

HUMANITY

Series of PowerPoint Presentations by J. W. Gardner



- **Misbeliefs – Acquisition & Probable Examples**
- **Big Picture Science – Observable Universe**
- **Big Picture Science – Planet Earth**
- **Big Picture Science – Life on Earth**
- **Basic Science Sampler – Quantum Physics, Relativity and Thermodynamics**

Contents

Introduction

Misbelief Acquisition – 4 I's

Ignorance

Insecurity

Intuition

Indoctrination

Empirical Truths

Scientific Consensus

Historical Knowledge

Benefits of Modern Medicine

Popularity of Liberal Democracy

Reliability of Modern Technology

Probable Misbeliefs

Resources

Pseudohistory

Pseudoscience

Paranormal

Belief Surveys

Wrap-up

Quotes

Contents

Introduction

Misbelief Acquisition – 4 I's

Ignorance

Insecurity

Intuition

Indoctrination

Empirical Truths

Scientific Consensus

Historical Knowledge

Benefits of Modern Medicine

Popularity of Liberal Democracy

Reliability of Modern Technology

Probable Misbeliefs

Resources

Pseudohistory

Pseudoscience

Paranormal

Belief Surveys

Wrap-up

Quotes

Introduction

Humans are the only beings known to provide explanations for their existence. Simple accounts might date back to the first behaviorally modern humans (400 centuries or so ago)

Prior to modern science most explanations involved supernatural causes

Although a fairly deep scientific understanding of the world was achieved in the 20th century, most humans have yet to fully embrace it, either for lack awareness or a penchant for traditional accounts

Unfortunately, a world overpopulated by a technologically advanced but often irrational species is both a dangerous and endangered place

*We do not have to visit a madhouse to
find disordered minds; our planet is the
mental institution of the universe*

– Johann Wolfgang von Goethe

Contents

Introduction

Misbelief Acquisition – 4 I's

Ignorance

Insecurity

Intuition

Indoctrination

Empirical Truths

Scientific Consensus

Historical Knowledge

Benefits of Modern Medicine

Popularity of Liberal Democracy

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Resources

Pseudohistory

Pseudoscience

Paranormal

Belief Surveys

Wrap-up

Quotes

Misbelief Acquisition – 4 I's

1. **Ignorance** Many long-held beliefs arose in ignorance of natural world. Deep knowledge of latter fairly recent
2. **Insecurity** Most people uneasy with uncertainty and want answers to Big Questions now, often adopting unsubstantiated answers for sake of closure
3. **Intuition** Too much reliance on the gut and too little on reason / evidence when forming beliefs
4. **Indoctrination** Poorly justified beliefs passed down to generations of young minds as dogma

Misbelief Acquisition – 4 I's

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Quirkiness of Beliefs

- Beliefs held most strongly often least justified
- Beliefs most justified sometimes least intuitive

Faith, for example, has been described as "belief in spite of evidence to the contrary" as if a good thing

Quirkiness of Beliefs

- Beliefs held most strongly often least justified
- Beliefs most justified sometimes least intuitive

Certain concepts in relativistic and quantum physics are extremely counterintuitive, yet strongly supported by experiment. See Basic Science presentation

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400+ Centuries of Ignorance

Falling Stars Comets

Hurricanes Tsunamis Earthquakes

Volcanos Eclipses

Tornados **What / Why ?** Floods

Thunder Lightning

Insanity Pestilence Death

Droughts Famine

Dramatic Changes in Recent Times

- **Modern world very different from world occupied by ancestors**
- **Explosion of scientific knowledge and technology in 20th century**
- **In same century liberal democracy became dominant form of government worldwide. Monarchy, which had dominated for 49 centuries, became minor player**
- **Conceptual journey through historic times quantifies changes in various areas**

Information Gathered by Century-Hopping Time Traveler

- **Time traveler leaps through history one century at a time from dawn of civilization (3000 BC) to 2000 AD**
- **At each stop he learns what happened throughout world during past century and records where things stand in a number of quantifiable areas**
- **Through jump to 1900 traveler plots results from previous century at century end**
- **Reaching 2000 he plots 20th century changes in year that they occurred. Later, he adds a few results from the first two decades of the 21st century**

Century-Hopping Topics

Towering Tall – Human Built Structures

Truncating Transit Time – Transport Speeds

Breeding like Bunnies – World Population

Settling in Cities – Urbanization

Dissipating Joules – Energy Consumption

Getting on the Grid – Electrification

Doing it Digitally – Cell Phone Usage

Doing it Digitally – Internet Usage

Doing it Digitally – Computing Speed

Doing it Digitally – Stuffing the Chips

Sizing the Small – It's the Little Things

Probing the Past – Prehistoric Dating

Delineating the Distant – Far Away Places

Arming for Armageddon – Nuclear Stockpiles

Diminishing Disease – Increased Life Expectancy

Diminishing Disease – Epidemiological Transition

Diminishing Disease – Vaccines

Diminishing Disease – Antibiotics

Recognizing Rights – Rise of Democracy

Recognizing Rights – Abolition of Slavery

Recognizing Rights – Women's Suffrage

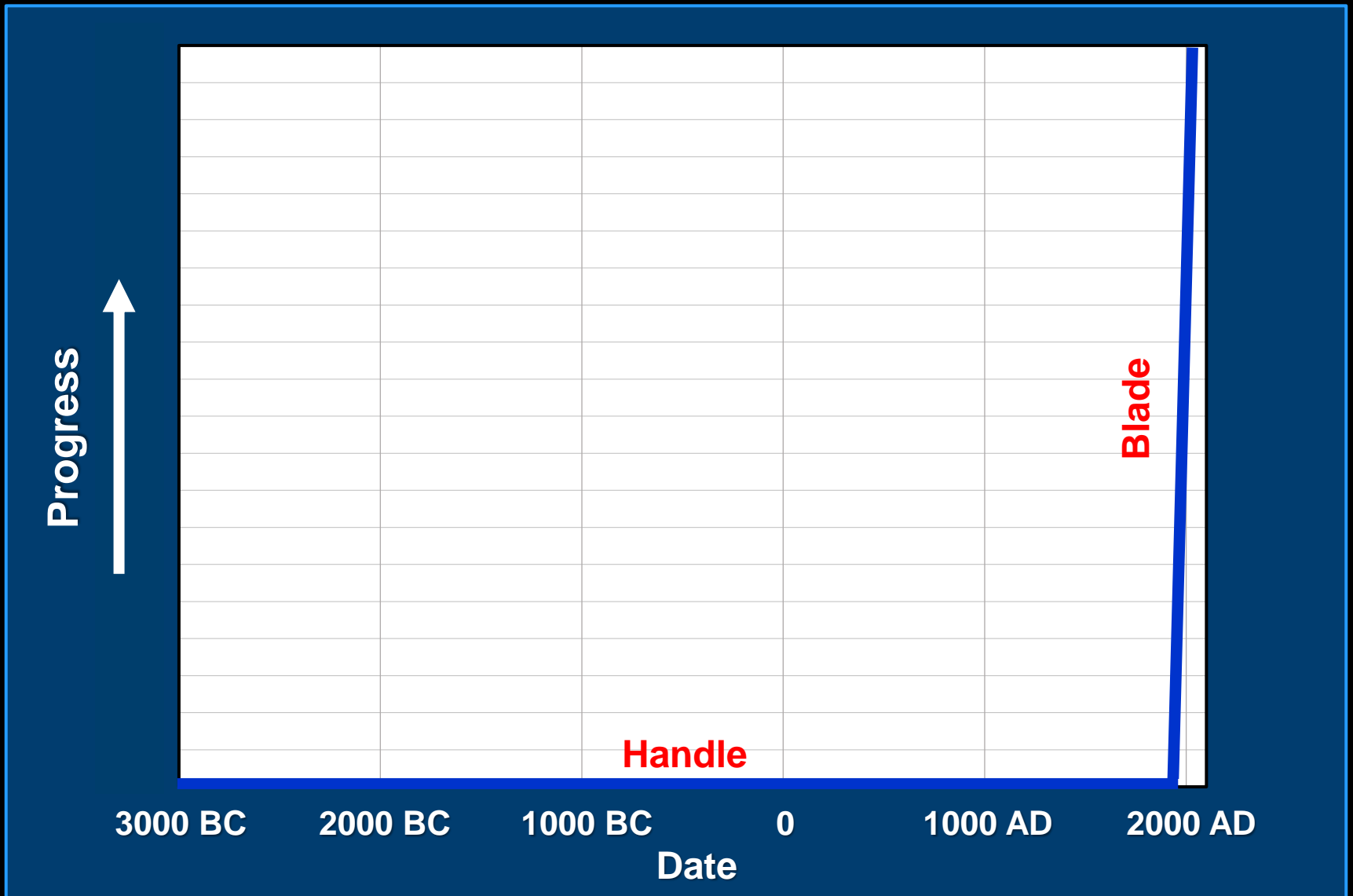
Recognizing Rights – Additional Examples

