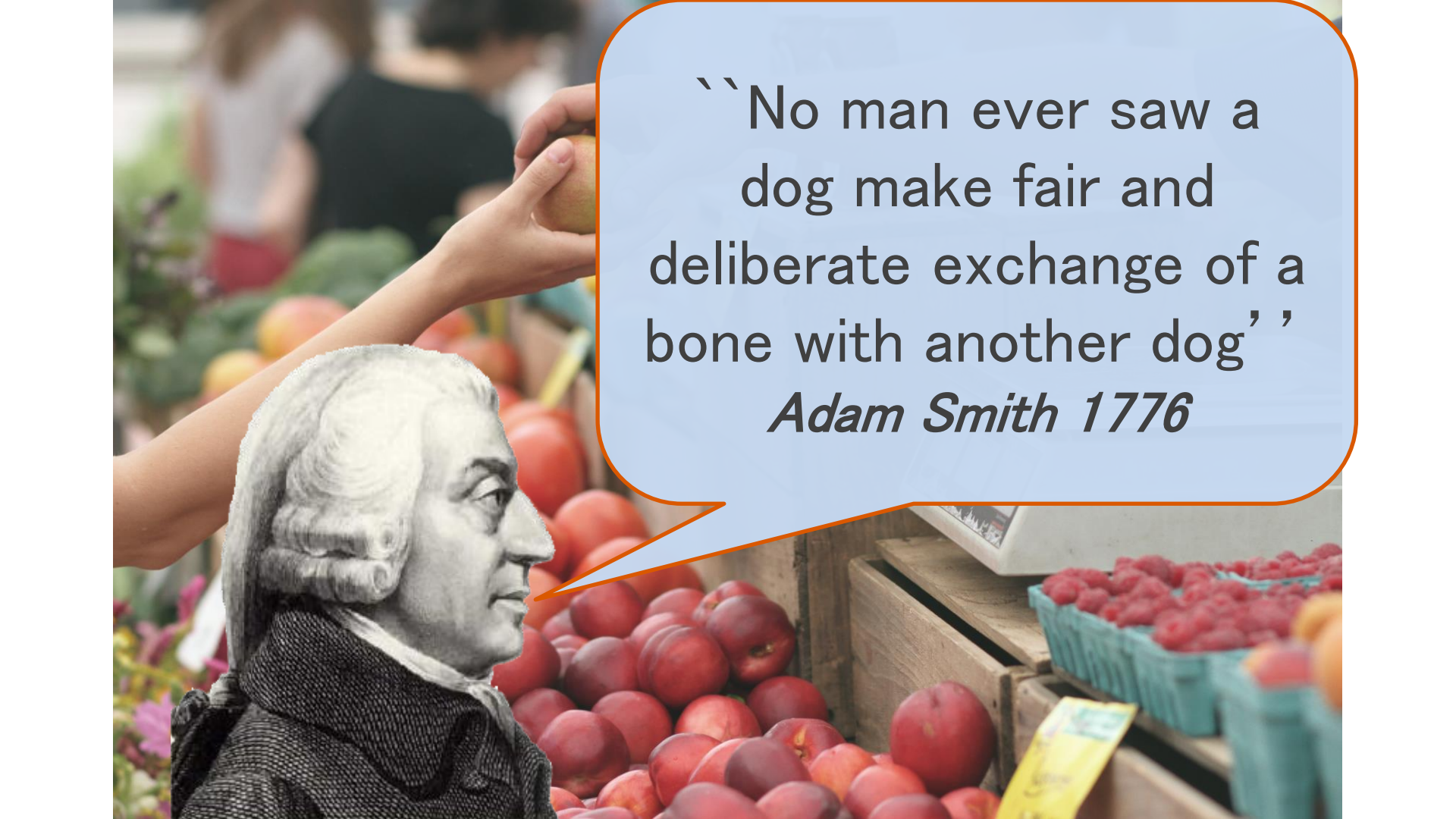
Asexual
population



Sexual
population







“No man ever saw a dog make fair and deliberate exchange of a bone with another dog”
Adam Smith 1776

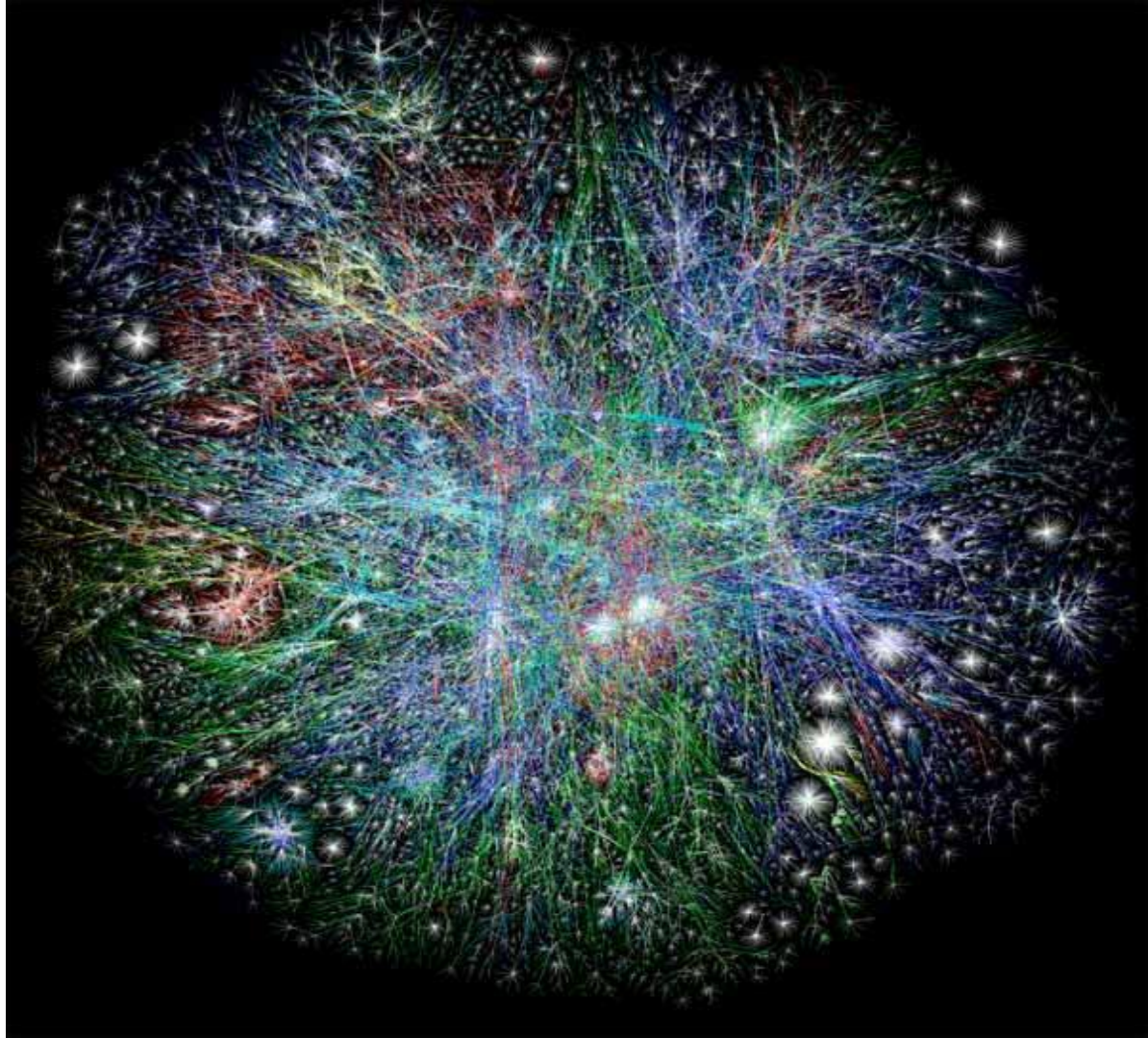
When ideas have sex...











