Never for Ever

Is the world really getting more complex, unpredictable and volatile?

17 September 2014
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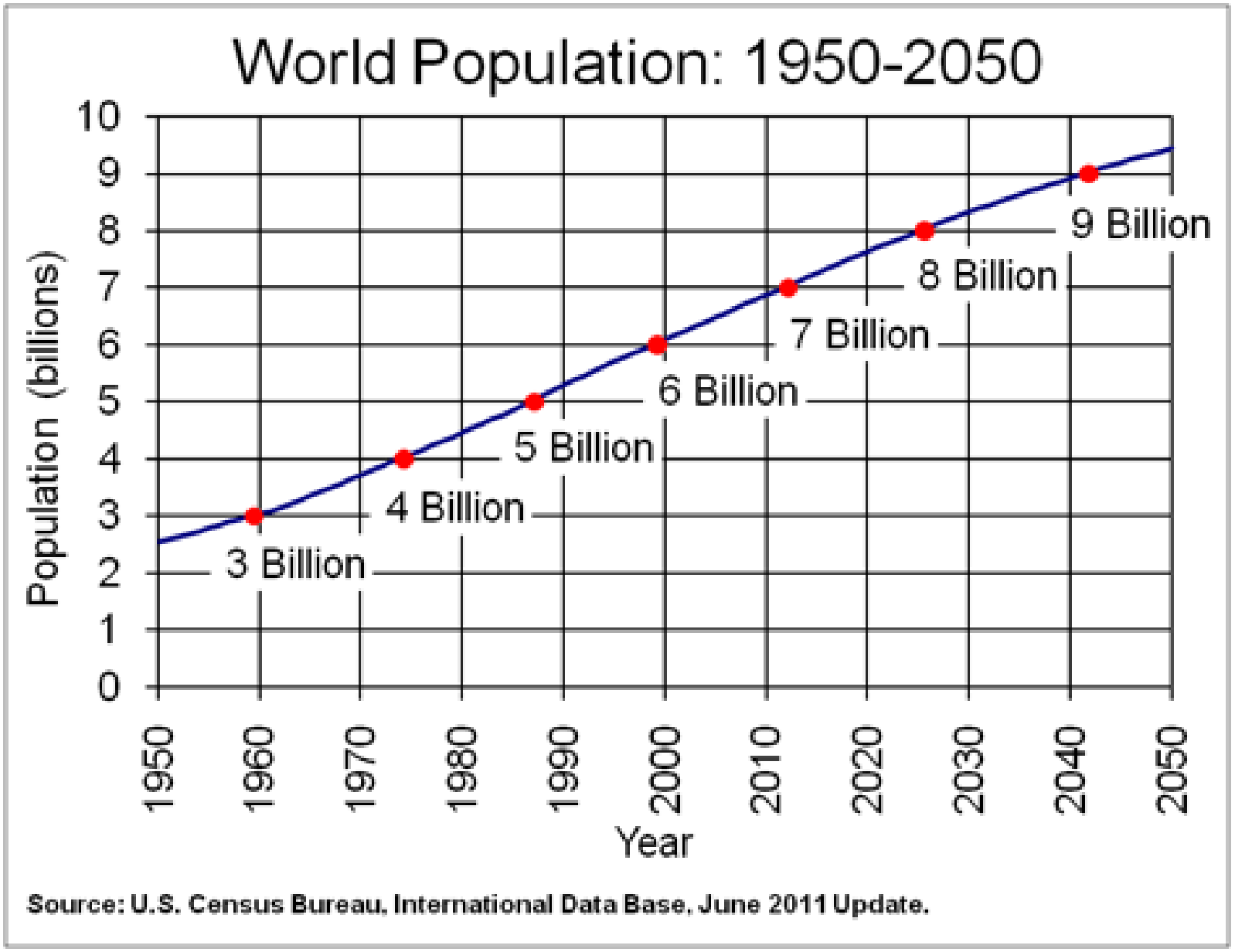
LSE COMPLEXiTY research programme

Is the world really getting more complex, unpredictable and volatile?