Recognizing Rights – Regression



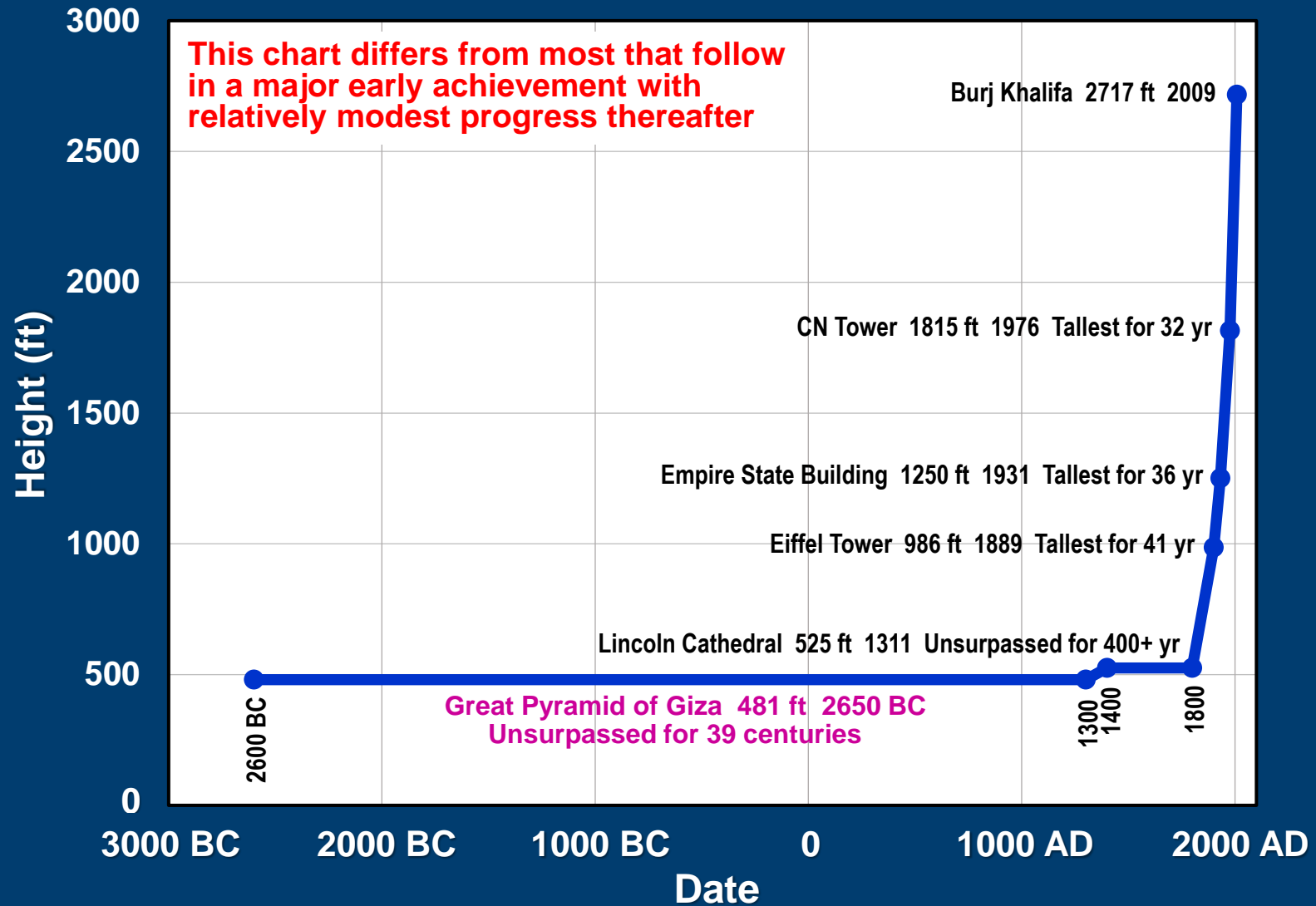
Lots of hockey-stick plots coming up

Typical Hockey-Stick Plot



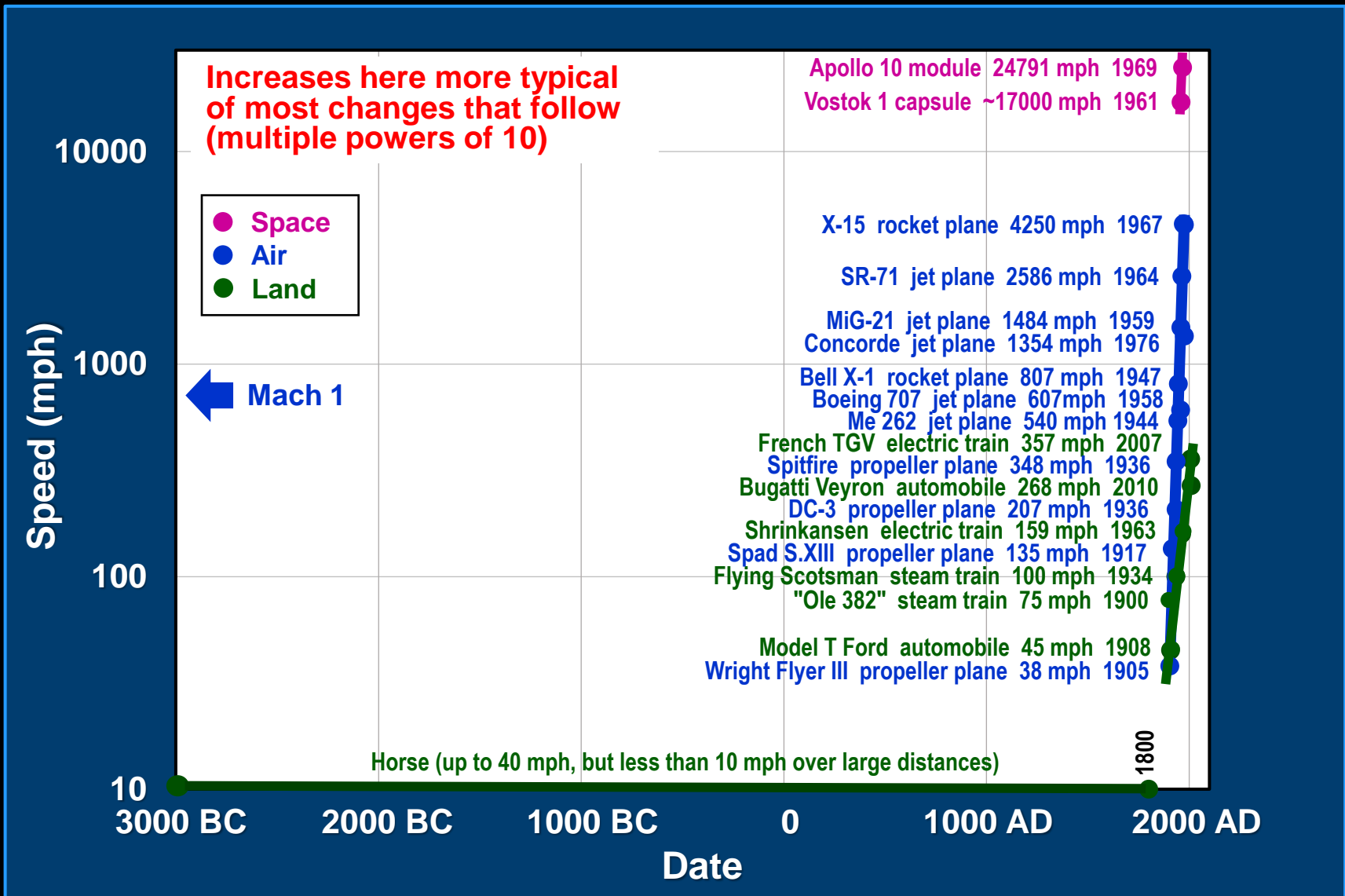
Handle often implicit

Towering Tall – Human Built Structures

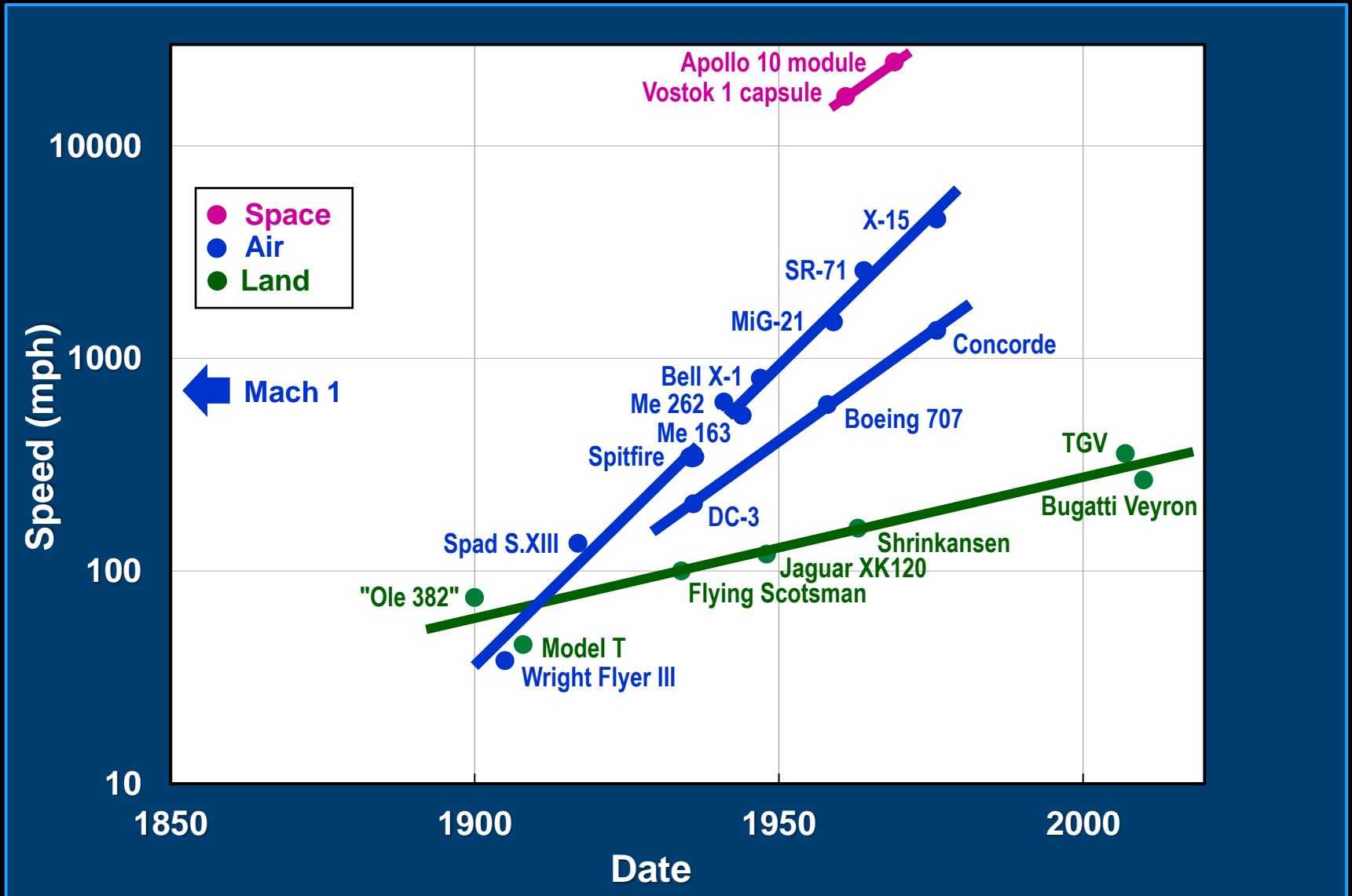


Only a subset of record holders beyond 1800 shown

Truncating Transit Time – Transport Speeds



Transport Speeds (Detail)



The DC-3, Boeing 707 and Concorde are passenger planes, which lag fighter planes, spy planes and the like in performance. All but two speeds achieved before 1980. Apollo 10 crew fastest-moving humans so far

Factoid: Saturn 5 rocket, which sent Apollo astronauts to Moon 9 times (6 landing missions, 2 orbiting-only missions and 1 flyby), stood roughly 75% of Great Pyramid height

Flyby associated with shortened Apollo 13 mission

Saturn 5 vs Great Pyramid

Height (ft)

500

481 ft

400

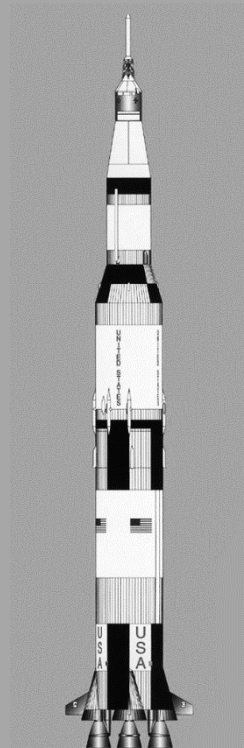
363 ft

300

200

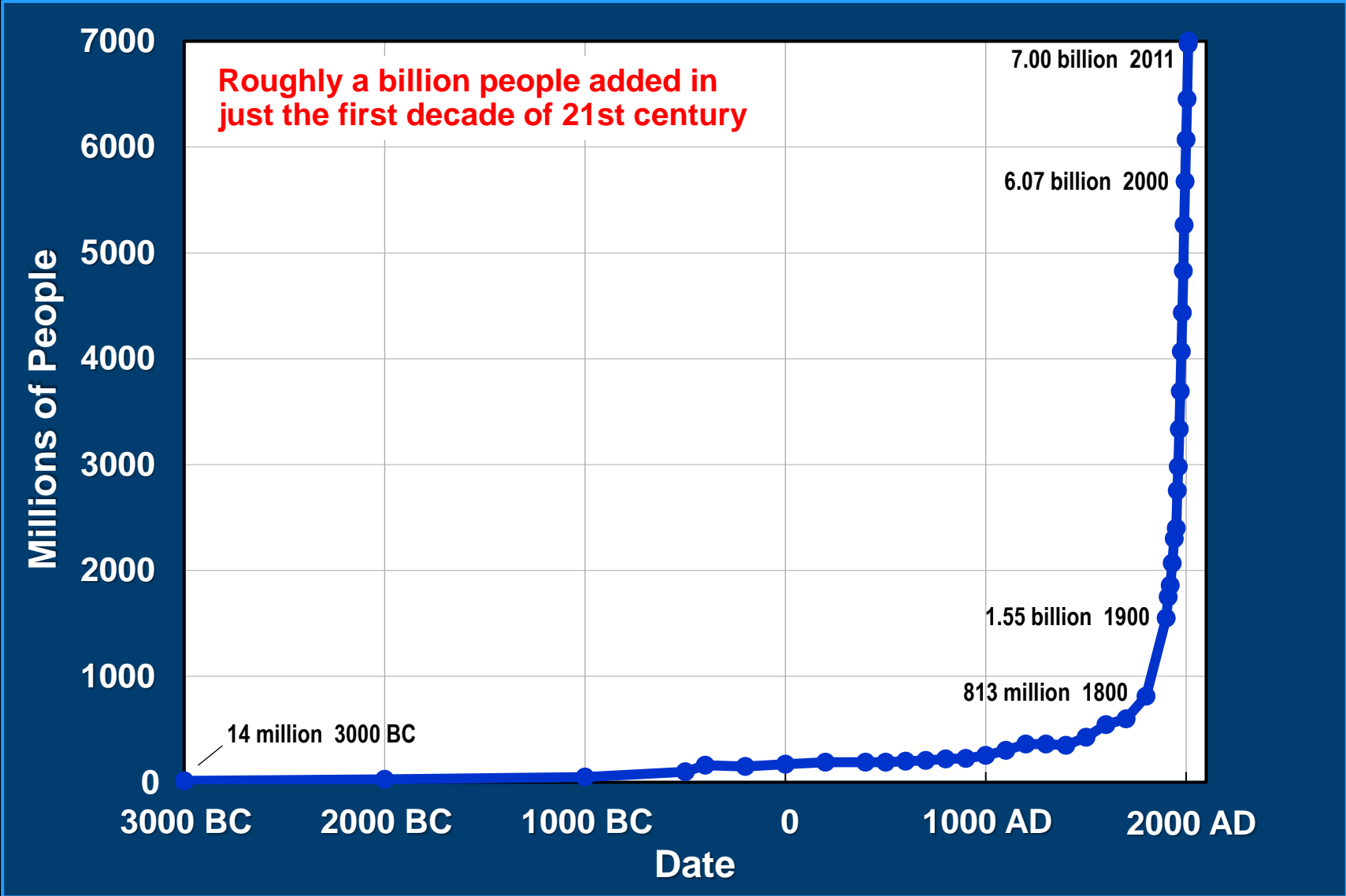
100

0



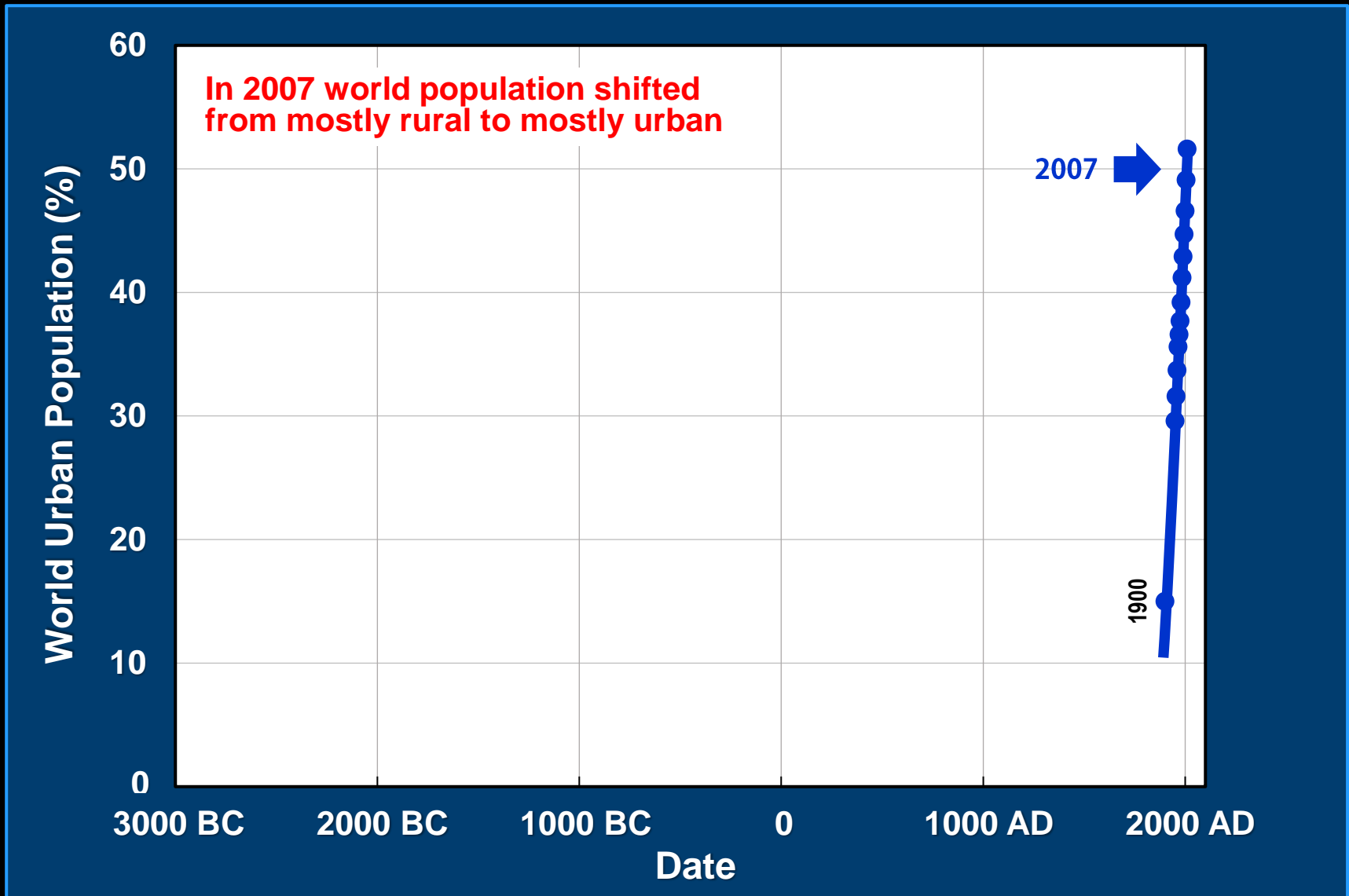
Height of Saturn 5 includes Apollo module at top

Breeding like Bunnies – World Population



Data points from Wikipedia and US Census Bureau. 20th century population growth aided by advances in medicine and agriculture (and vice versa). African population now fastest growing