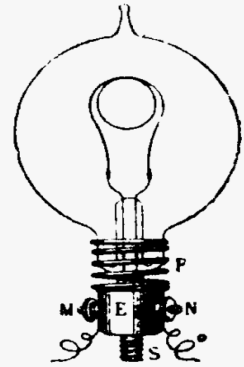
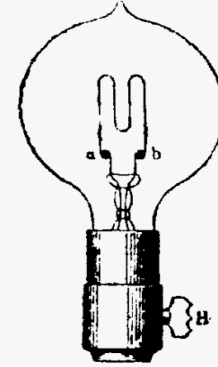
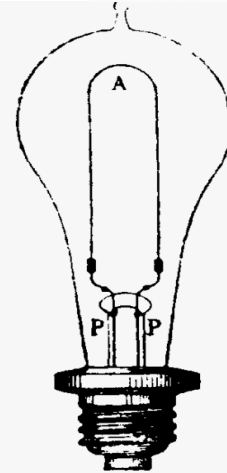
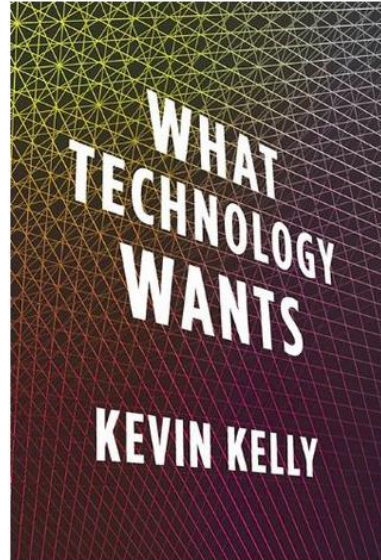
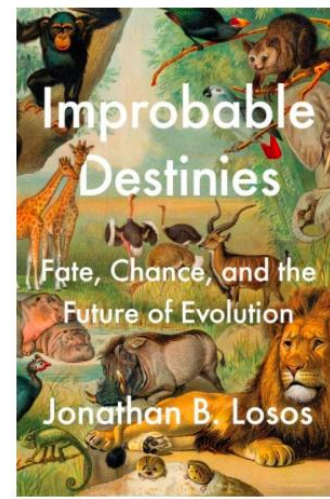
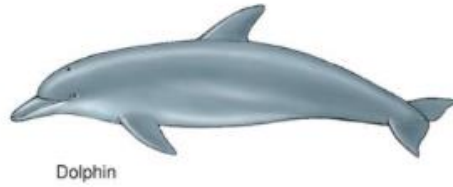
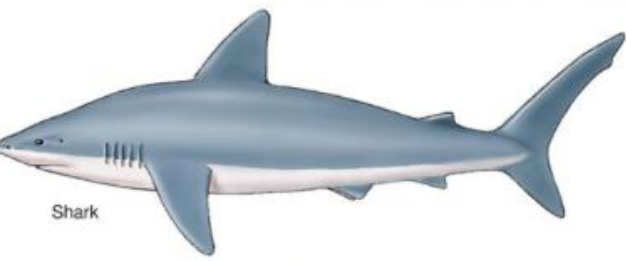


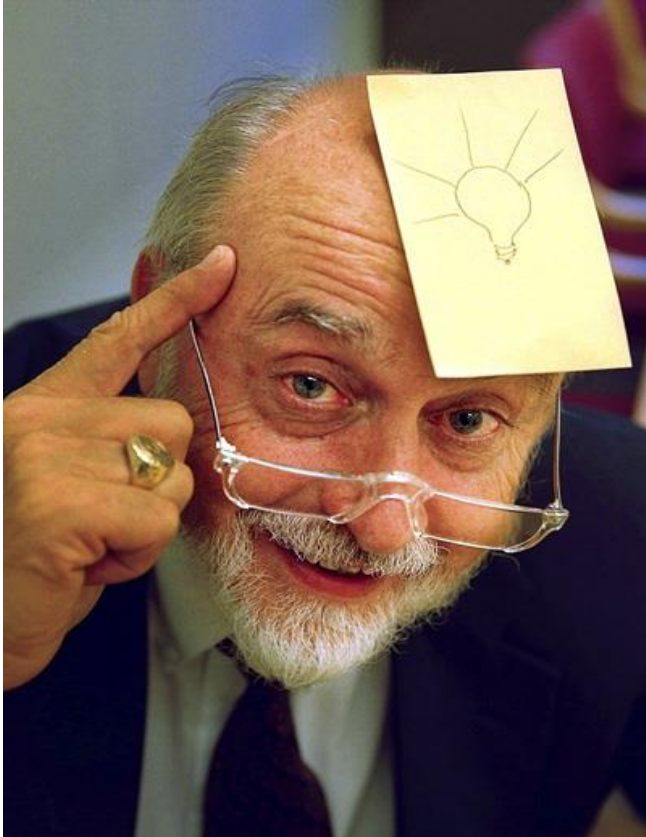
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Fig. 10. Lampa Maxime'a.

Fig. 11. Lampa Swana.



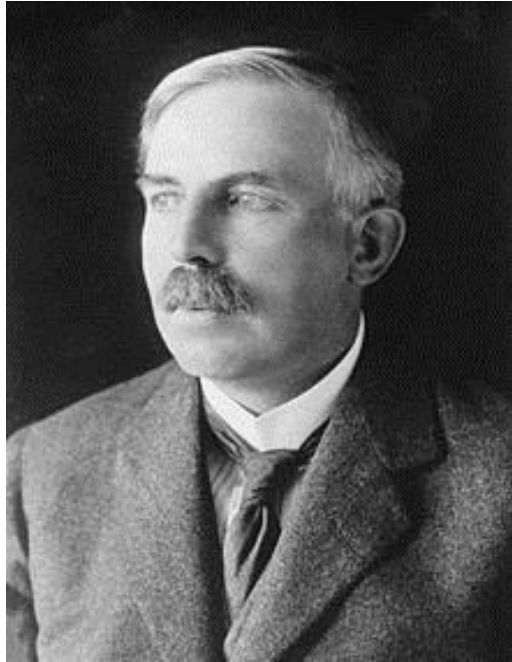
Trial and error



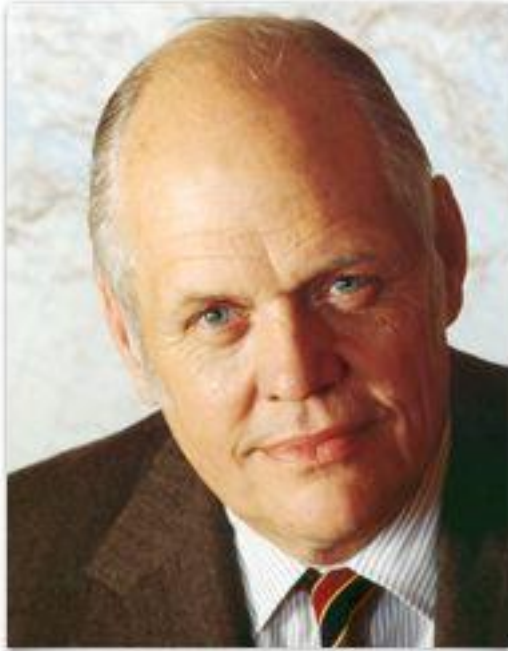
“Innovation is a numbers game. You have to go through 5,000 to 6,000 raw ideas to find one successful business.”

Art Fry, inventor of the Post-it note at 3M

Prediction is hard...



Ernest Rutherford, Nobel Prize Winner, 1933

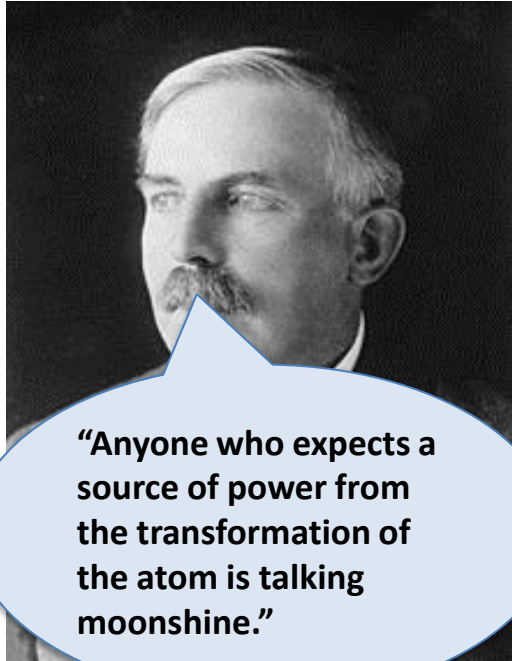


Ken Olsen, founder and chairman, Digital Equipment Corporation, 1977



Paul Krugman, Nobel-winning economist, 1998.

Prediction is hard...



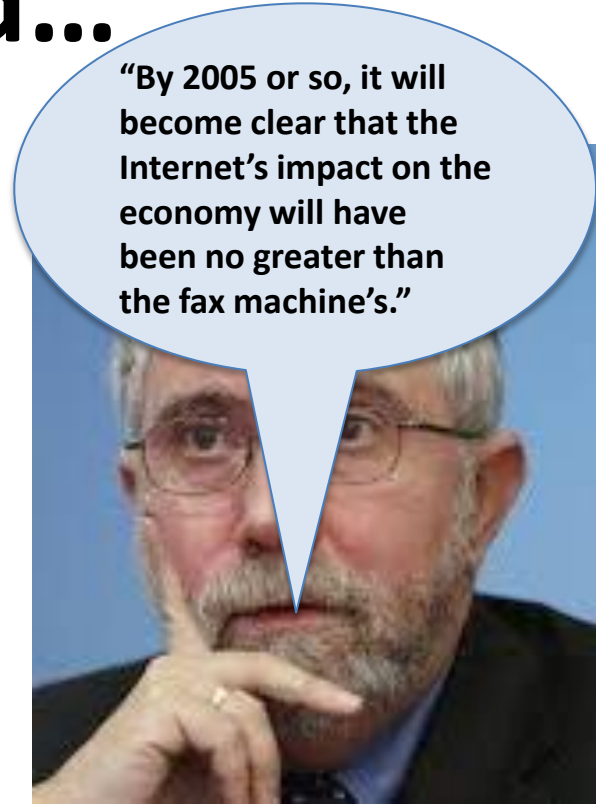
“Anyone who expects a source of power from the transformation of the atom is talking moonshine.”

Ernest Rutherford, Nobel Prize Winner, 1933



“There is no reason anyone would want a computer in their home.”