- Is there any empirical evidence for an accelerated change in the world?
- Is there really greater change today than in the past?
  - we will look at population growth, wars & technology
  - within a historical context

- In what sense is the world complex and unpredictable?
- Is it becoming more complex?
  - from a complexity theory perspective

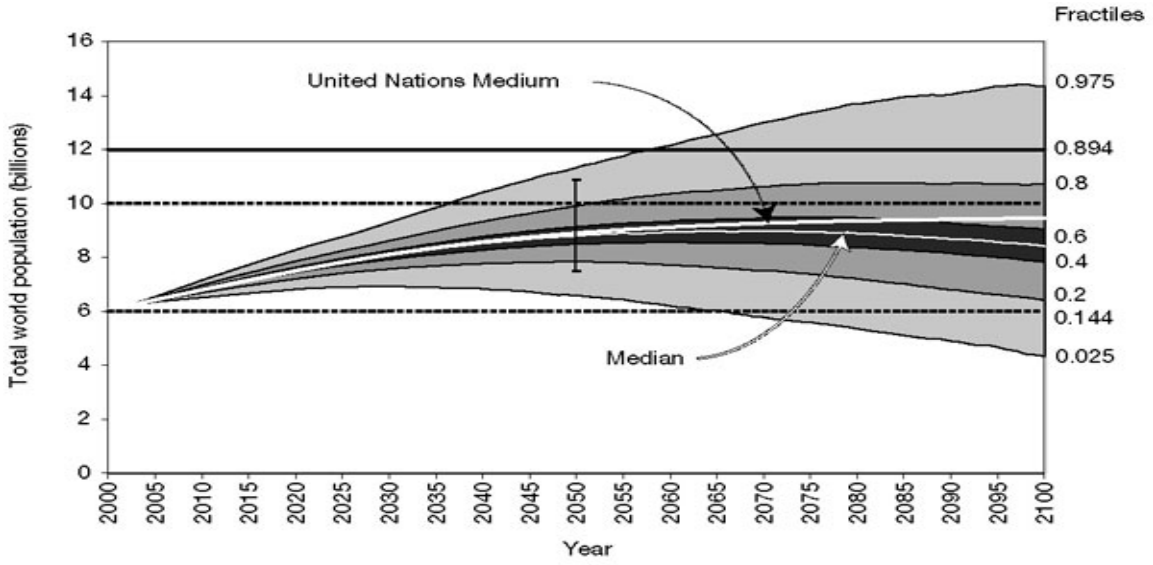

World Population: 1950-2050
Population (billions)
0
1
2
3
4
5
6
7
8
9
10
1950
1960
1970
1980
1990
2000
2010
2020
2030
2040
2050
Year
3 Billion
4 Billion
5 Billion
6 Billion
7 Billion
8 Billion
9 Billion
Source: U.S. Census Bureau, International Data Base, June 2011 Update.

The end of world population growth

*W. Lutz, W. Sanderson & S. Scherbov**

- Population growth is likely to come to an end in the foreseeable future
- Improving on earlier methods of probabilistic forecasting, the authors show that there is:
  - 85% chance that the world's population will stop growing before the end of the century
  - 60% probability that the world's population will not exceed 10 billion people before 2100
  - 15% probability that the world's population at the end of the century will be lower than it is today
  - For different regions, the date and size of the peak population will vary considerably

*Lutz, W, Sanderson, WC and S Scherbov, 'The end of world population growth,' *Nature*, vol. 412, no. 6846 (2 August 2001), 543-545



Forecasted distributions of world population sizes

Distribution of simulated world population sizes over time. The median value of the projections reaches a peak around 2070 at 9.0 billion people and then slowly decreases

In 2100, the median value of the projections is 8.4 billion people

The medium scenario of the most recent United Nations long-range projection is almost identical to the median until the middle of the century, but is higher thereafter owing to the United Nations assumption of universal replacement-level fertility, that is two surviving children per woman.