Settling in Cities – Urbanization



Britain and the US (the great economic powers of the 19th and 20th centuries) became urbanized in the 2nd quarter of the 19th century and the 1st quarter of the 20th century, respectively. Africa least urbanized

Keep in mind that percentages of the human population are percentages of quantity that is increasing rapidly with time

That is, number of people involved are increasing faster than percentages might suggest

Before leaving cities

Although Western countries were first to become predominantly urban, beginning in the late 19th century, the East (Asia) has been home to the largest cities through almost all of human history

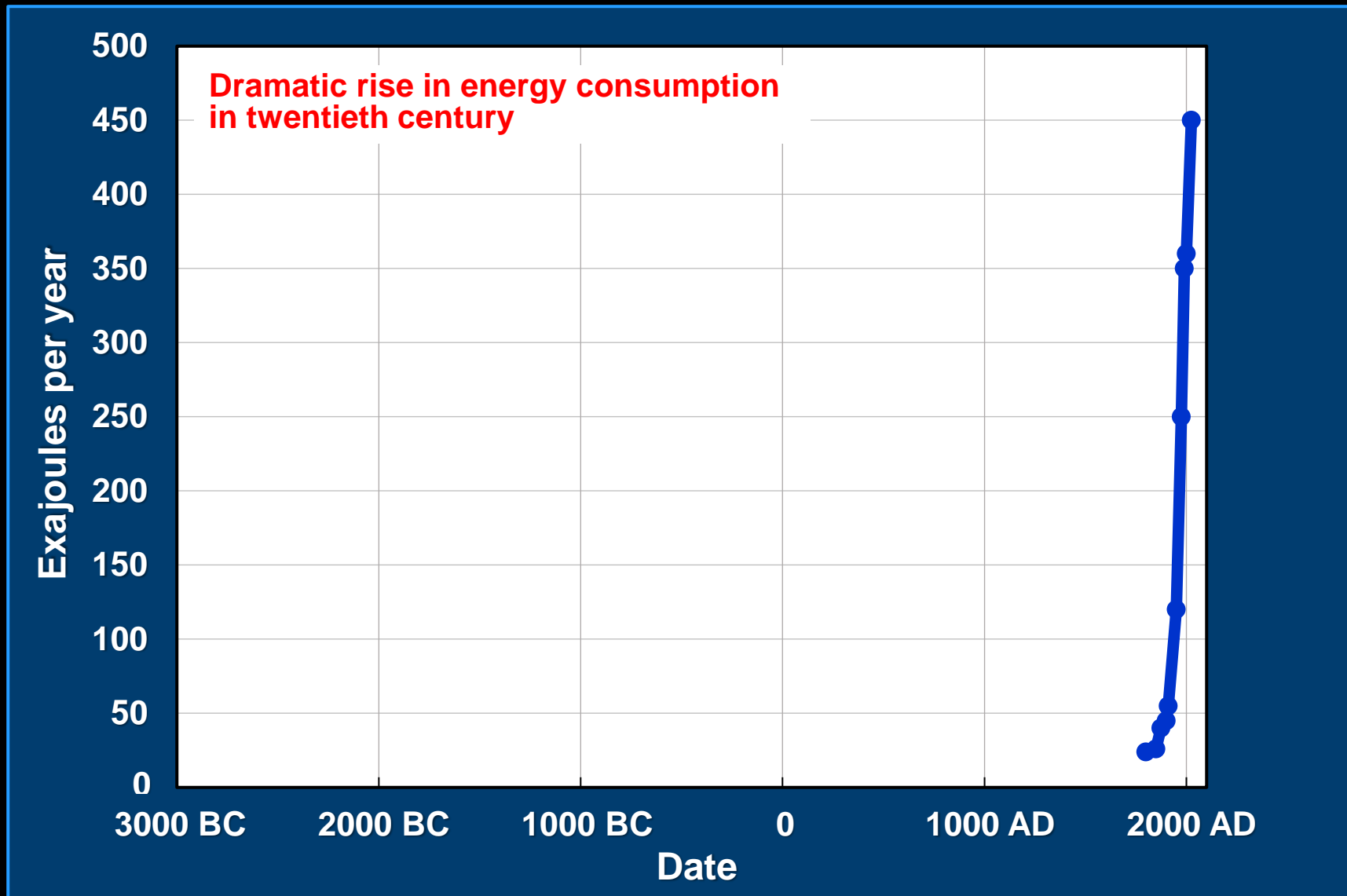


Largest Cities on Earth

	#1	#2	#3
2000 BC	Ur	Memphis	Thebes
1600 BC	Avaris	Babylon	Setabul
1200 BC	Memphis	Khattushash	Dur-Kurigalza
1000 BC	Thebes	Sian	Loyang
800 BC	Thebes	Sian	Loyang
650 BC	Nineveh	Lintzu	Loyang
430 BC	Babylon	Yenhsiatsu	Athens
200 BC	Chang'an	Patna	Alexandria
100 AD	Rome	Loyang	Seleucia
361 AD	Constantinople	Ctesiphon	Patna
500 AD	Constantinople	Ctesiphon	Loyang
622 AD	Ctesiphon	Chang'an	Constantinople
800 AD	Baghdad	Chang'an	Loyang
1000 AD	Cordoba	Kaifeng	Constantinople
1200 AD	Hangchow	Fez	Cairo
1350 AD	Hangchow	Peking	Cairo
1500 AD	Peking	Vijayanagar	Cairo
1600 AD	Peking	Constantinople	Agra
1700 AD	Constantinople	Yedo	Peking
1800 AD	Peking	London	Canton
1850 AD	London	Peking	Paris
1900 AD	London	New York	Paris
1950 AD	New York	London	Tokyo
1975 AD	Tokyo	New York	Osaka

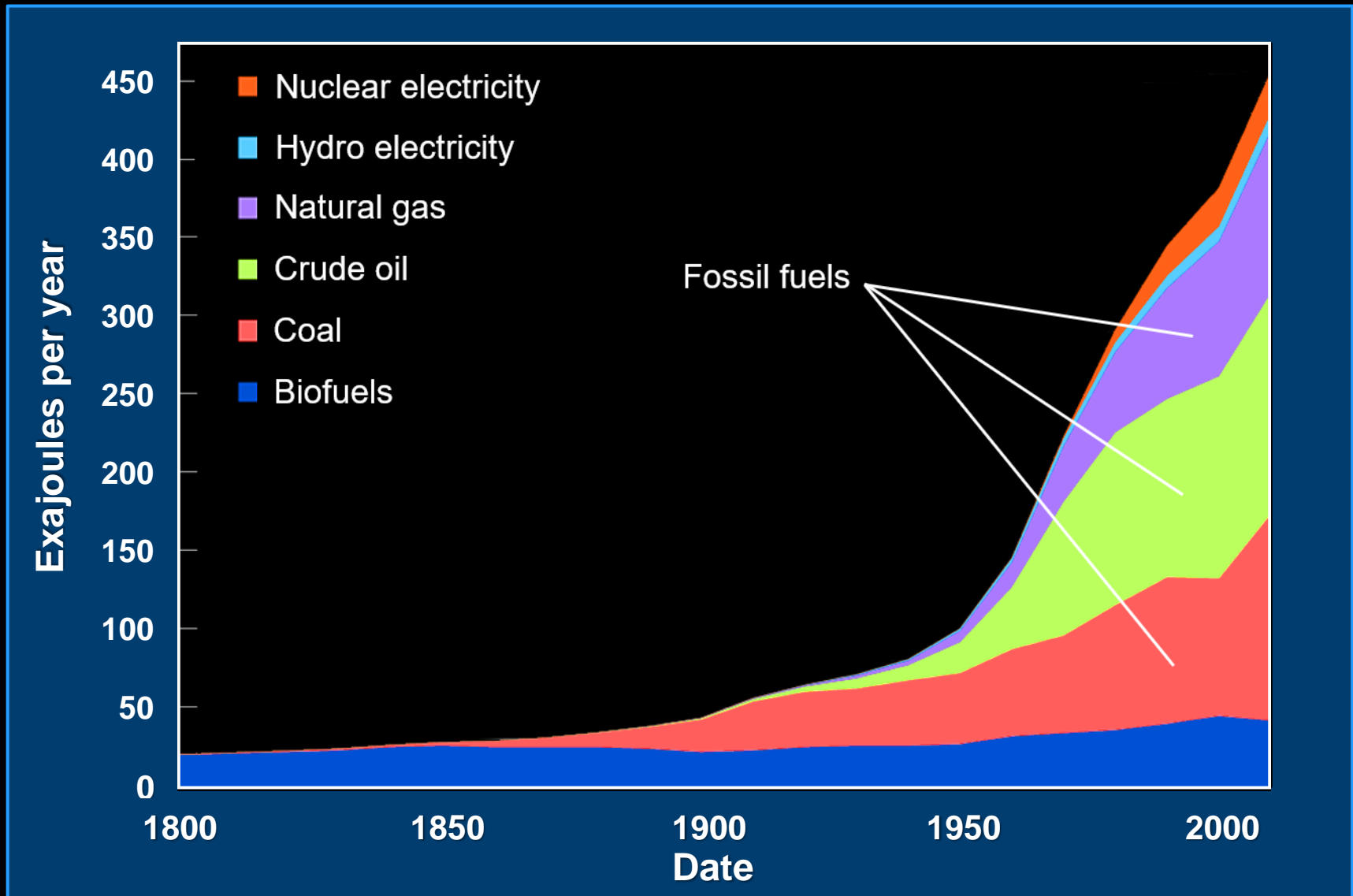
Red denotes Asian cities. Data from *Four Thousand Years of Urban Growth*. Chandler (1987)

Dissipating Joules – World Energy Consumption



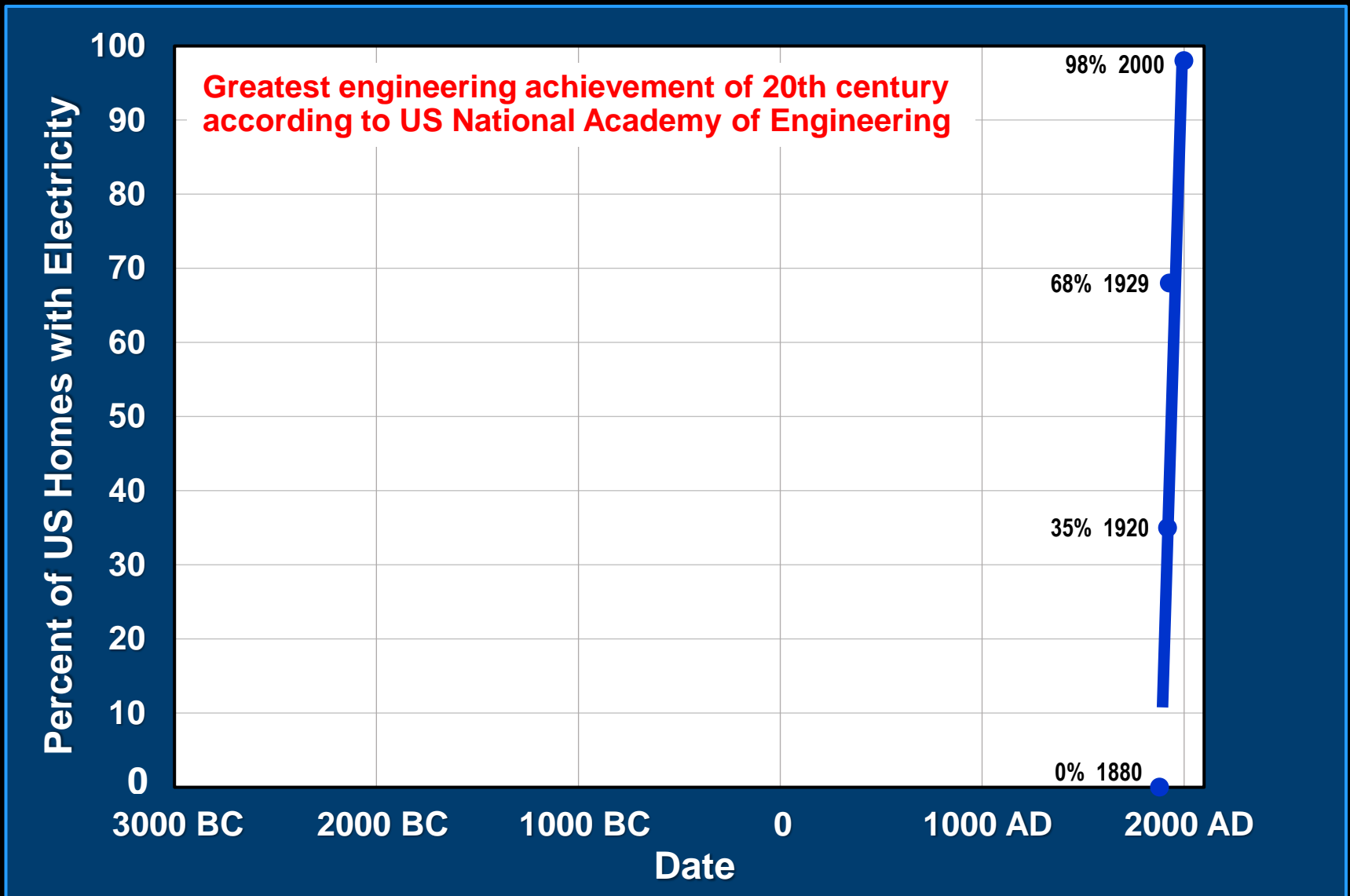
From *Energy Descent, Transition and Alternatives to 2050*. J. Floyd (2014) Centre for Australian Foresight. 1 Exajoule = 10^{18} joules

World Energy Consumption (Detail)