Ken Olsen, founder and chairman, Digital Equipment Corporation, 1977

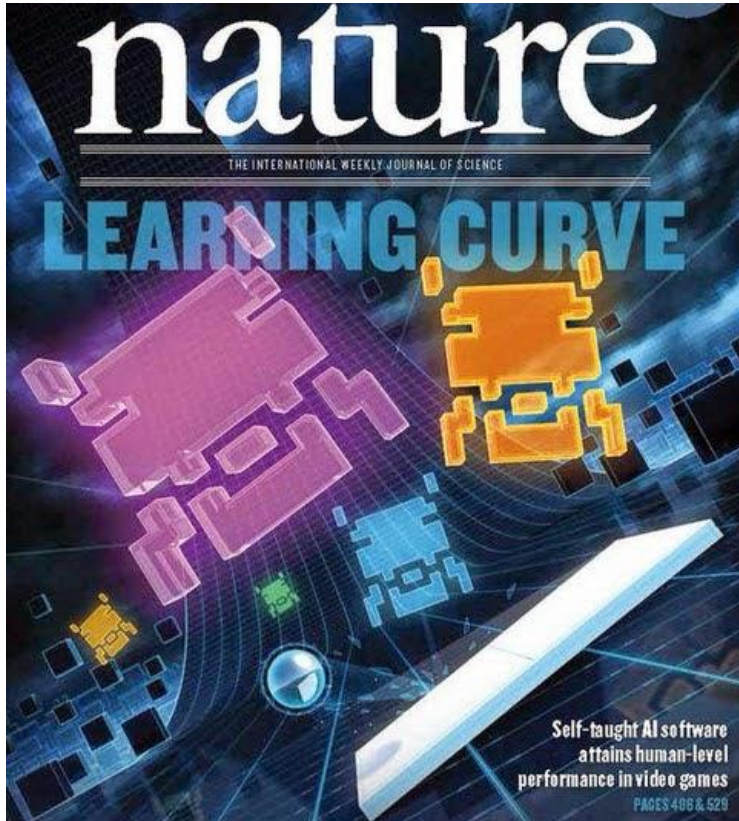


“By 2005 or so, it will become clear that the Internet’s impact on the economy will have been no greater than the fax machine’s.”

Paul Krugman, Nobel-winning economist, 1998.



The cognification revolution?





“The capitalist achievement does not typically consist in providing more silk stockings for queens but in bringing them within reach of factory girls.”

Joseph Schumpeter

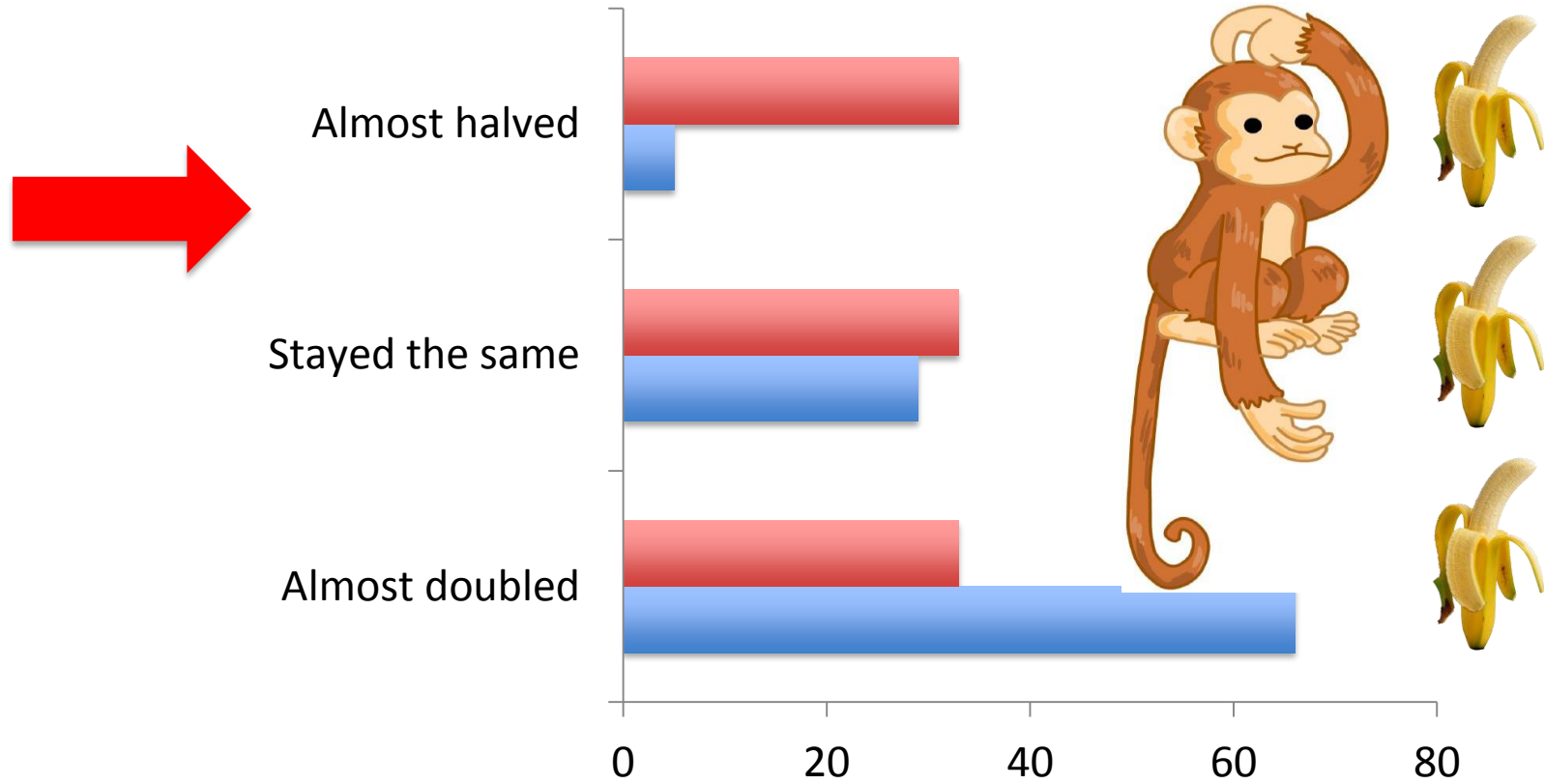




Optimism and innovation

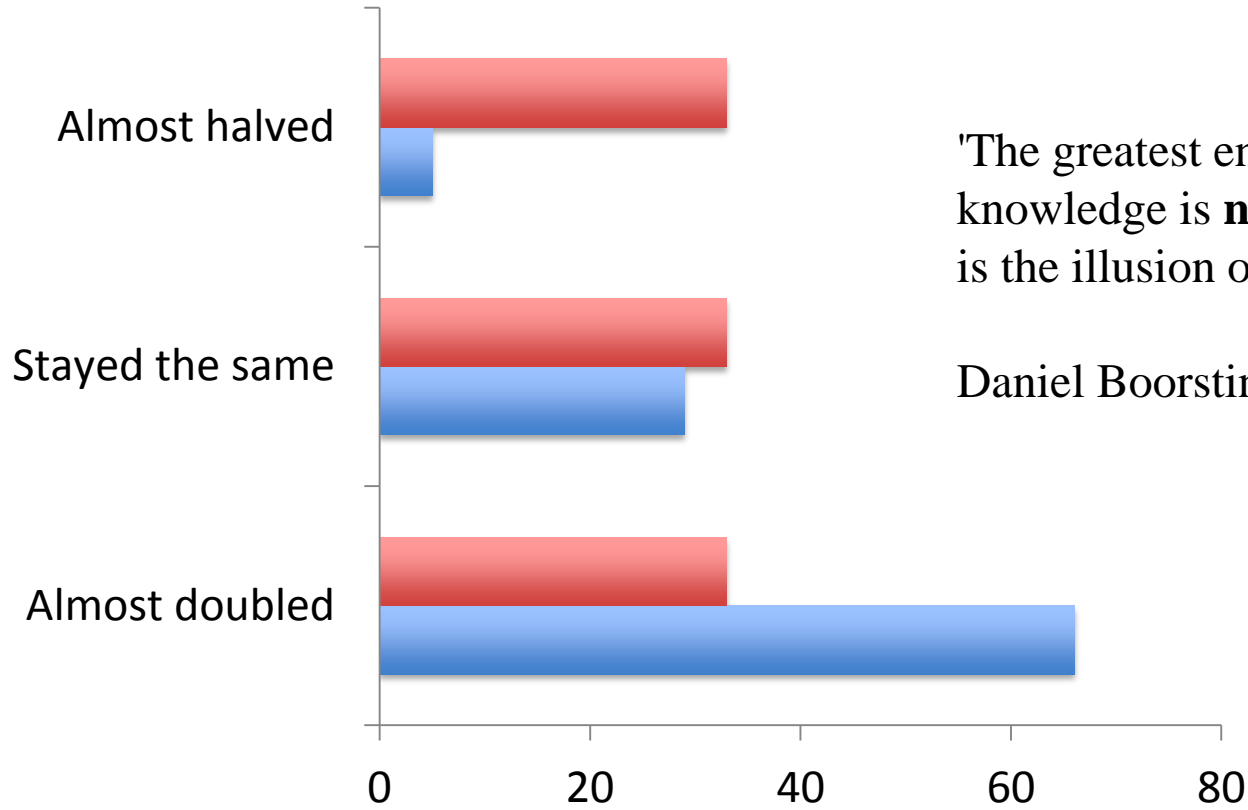


In the last 20 years the proportion of the world living in extreme poverty has....