Lutz, Sanderson and Scherbov, 'The end of world population growth', *Nature*

Trends in Great Power War

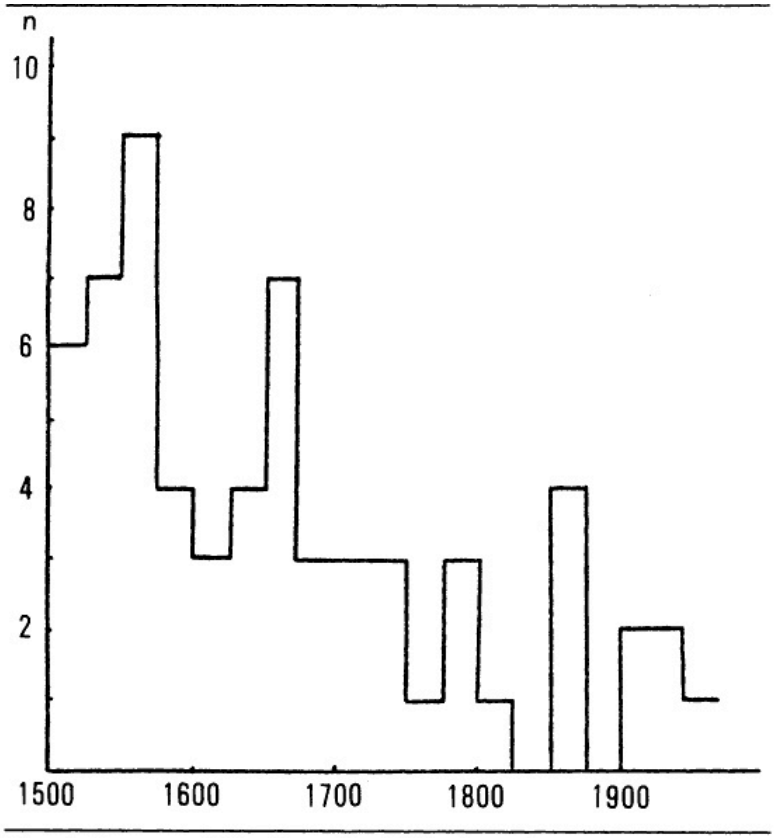


Figure 1: Frequency of Great Power War, 25-Year Intervals

TABLE 3
Average Frequency of Great Power War per Decade for Each Century

Century	*Average Frequency per Decade*
16th	2.6
17th	1.7
18th	1.0
19th	.50
20th	.66

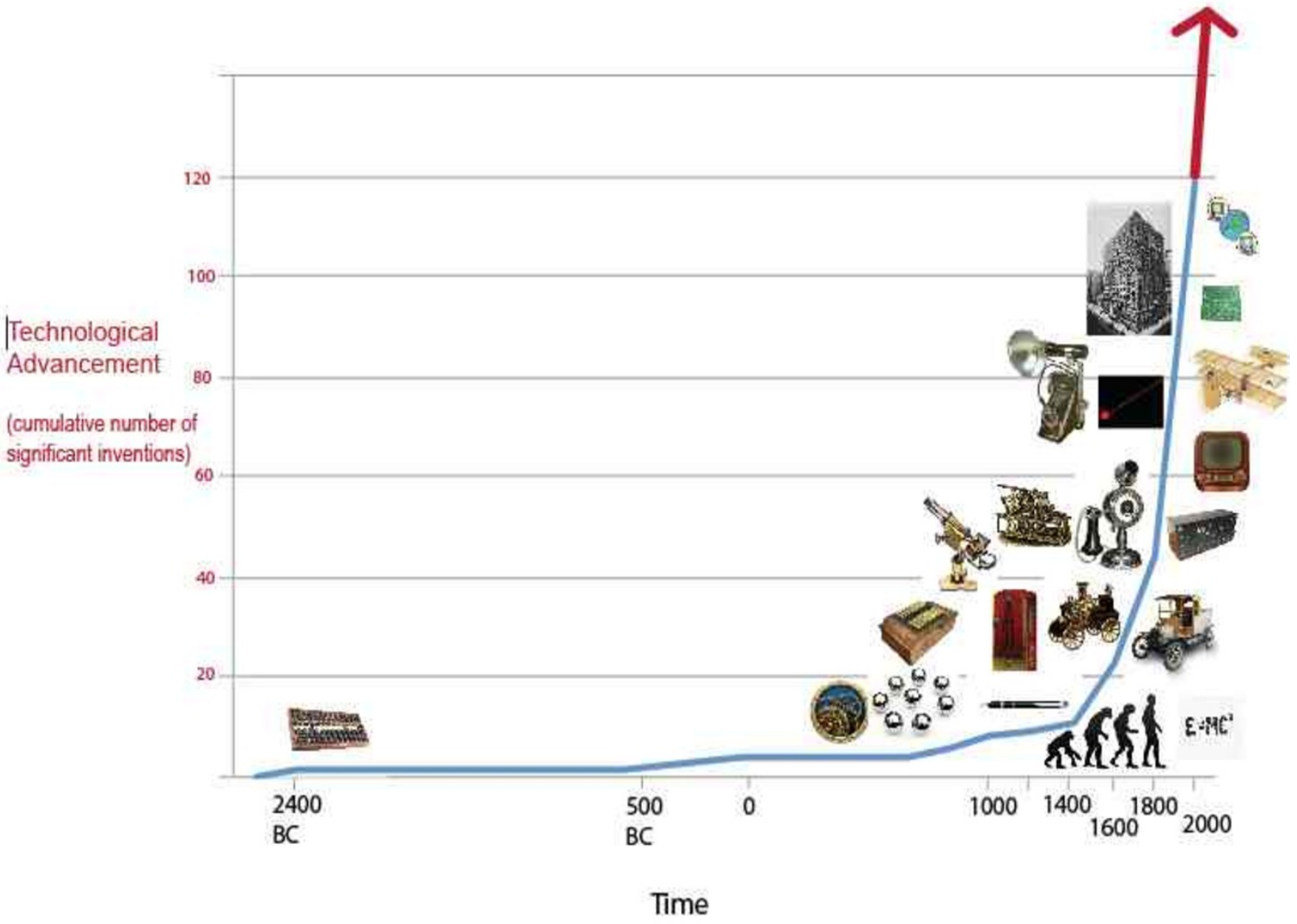
Source: Levy, Jack S. 'Historical Trends in Great Power War, 1495-1975,' *International Studies Quarterly*, Vol. 26, No. 2 (June 1982), 278-300.