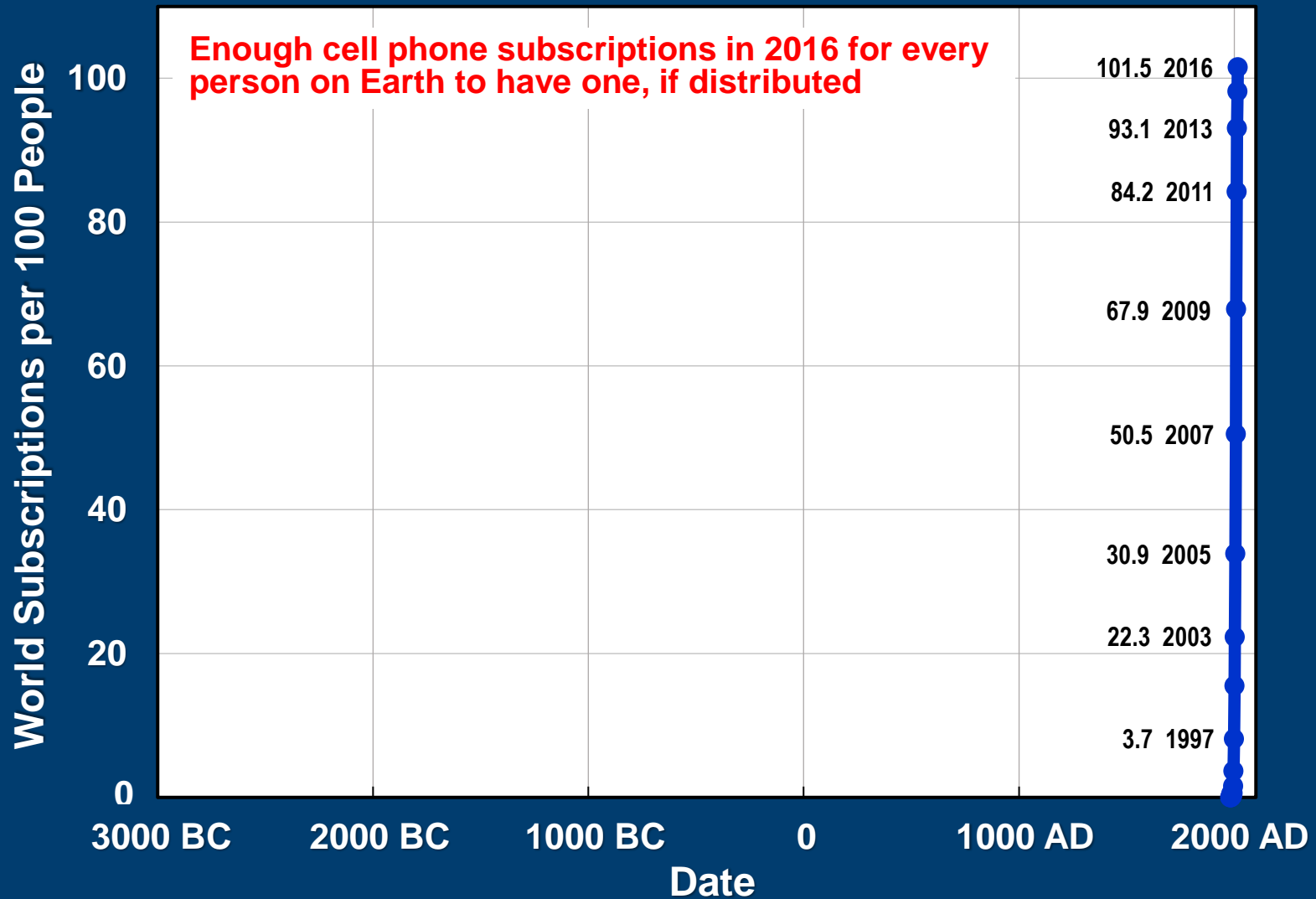
Burning of fossil fuels primary contributor to anthropogenic global warming. Fossil fuels also are non-renewable. Biofuels are produced directly from living matter and include wood

Getting on the Grid – Electrification



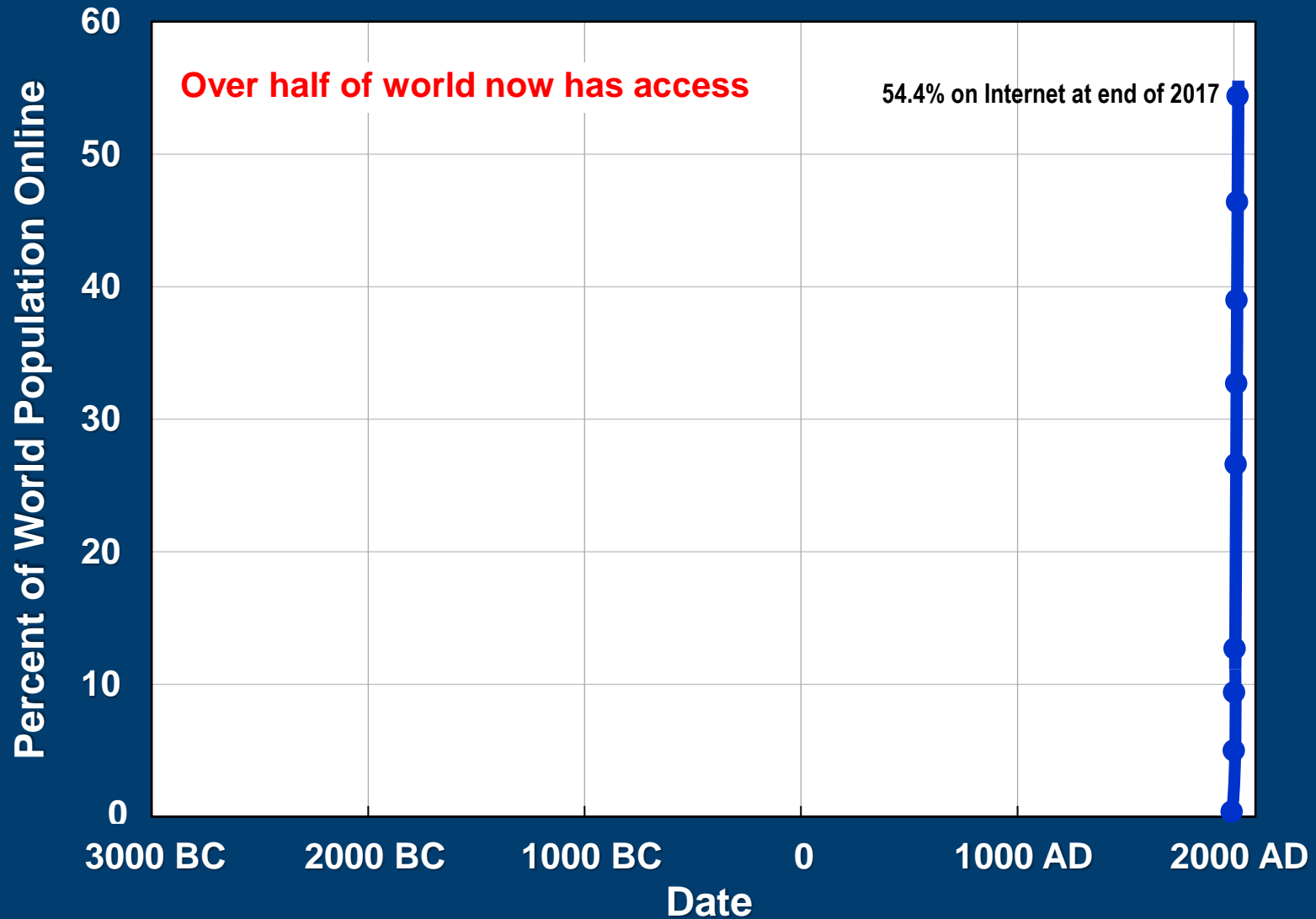
Electric light bulb patented by Edison in 1880. 1920 and 1929 points from Matt Novak's Paleofuture blog on Gizmodo. 2000 data point from Simon and Moore's "The Greatest Century That Ever Was" (1999).

Doing it Digitally – Cell Phone Usage



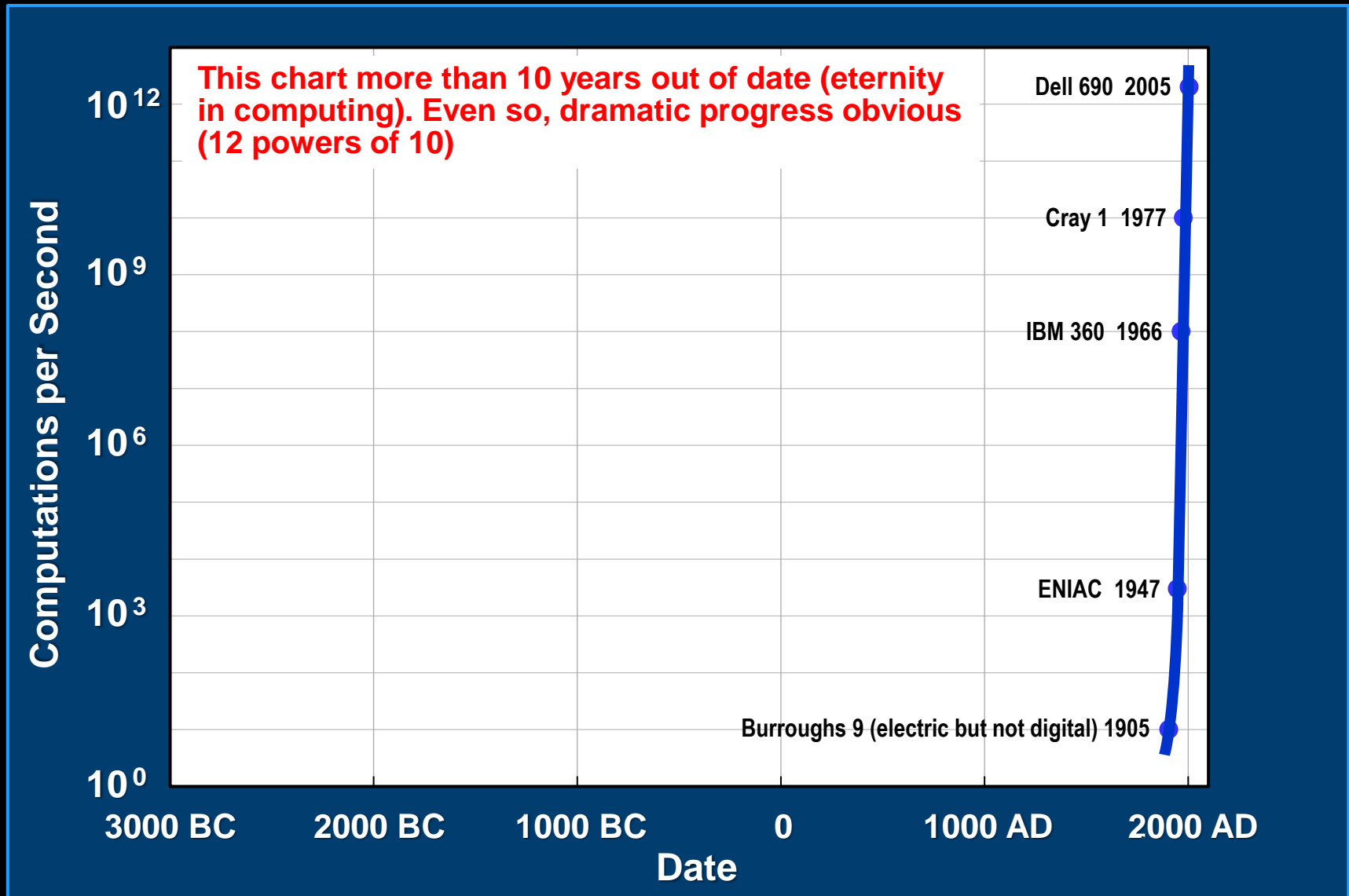
Data from World Bank Group

Doing it Digitally – Internet Usage



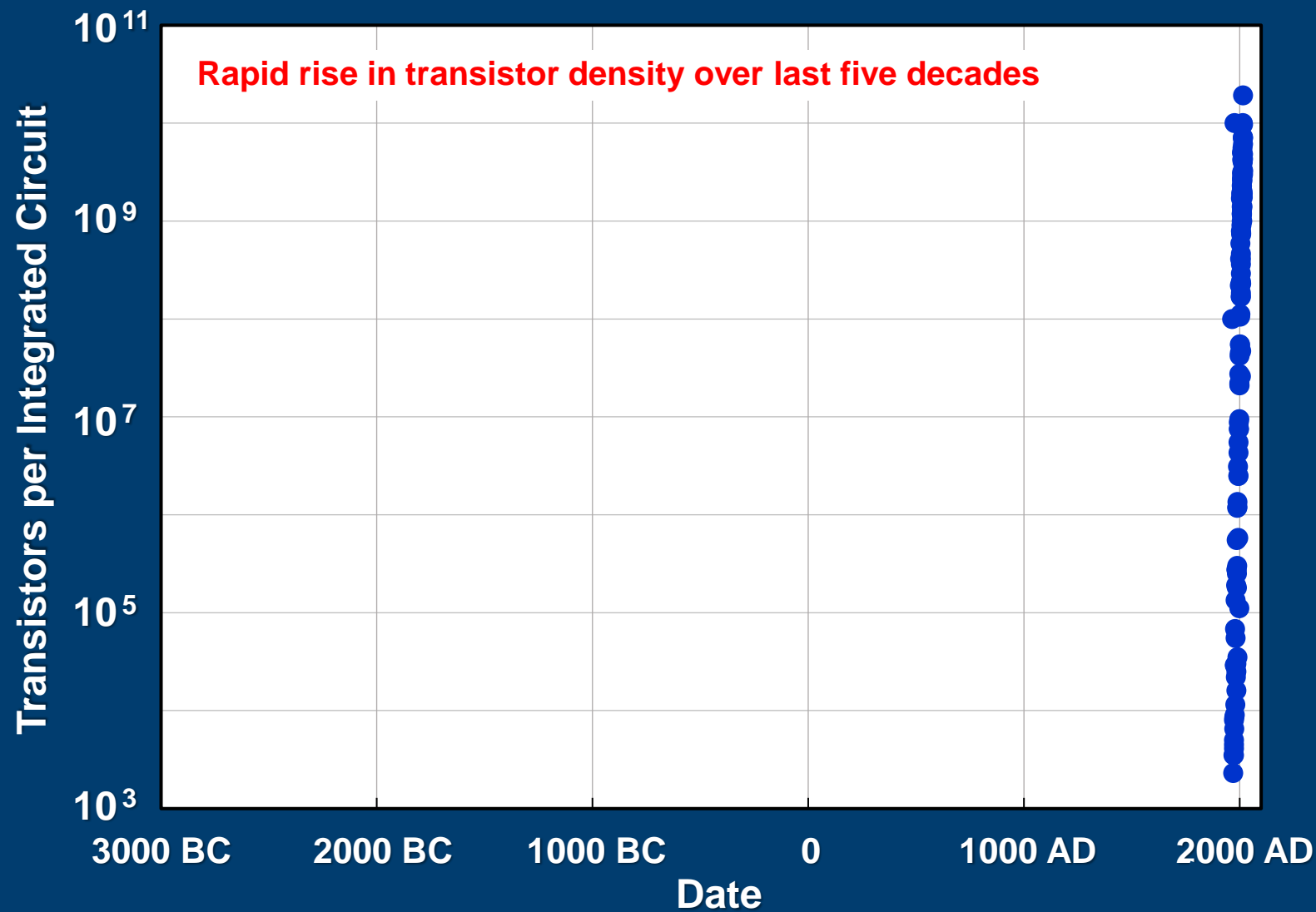
Internet in current form came into existence in 1990 with invention of World Wide Web. Data from Internet World Stats