Source: Gapminder and Novus, n=1005

In the last 20 years the proportion of the world living in extreme poverty has....



'The greatest enemy of knowledge is **not ignorance**, it is the illusion of knowledge.'

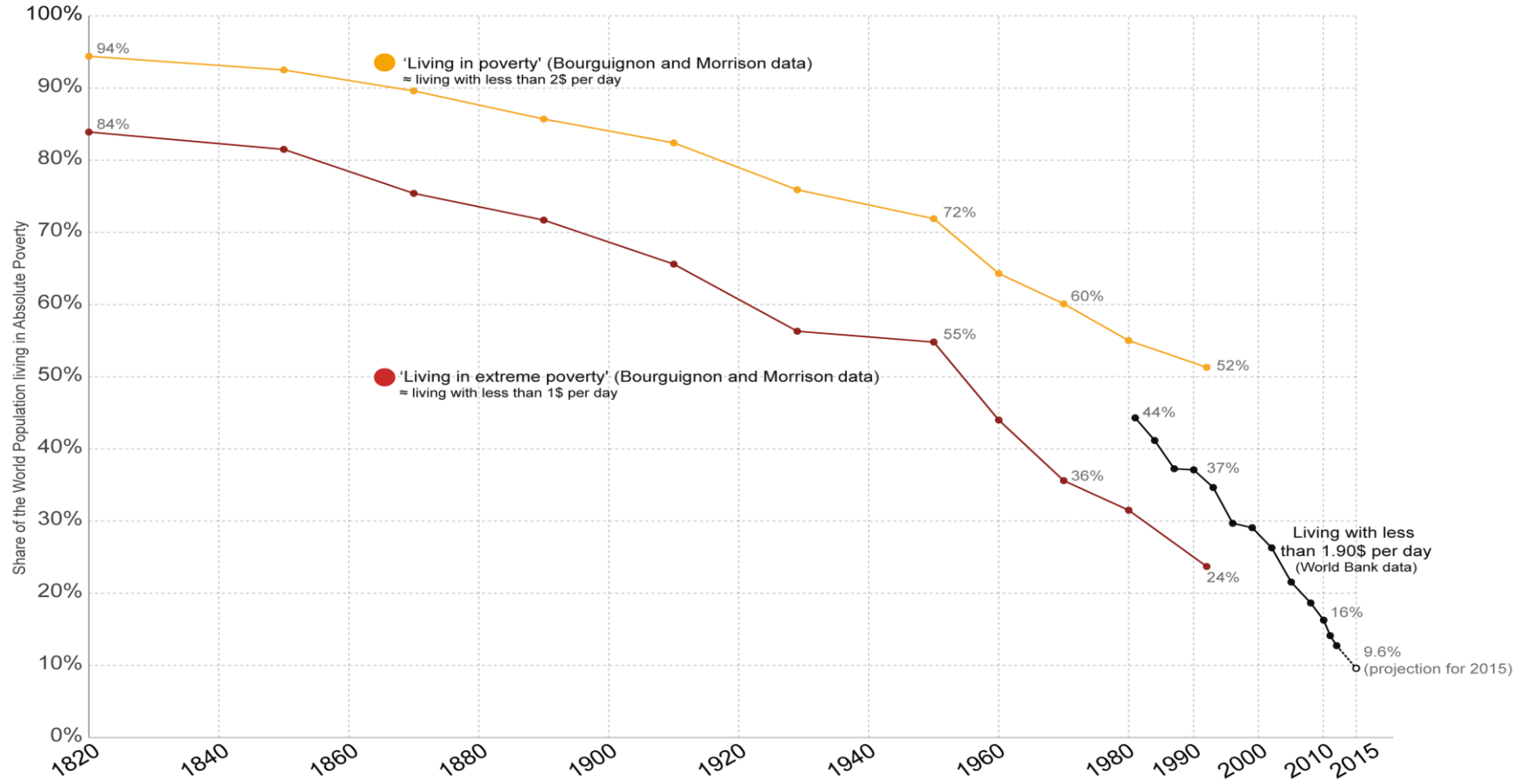
Daniel Boorstin



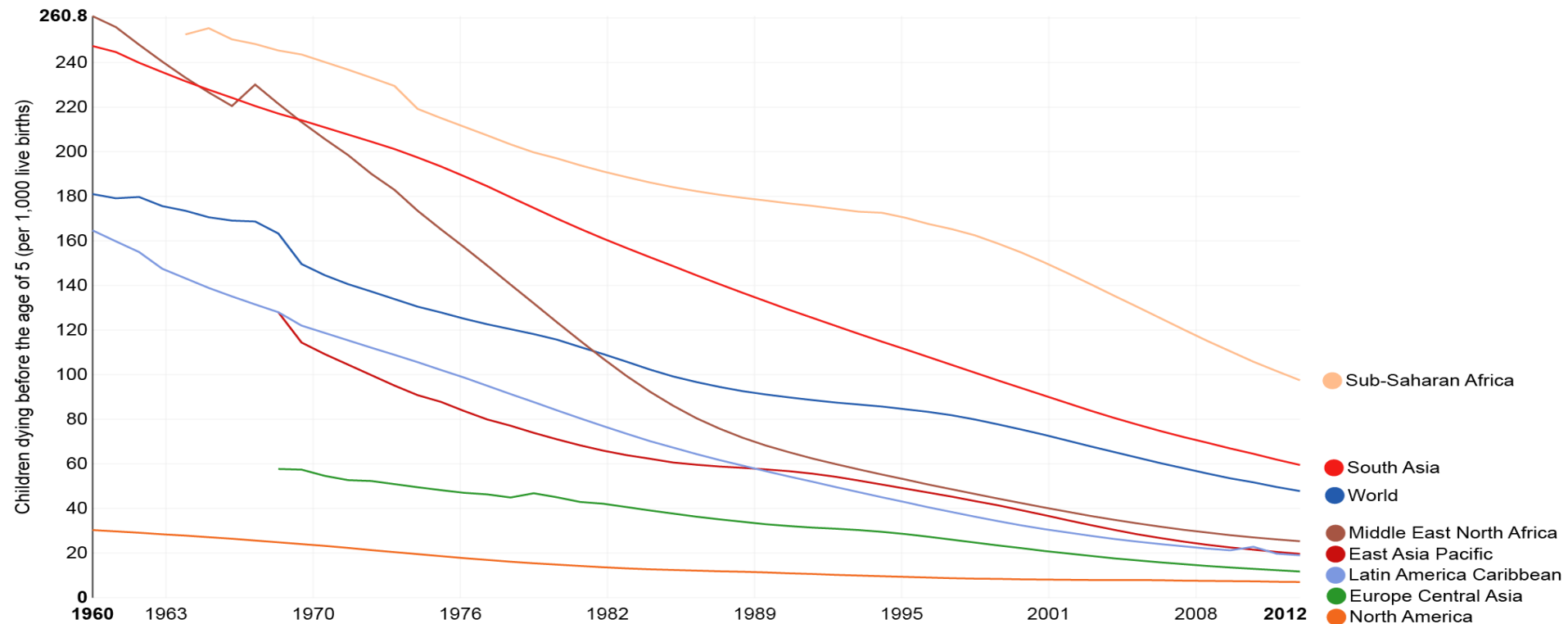
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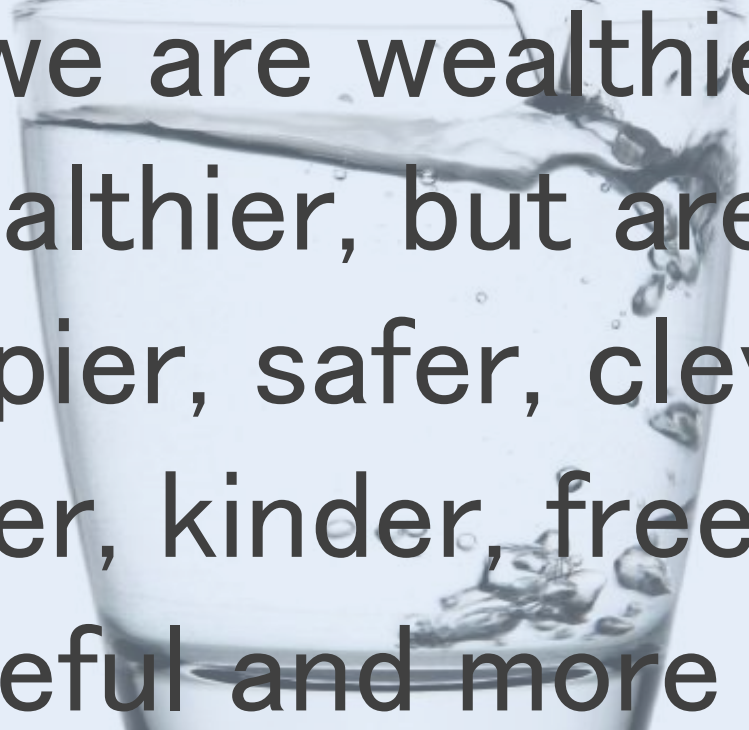
Share of the World Population living in Absolute Poverty, 1820-2015

All data are adjusted for inflation over time and for price differences between countries (PPP adjustment).