Wars are becoming less frequent

*KS Gleditch & S Pickering**

- There is no reason to suspect that states no longer have contentious issues
- Indeed they have increased with greater interaction and globalisation
- However, development, democratisation and capitalism may have made it easier for states to reach agreement and avoid escalation to war and more costly to fail to reach agreement
- Trend towards a decline in war is also facilitated by global macro-trends such as increases in education and urbanisation
- As they foster attitudes that make people less likely to glorify violence and more likely to seek rational compromise

- *Economic History Review, 67, 1 (2014), pp 214-230


Technological Advancement
(cumulative number of significant inventions)
120
100
80
60
40
20
2400 BC
500 BC
0
1000
1400
1600
1800
2000
Time
E=MC²

Industrial Revolution: 1760-1840

- This transition included:
  - going from hand production methods to machines,
  - new chemical manufacturing and iron production processes,
  - improved efficiency of water power
  - the increasing use of steam power
  - the development of machine tools
  - the change from wood and other bio-fuels to coal

- Started in Great Britain and spread to Western Europe and the United States within a few decades

- Economic historians agree that the *onset of the Industrial Revolution is the most important event in the history of humanity since the domestication of animals, plants and fire*.

Important technological developments

- Industrial Revolution is closely linked to a small number of innovations, beginning in the second half of the 18th century

By the 1830s the following gains had been made in important technologies:

- **Textiles** – Mechanised cotton spinning powered by steam or water increased the output of a worker by a factor of about 1000

- **Steam power** – The efficiency of steam engines increased so that they used between one-fifth and one-tenth as much fuel

- **Iron making** – The substitution of coke for charcoal greatly lowered the fuel cost for pig iron and wrought iron production
  - Using coke also allowed larger blast furnaces, resulting in economies of scale

Is Technological Development Accelerating?

- Consider the technological development between 1825 - 1960
  - railways
  - electric light and telephones,
  - cars and airplanes,
  - the atomic bomb and nuclear power,
  - vacuum electronics, semiconductor electronics, the computer
  - plastics,
  - most vaccines and antibiotics
  - manned space flight

- In 1903 the Wright Brothers achieved man's first flight
  - less than 60 years later, Yuri Gagarin was in space
- Child mortality was drastically cut, up to 80% during that period

- In human terms these achievements, in such a short space of time, are vast

Is Technological Development Accelerating?

- The kind of innovation that has profound social impact

- What major innovations have taken place in the past half century apart from the internet, increase in computing power & information processing?
  - incremental change – the *'next adjacent'*

- *"The pace of change has actually, generation by generation, been slowing down..." - Paul Krugman (Nobel Economics Laureate), speaking at Worldcon, 2009*

Summary

- Is there any empirical evidence for an accelerated change in the world?
- Is there really greater change today than in the past?
  - we looked at population growth, wars & technology
  - within a historical context

- *Evidence is that there is **no** accelerated change*

- So why do we *feel* that the world is getting more complex, unpredictable and volatile?
- To answer that question we need to understand what 'complexity' means based on *complexity science*

In what sense is the world complex?

- Distinction between complicated and complex
- Non-linear and unpredictable
- + complex systems exhibit the following characteristics:
  - Emergence
  - Self-organisation
  - Exploration of the space of possibilities
  - Co-evolution
  - Creation of new order

Conclusions

- If we understand our societies, institutions and the world as a whole, as complex systems
- We cannot possibly be surprised that the world is unpredictable and volatile!

- Is the world becoming more complex?
- I doubt it

- We may *feel* that the world is getting more complex, unpredictable and volatile
- But we need to distinguish between objective reality based on complexity science and our subjective perceptions

Thank you …

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