Doing it Digitally – Computing Speed



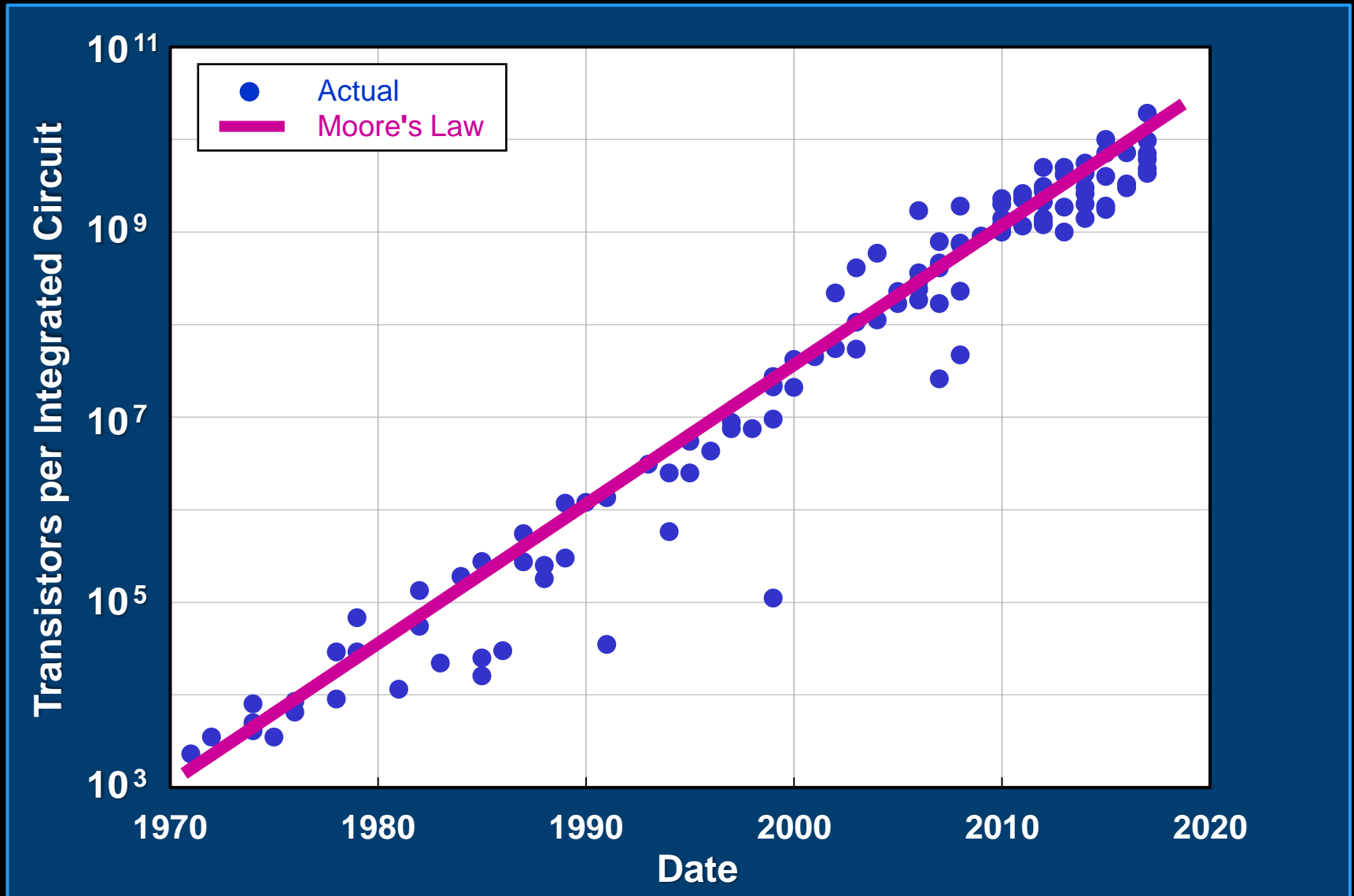
Data from William D. Nordhaus, "Two Centuries of Productivity Growth in Computing," *The Journal of Economic History*, Vol. 67, No. 1 (March 2007). ENIAC was first general-purpose digital computer

Doing it Digitally – Stuffing the Chips



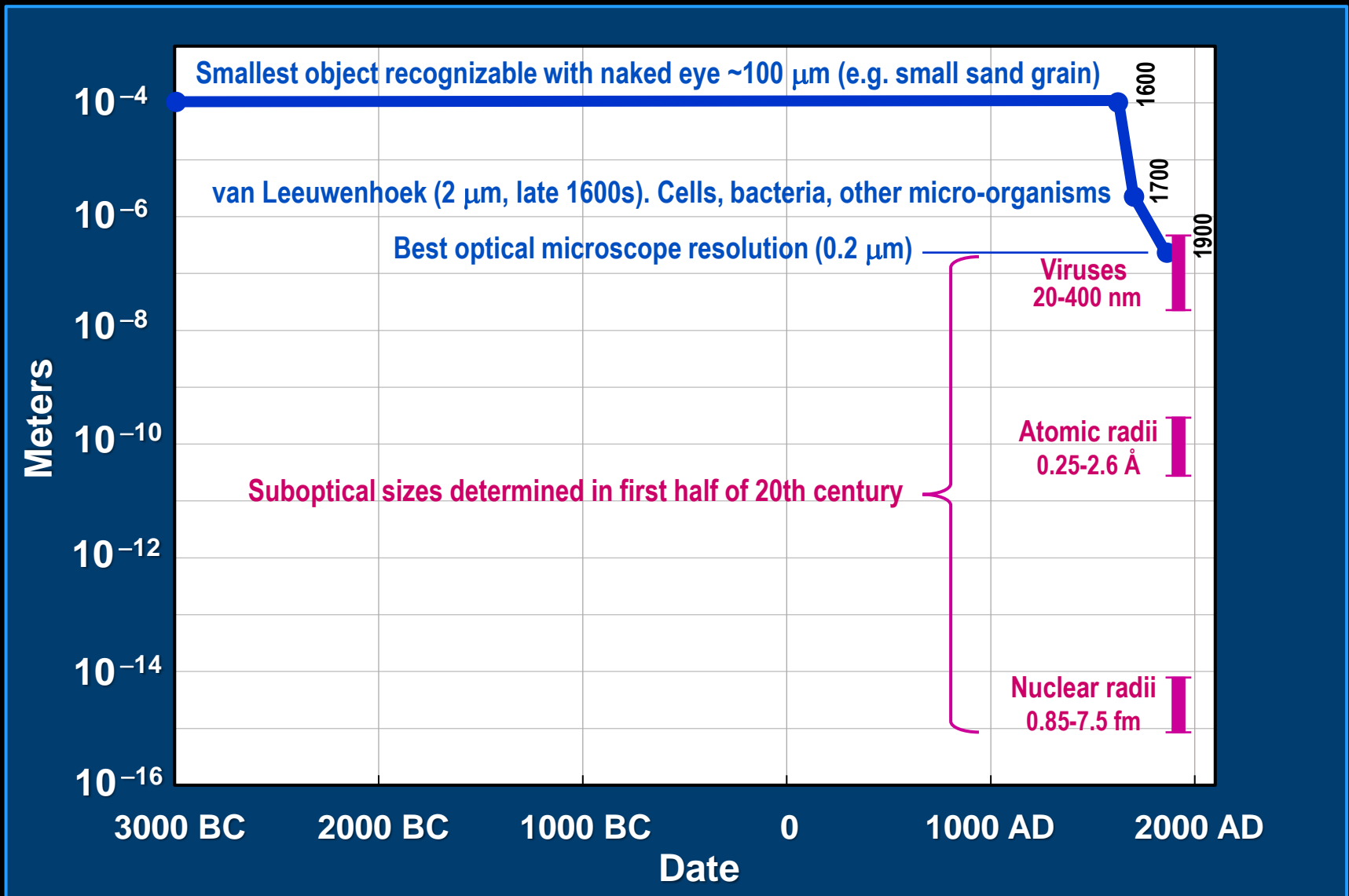
Data from Wikipedia "Transistor Count" article

Stuffing the Chips (Detail)



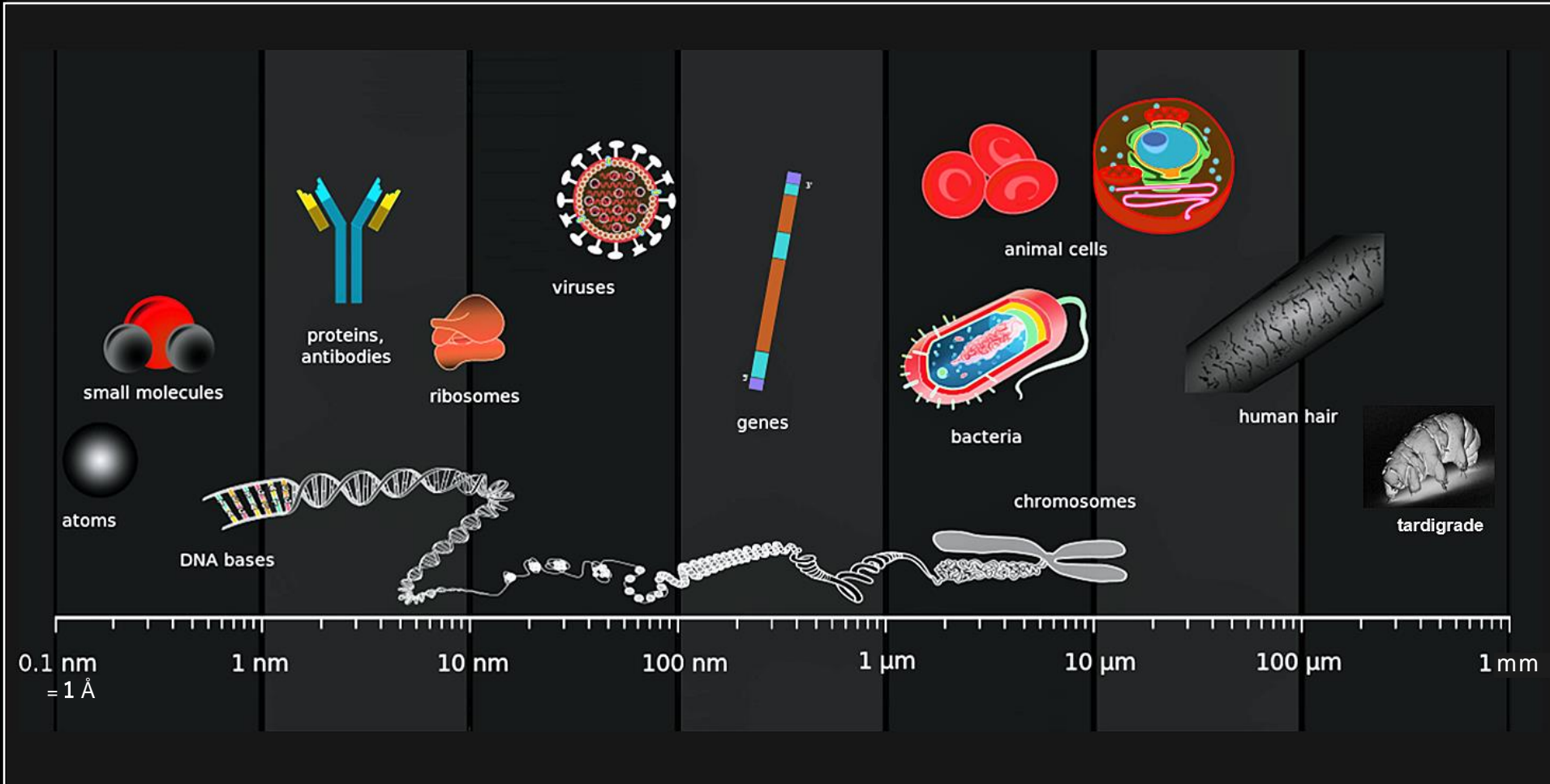
Moore's law states that transistor count per circuit doubles every 2 years, which has been roughly the case for almost five decades

Sizing the Small – It's the Little Things



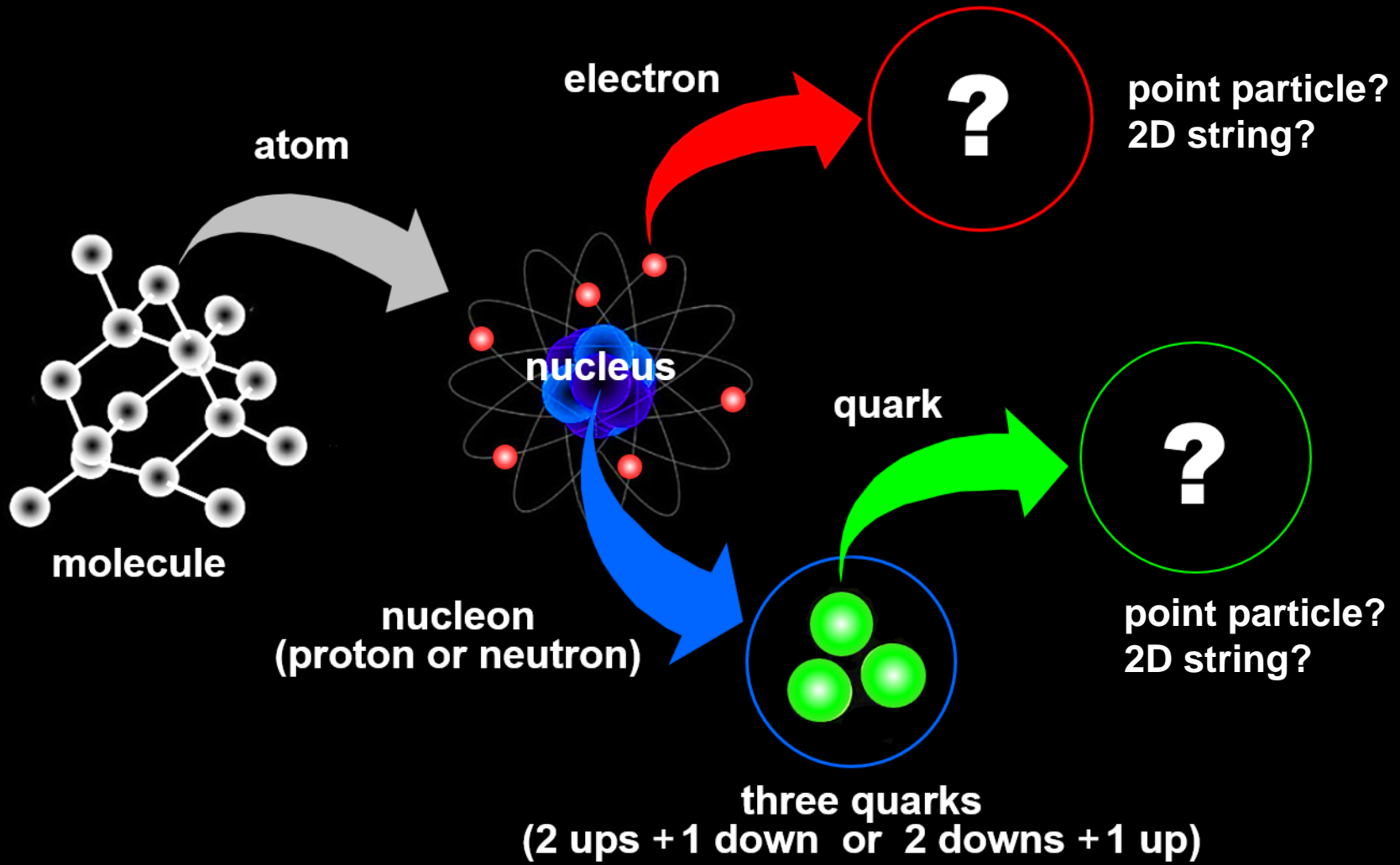
First direct image of molecule not obtained until 21st century (2009 via atomic force microscope)