Child Mortality by World Region Since 1960



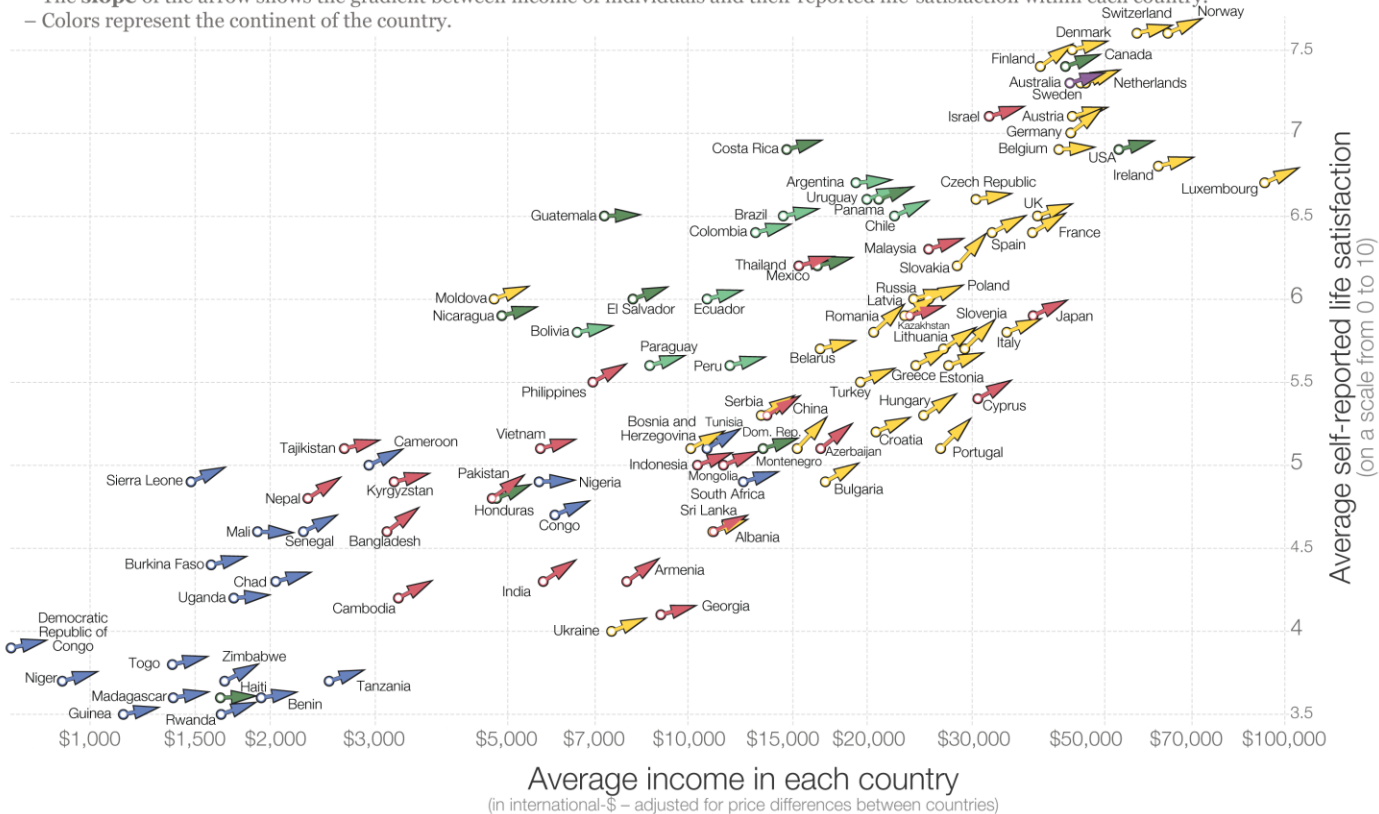


So we are wealthier and healthier, but are we happier, safer, cleverer, cleaner, kinder, freer, more peaceful and more equal?



People in richer countries tend to be happier and within all countries richer people tend to be happier

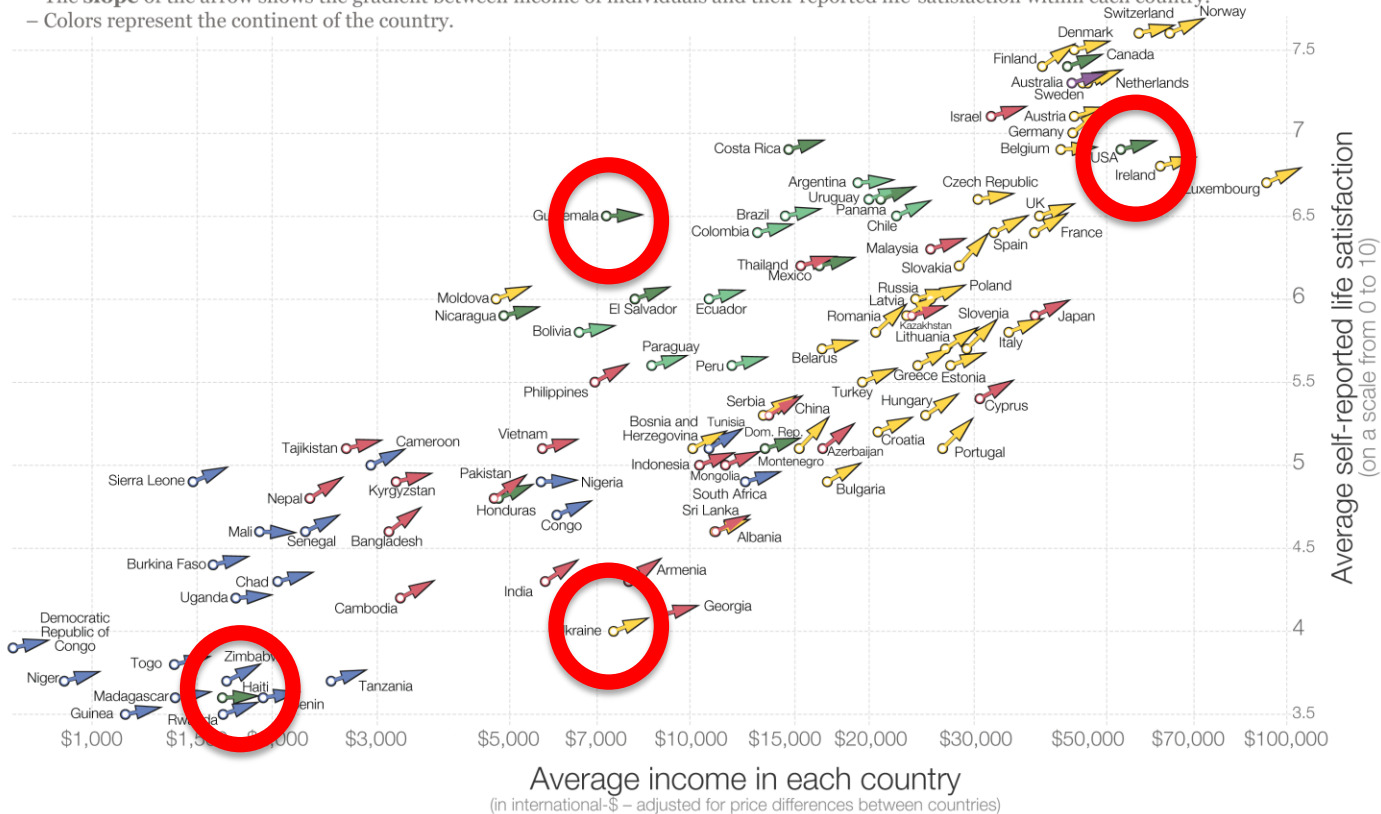
- The **position** of the arrow shows the average life satisfaction reported by the population of a country (vertical axis) and the average income of that country (horizontal axis).
- The **slope** of the arrow shows the gradient between income of individuals and their reported life-satisfaction within each country.*
- Colors represent the continent of the country.



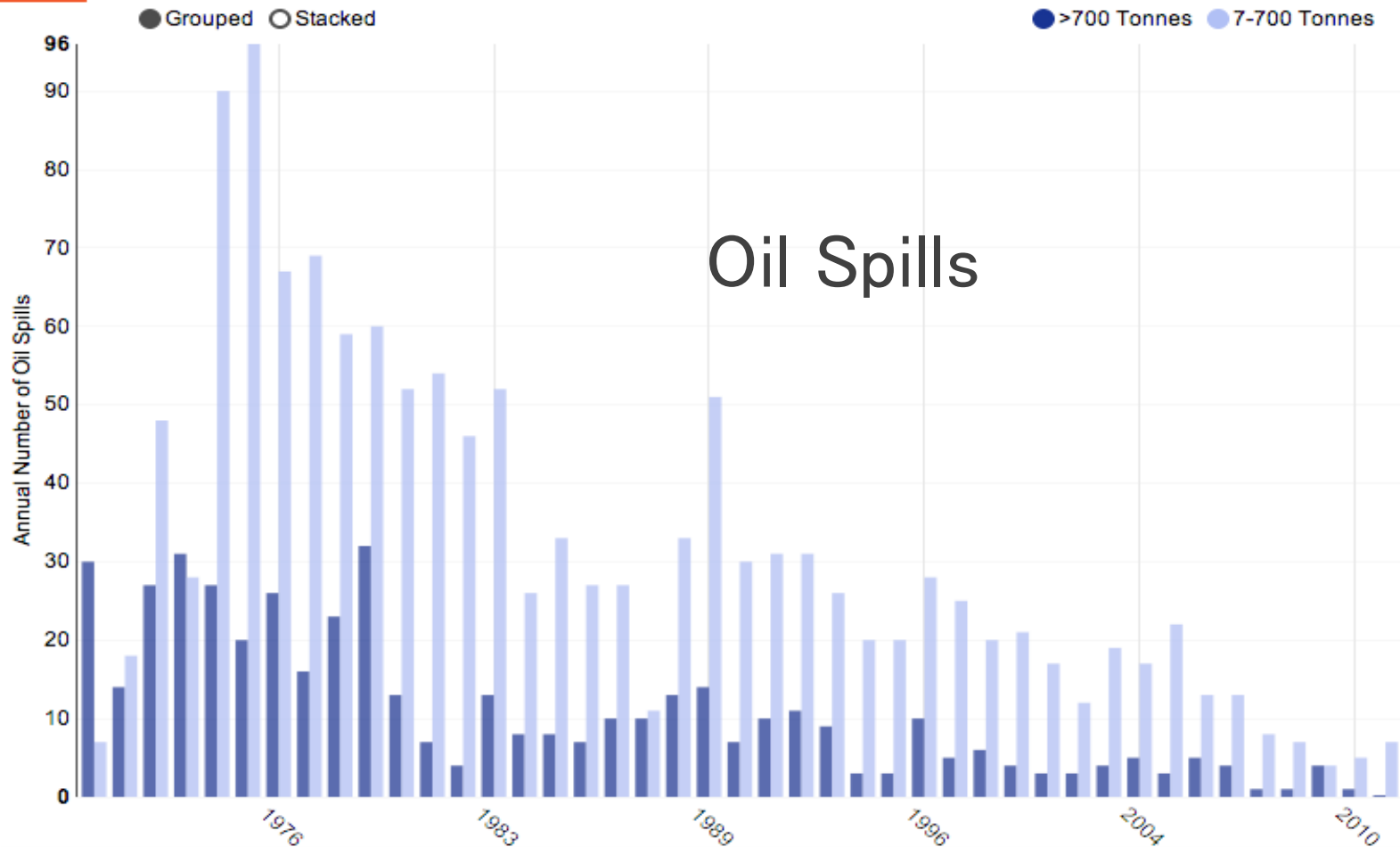
* The gradients correspond, country by country, to the regression coefficients between income quintiles and the related average life satisfaction reported by people within each income quintile.
Data sources: *World Bank* for data on incomes by quintile (based on income shares by quintile and GDP per capita as the mean income); *Gallup World Poll* for life satisfaction by income quintile. The visualization is available at [OurWorldinData.org](https://ourworldindata.org). There you find the research and more visualizations on life satisfaction. Licensed under [CC-BY-SA](https://creativecommons.org/licenses/by-sa/4.0/) by the author Max Roser.

People in richer countries tend to be happier and within all countries richer people tend to be happier

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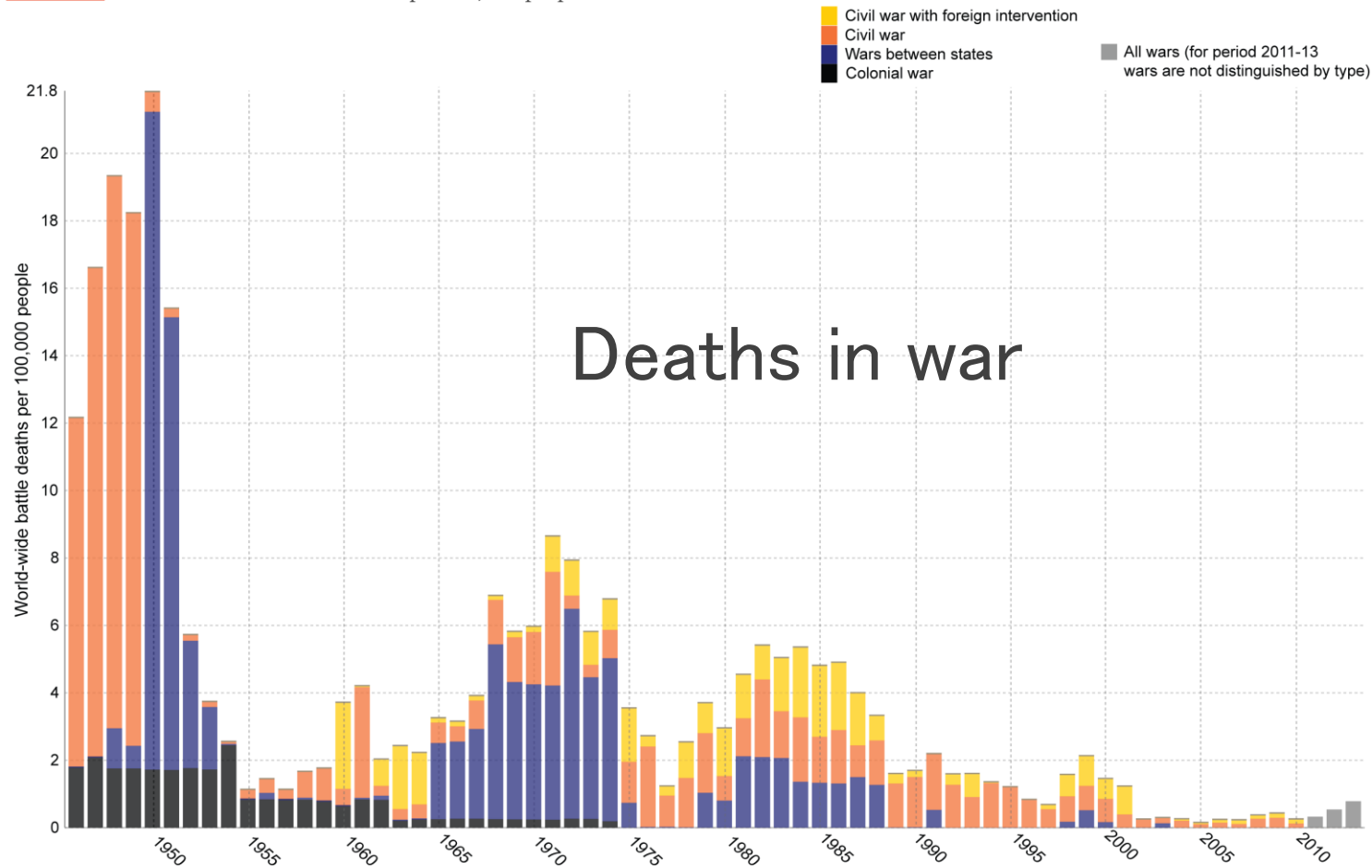


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Data sources: ITOFF

Battle death rate in state based conflicts by type (1946-2013) – by Max Roser

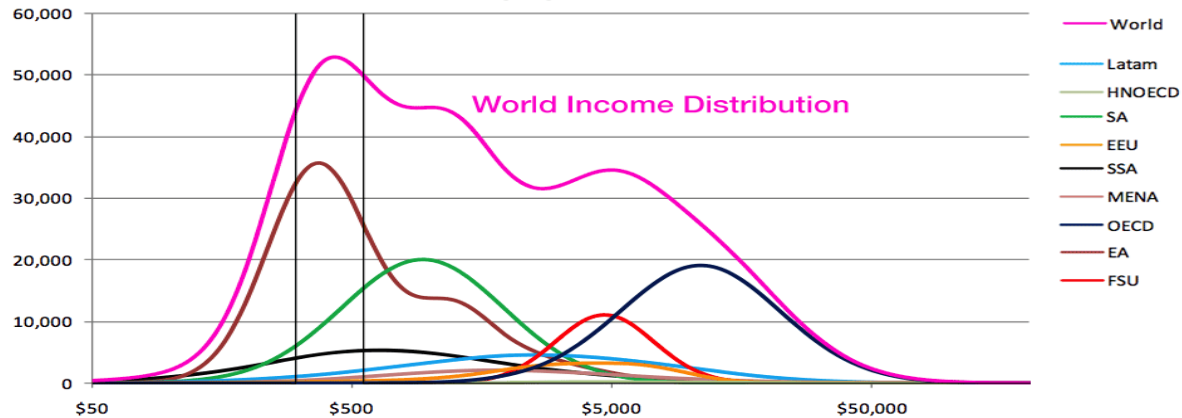
Annual world-wide battle deaths per 100,000 people