Sampling of Small Things



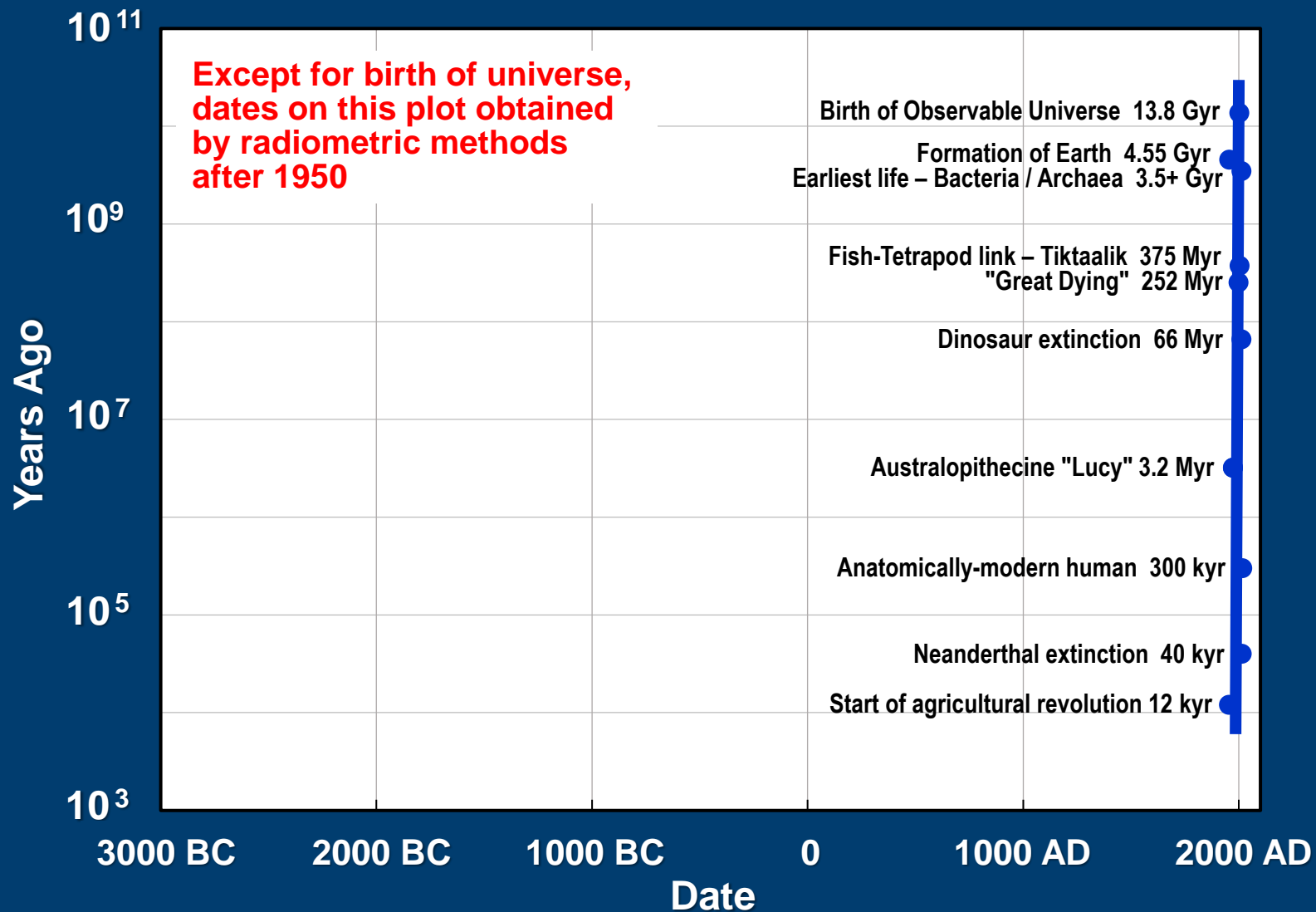
From Wikipedia "Nanoscope Scale" article (modified)

Inside Atoms



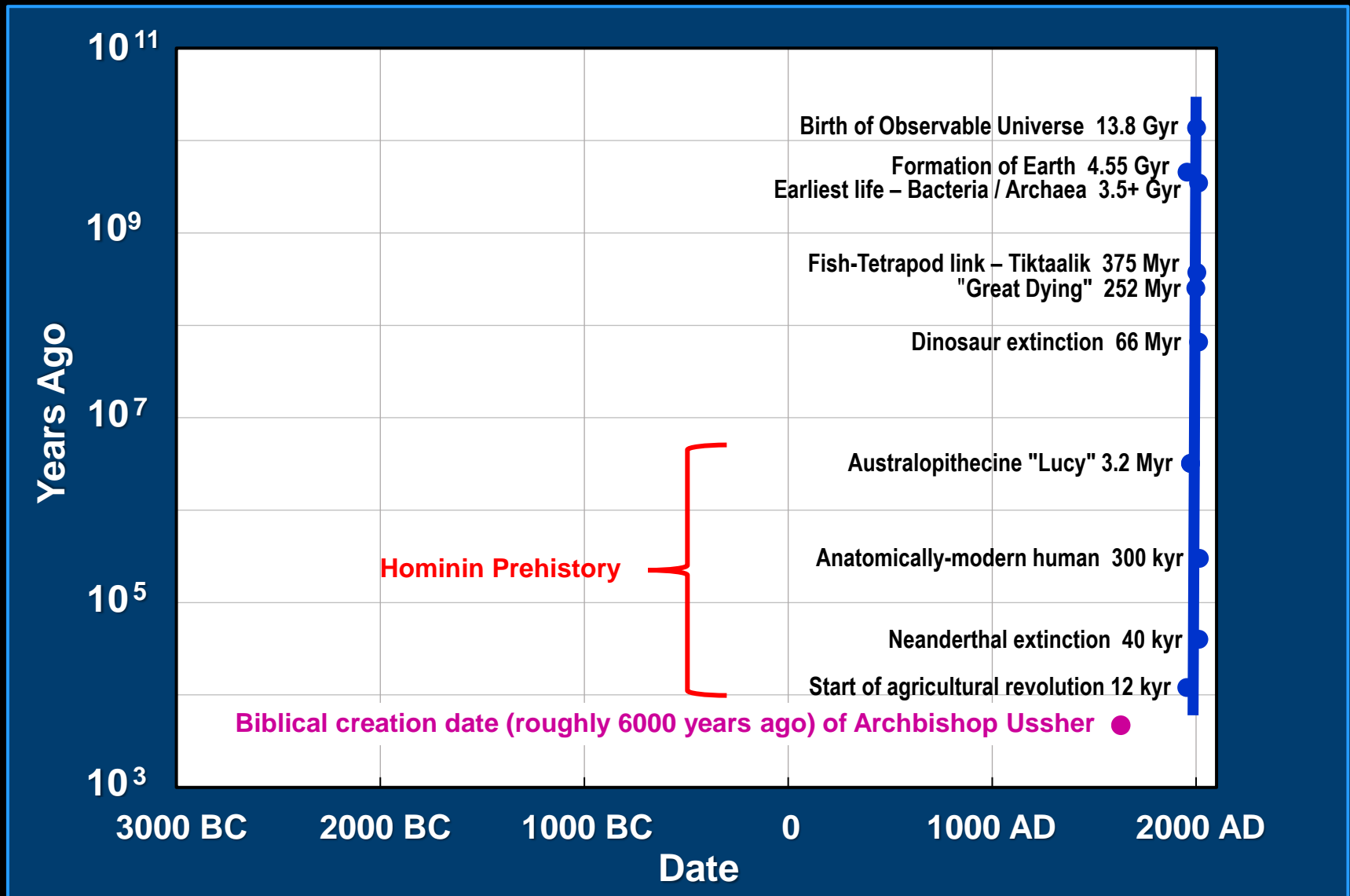
More on little things in Basic Science & Life on Earth presentations

Probing the Past – Prehistoric Dating



But there is much more evidence of great age in nature

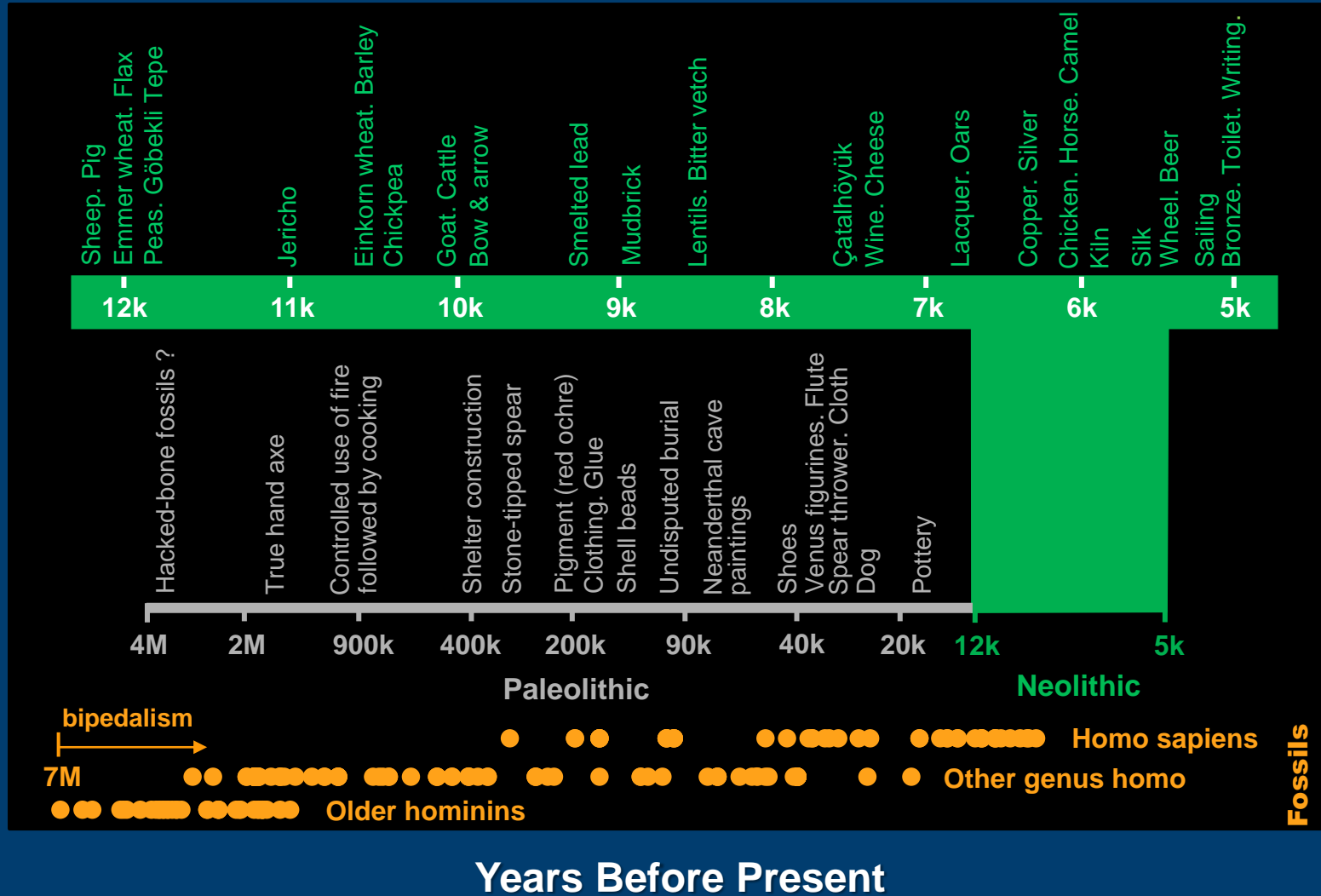
Probing the Past – Prehistoric Dating



Expanded view of hominin prehistory on next sequence of slides. Ussher date (4004 BC) included in number of editions of King James Bible. Many evangelicals consider 4004 BC to be actual creation date

Hominin Prehistory

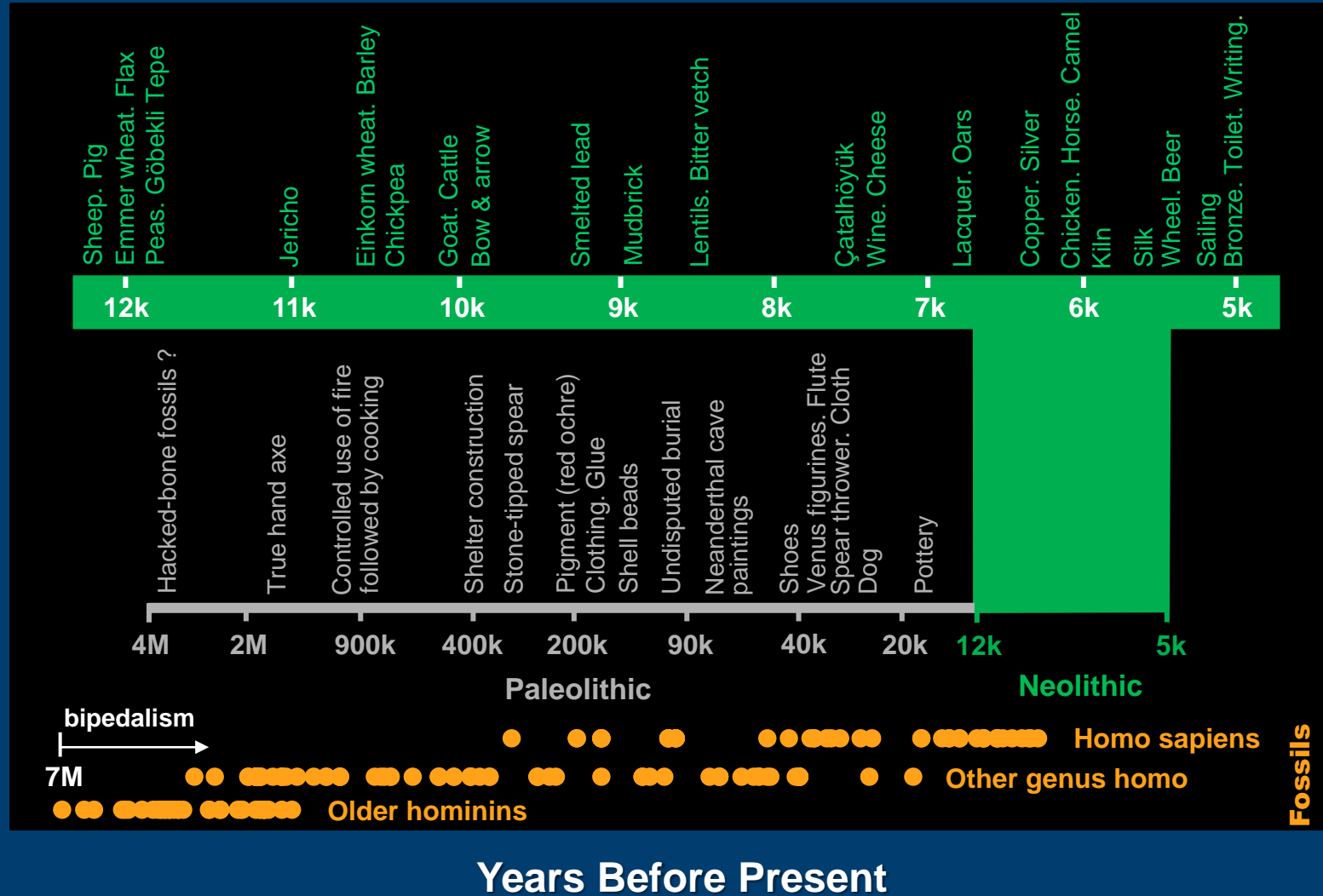
From Earliest Hominins to Civilization



Shown above are fossil dates (gold dots) and hominin technological/cultural advancements in old and new stoneages, ending at start of civilization (writing). Data from variety of sources (Wikipedia articles mostly)

Hominin Prehistory

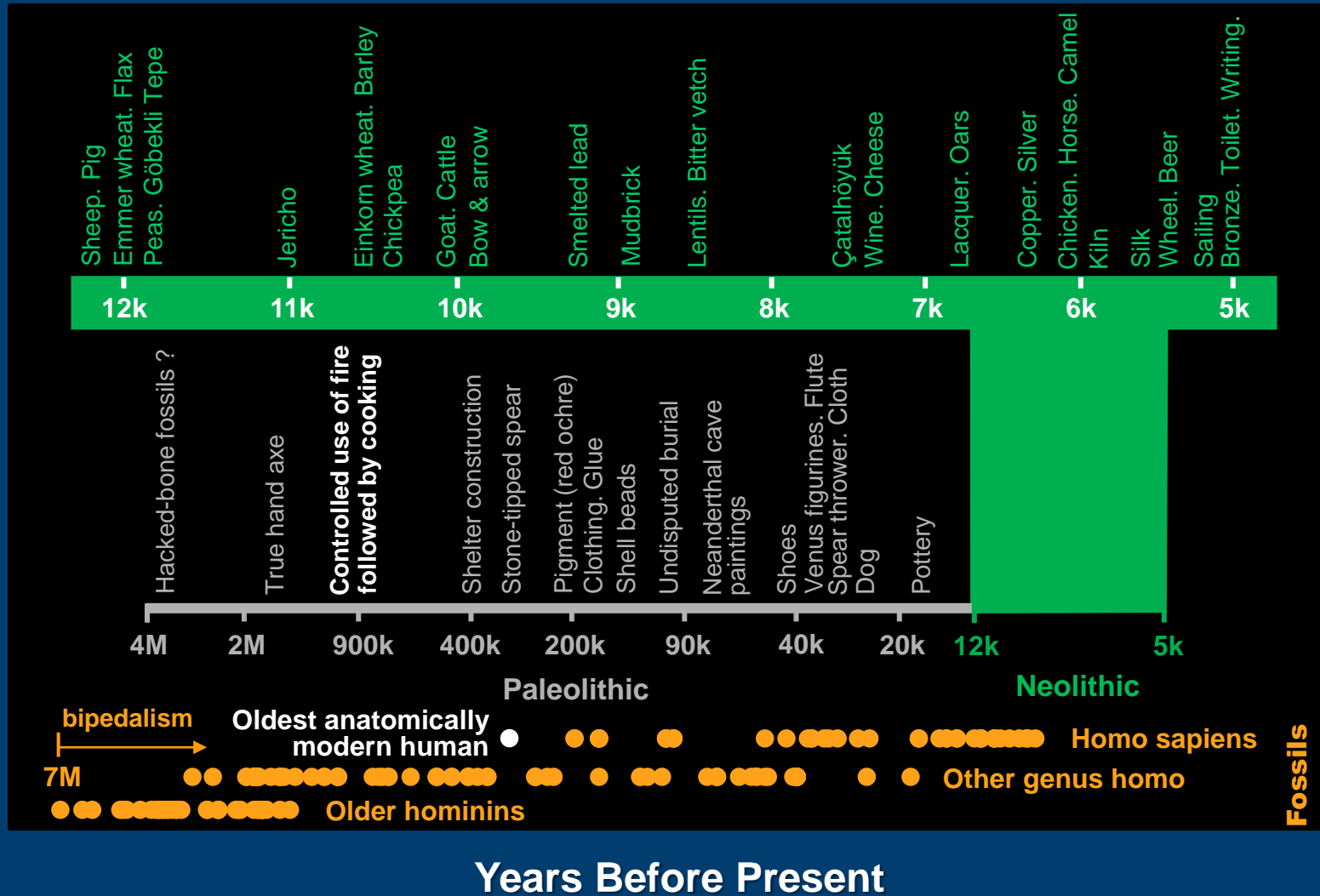
From Earliest Hominins to Civilization



Hominin appearance marked by bipedalism. Seven-million year-old fossil that of Sahelanthropus tchadensis

Hominin Prehistory

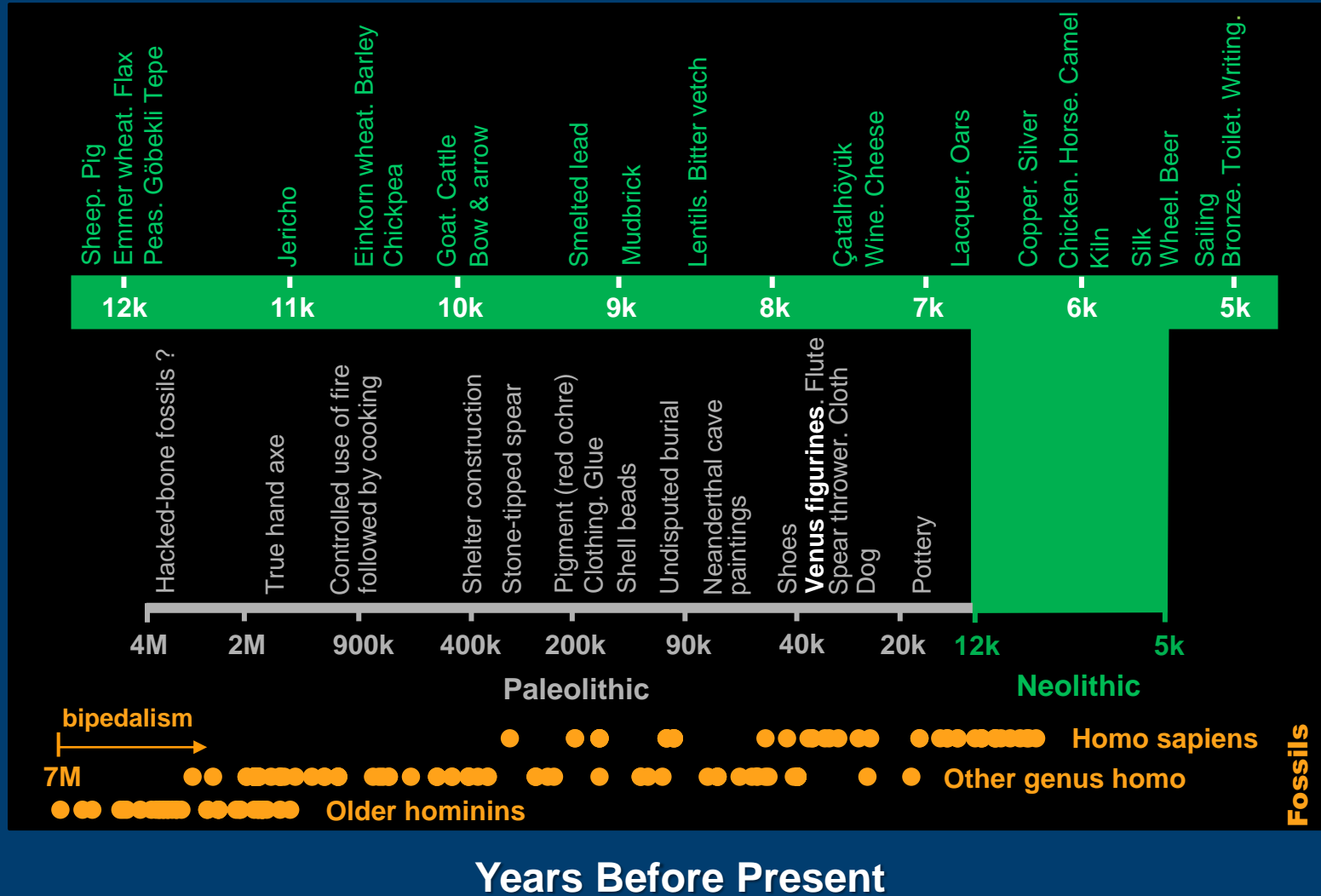
From Earliest Hominins to Civilization



Controlled use of fire appears to predate anatomically modern humans

Hominin Prehistory

From Earliest Hominins to Civilization



Venus Figurines



Venus of Hohle Fels
Made 35–40 kya. Germany
2.4 in tall. Mammoth ivory

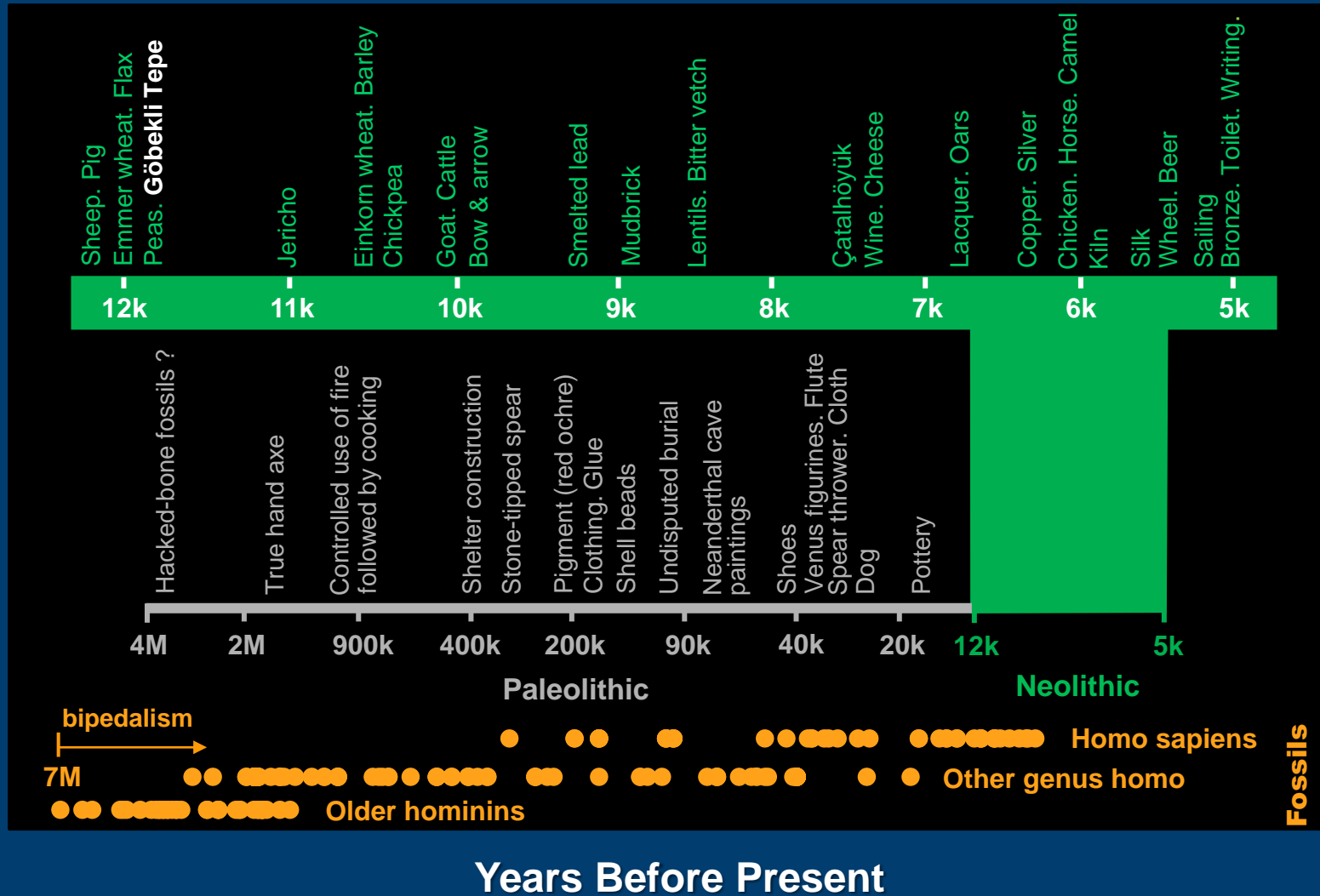


Venus of Willendorf
Made 27–30 kya. Austria
4.4 in tall. Oolitic limestone

Hohle Fels Venus is the earliest known, undisputed depiction of a human. Wikipedia