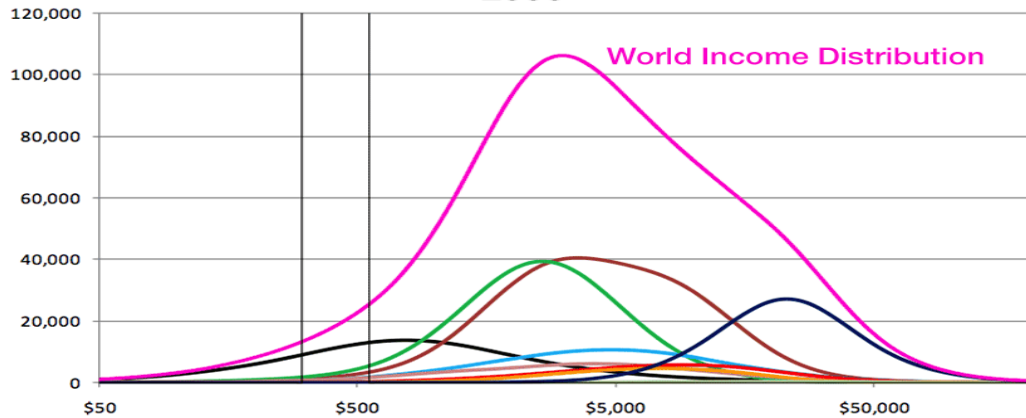
Deaths in war

Inequality

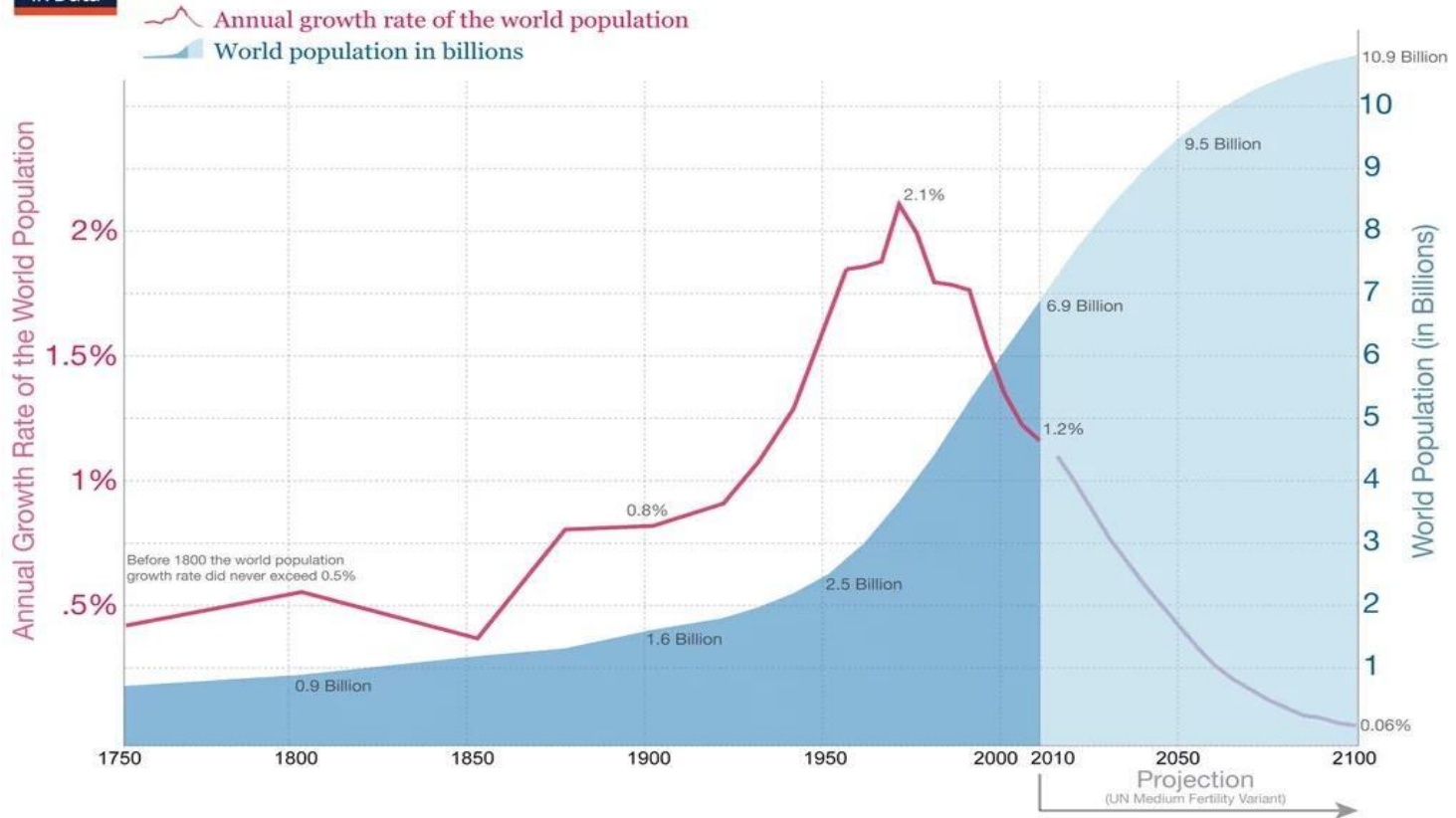
1970



2006



World population growth, 1750-2100 – By Max Roser

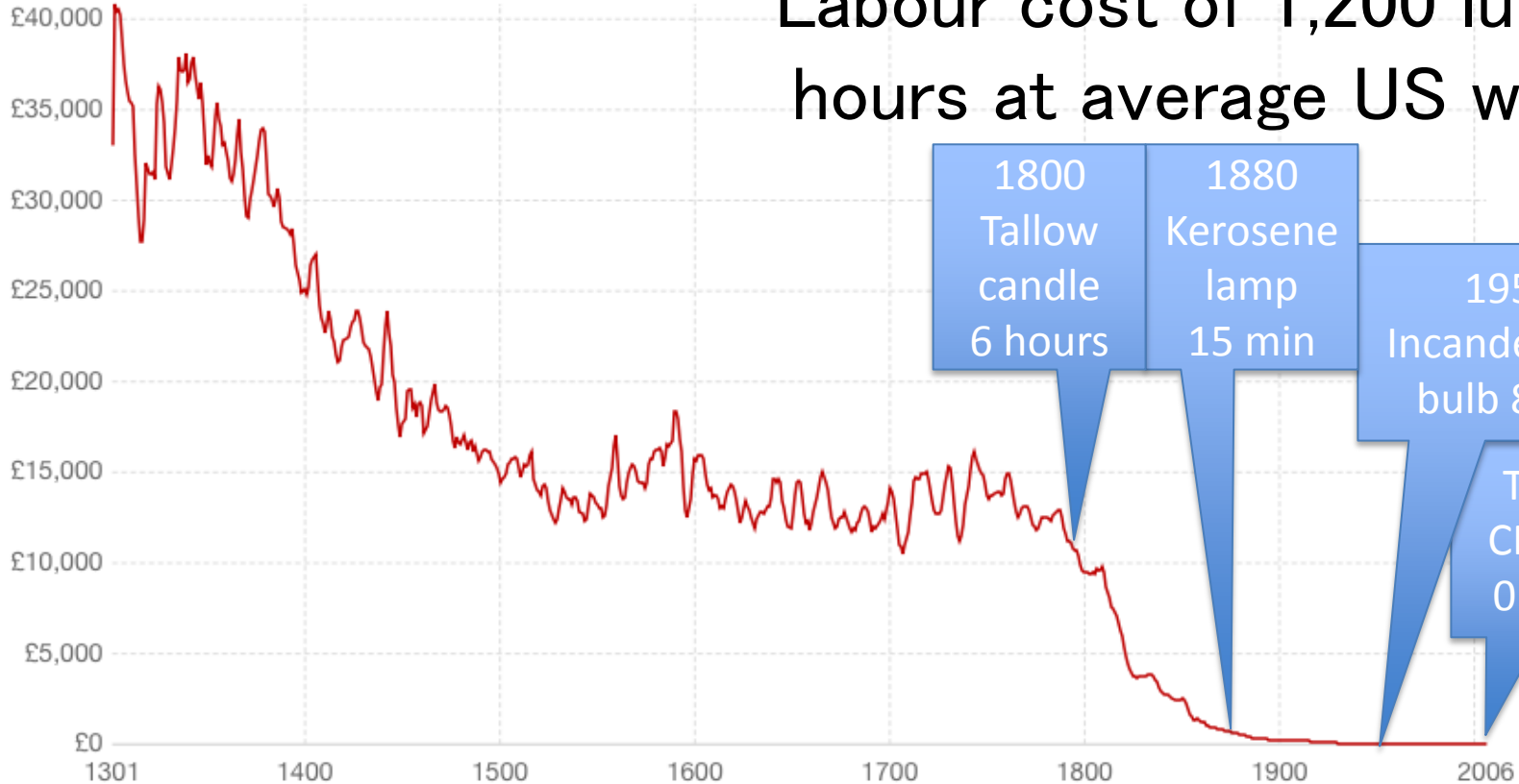


The Price for Lighting (per million lumen-hours) in the UK in British Pound



1 lumen hour is equal to the luminous energy emitted in 1 hour by a light source emitting a luminous flux of 1 lumen. For comparison: a standard 100W incandescent light bulb emits ±1700 lumen.

LINEAR

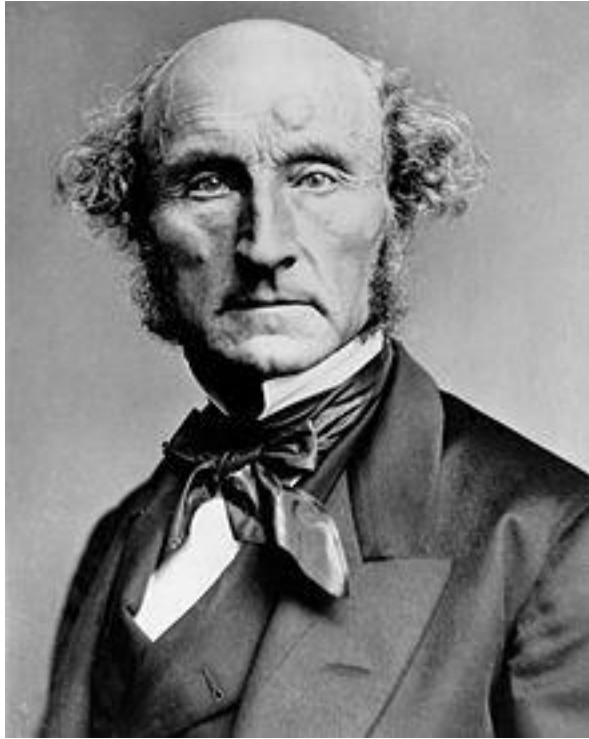


Labour cost of 1,200 lumen hours at average US wage

Source: Fouquet and Pearson (2012)

Notes: The price is adjusted for inflation and expressed in prices for the year 2000. Shown is a 5-year moving average.

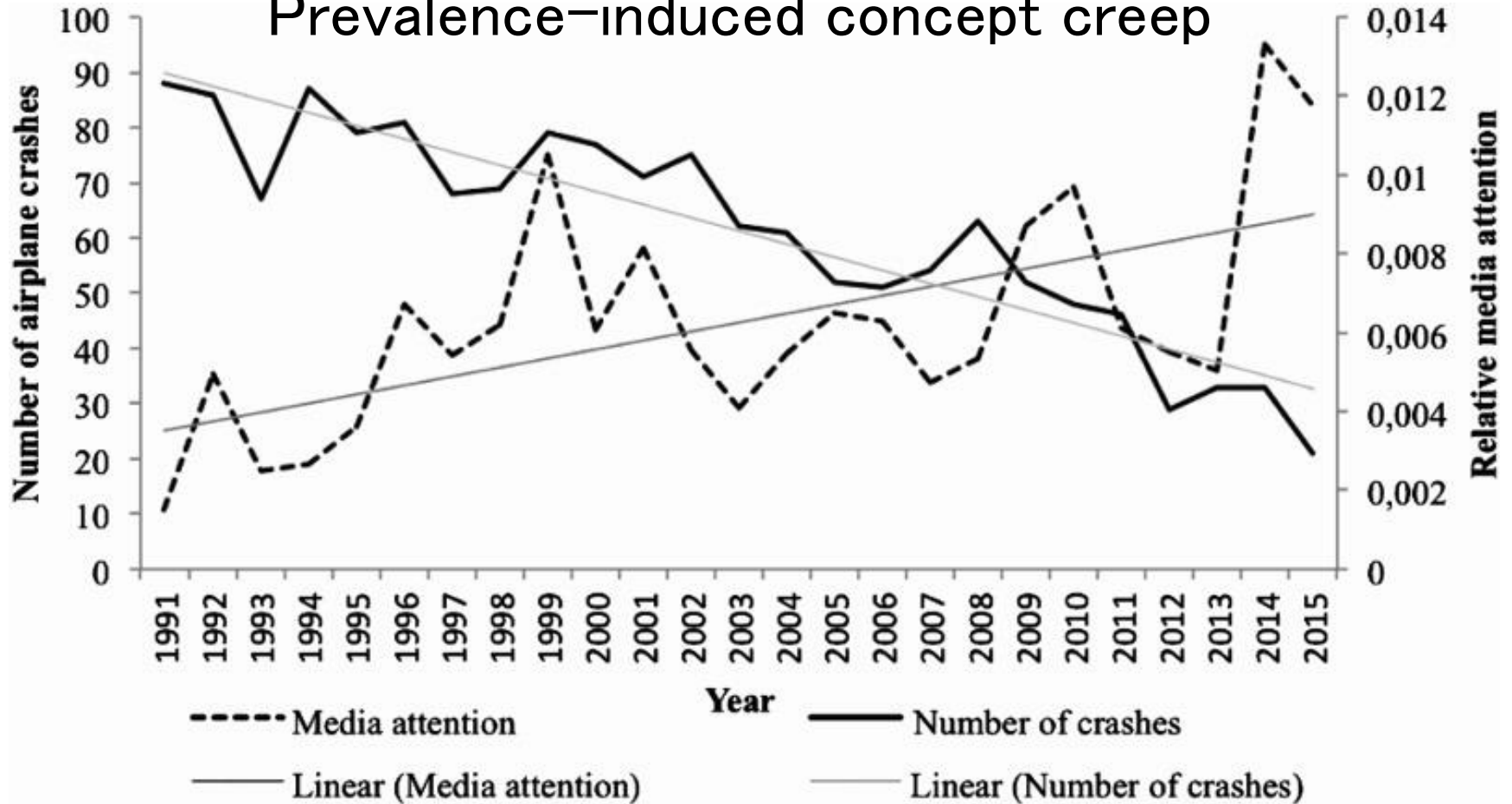
OurWorldInData.org/light/ • CC BY-SA



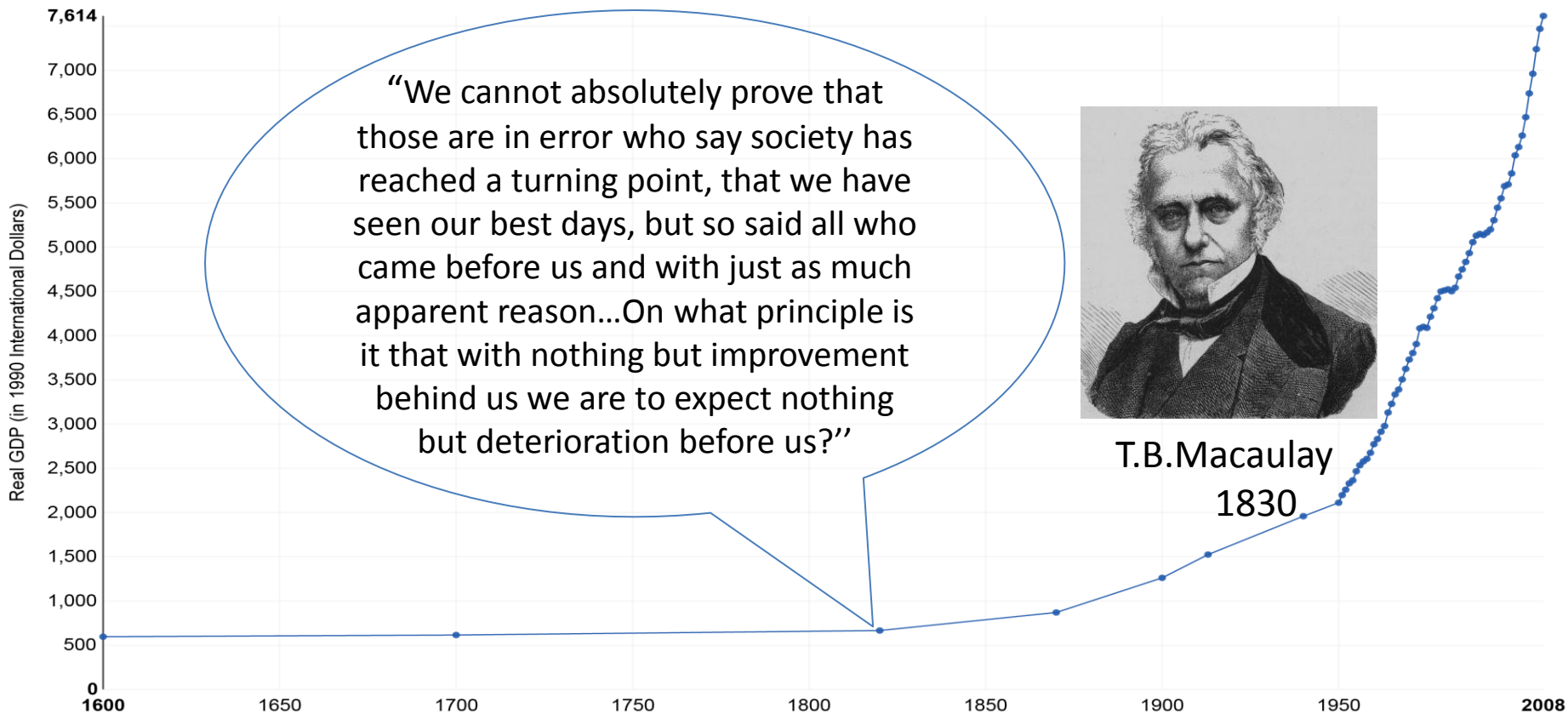
“I have observed that not the man who hopes when others despair, but the man who despairs when others hope, is admired by a large class of persons as a sage.”

John Stuart Mill, 1828

Prevalence-induced concept creep



Real World Average GDP per Capita Since 1600









The End