Hominin Prehistory

From Earliest Hominins to Civilization



Göbekli Tepe one of oldest known religious sites

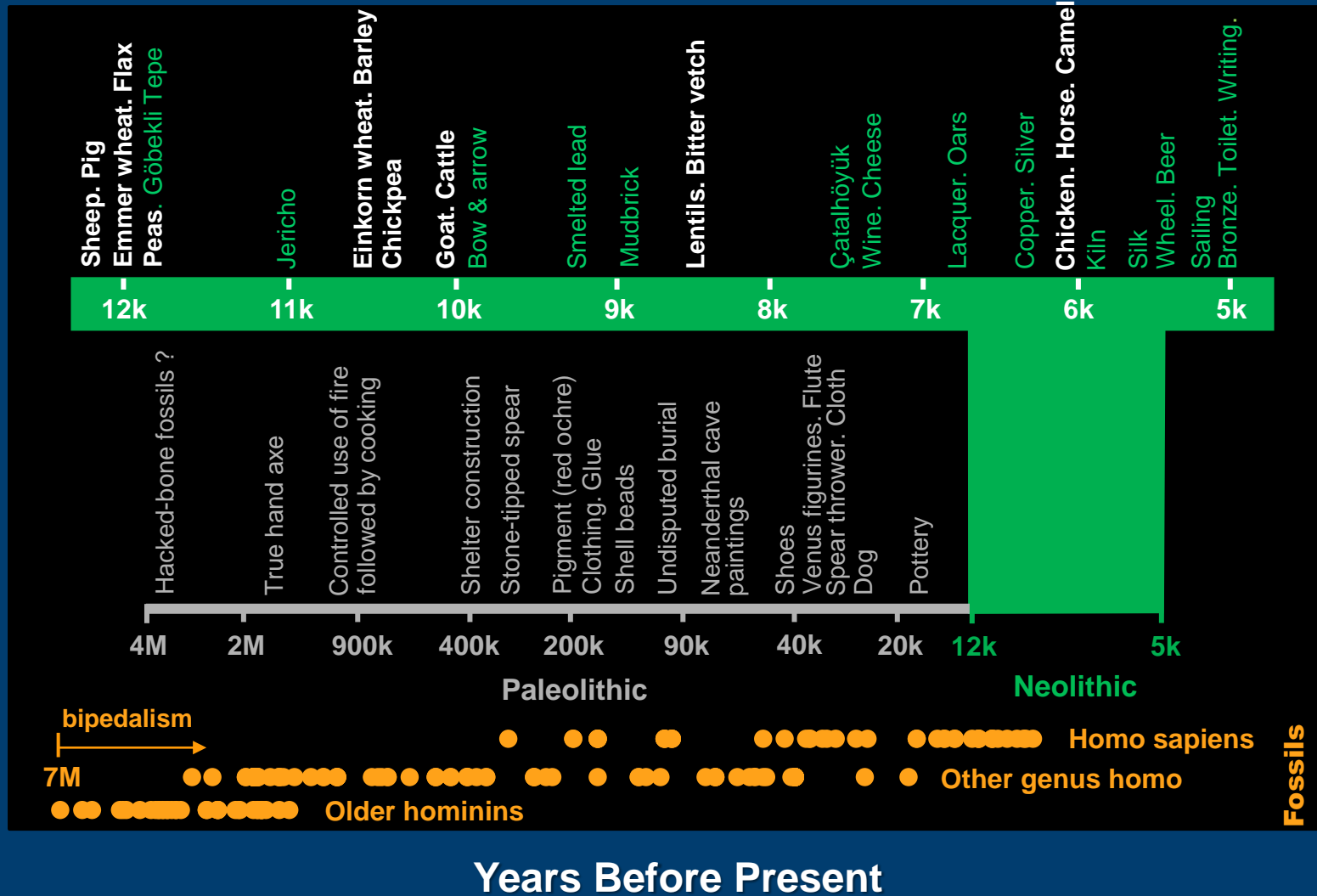
Göbekli Tepe (12 ky Old)



Located in southeastern Turkey. Buried until recently discovered. Consists of 20+ concentric circles formed from 200 pillars (only innermost seen here). Probably used for periodic religious gatherings. Wikipedia

Hominin Prehistory

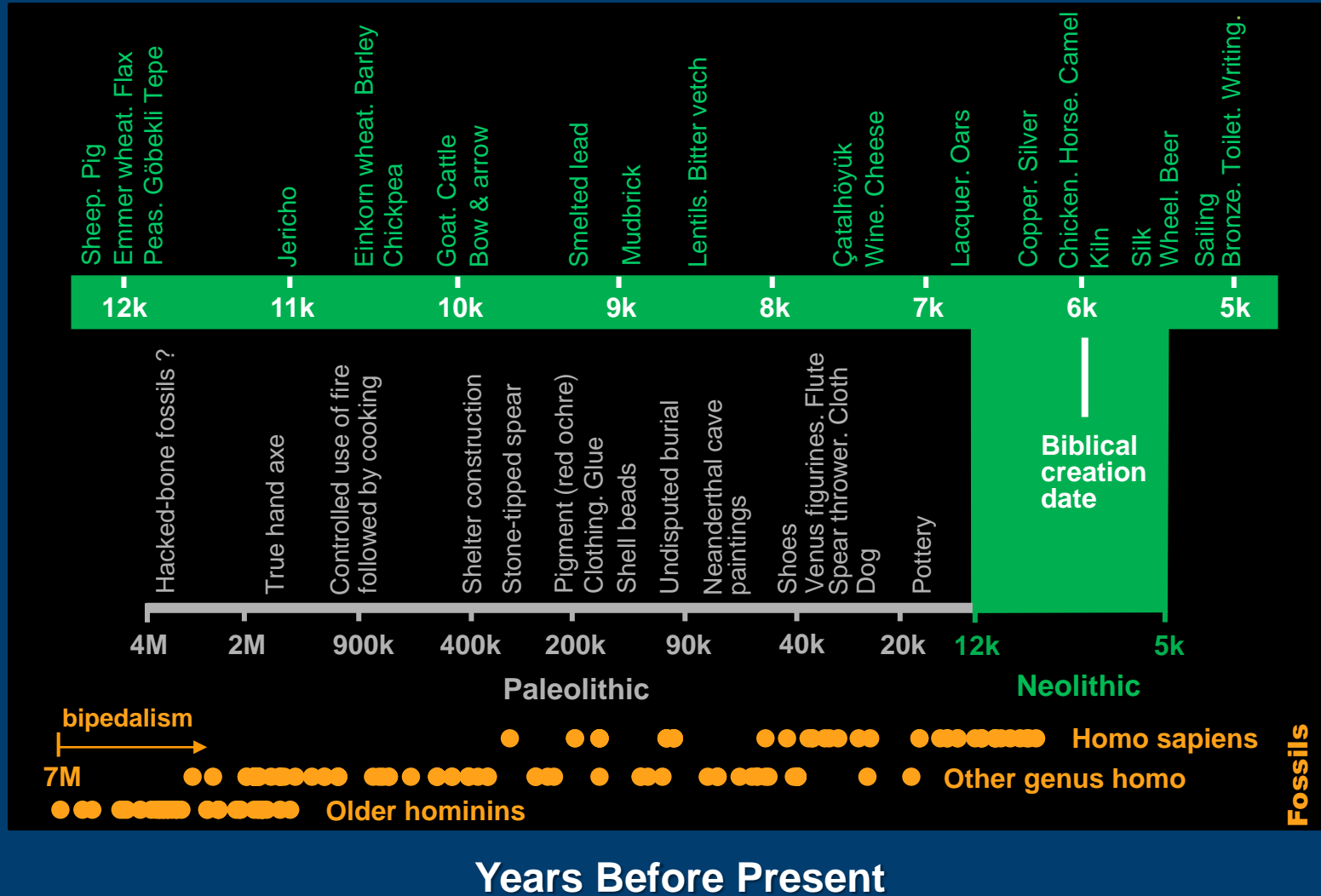
From Earliest Hominins to Civilization



Domestication of key plants and animals

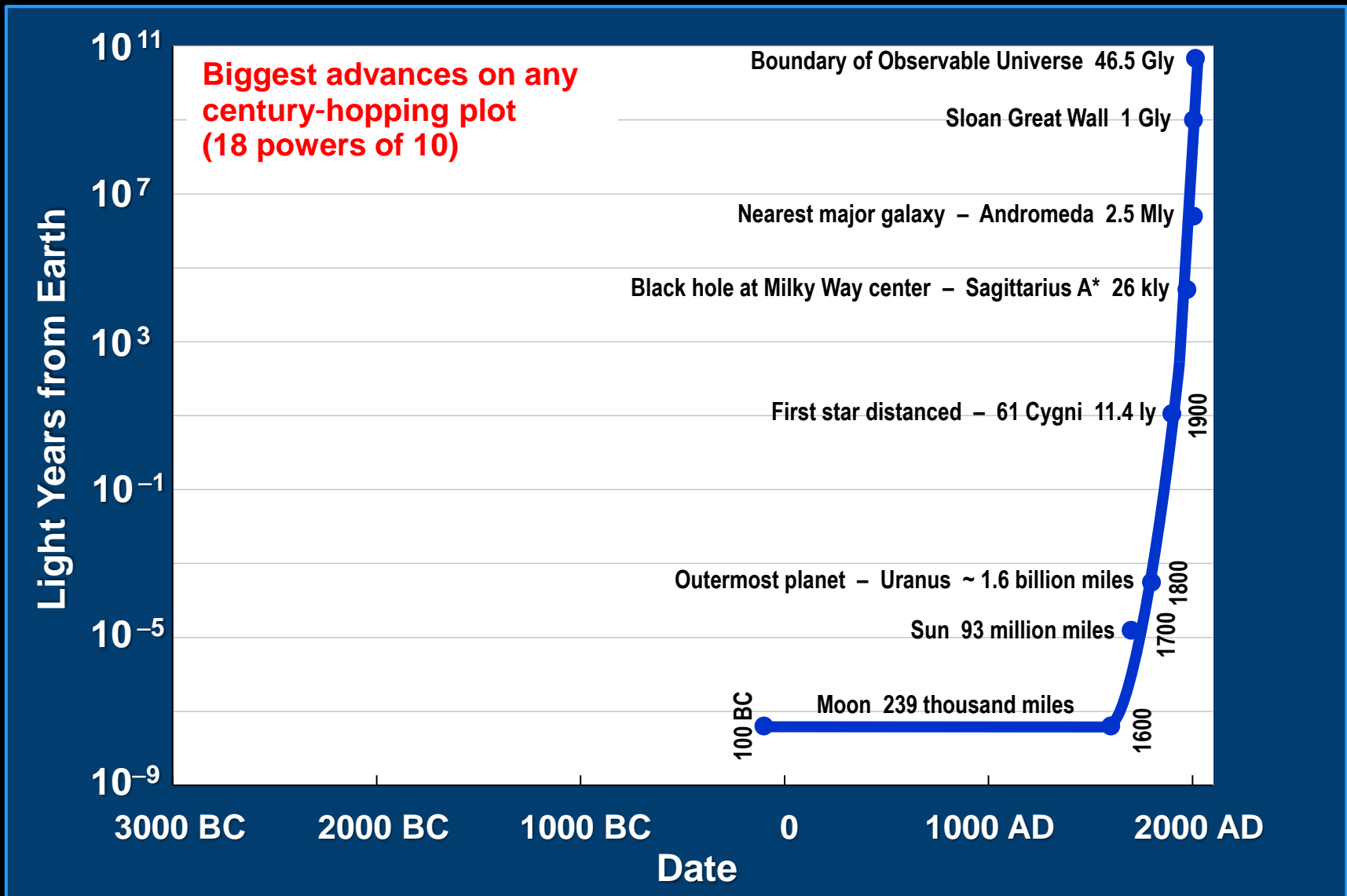
Hominin Prehistory

From Earliest Hominins to Civilization



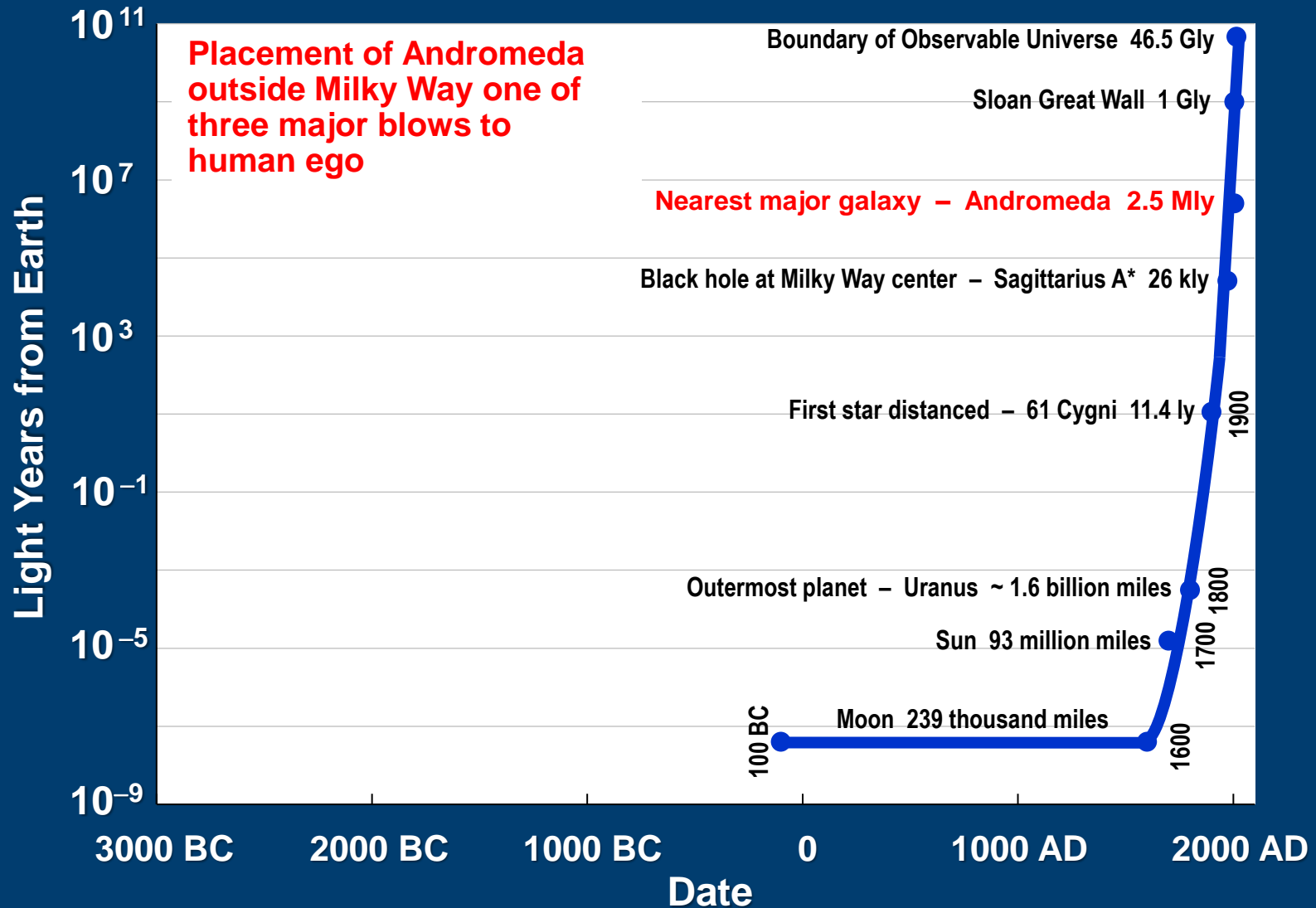
To accept the Biblical creation date, one must essentially deny the accuracy of scientific dating. More scientific dates in Biblical Account of Creation under Earth & Space Pseudoscience below

Delineating the Distant – Far Away Places



Displayed values from recent measurements. All but one (Andromeda - original Hubble distance 1.5 Mly, quickly adjusted upward) would be indistinguishable from historic values on plot spanning this range

Delineating the Distant – Far Away Places



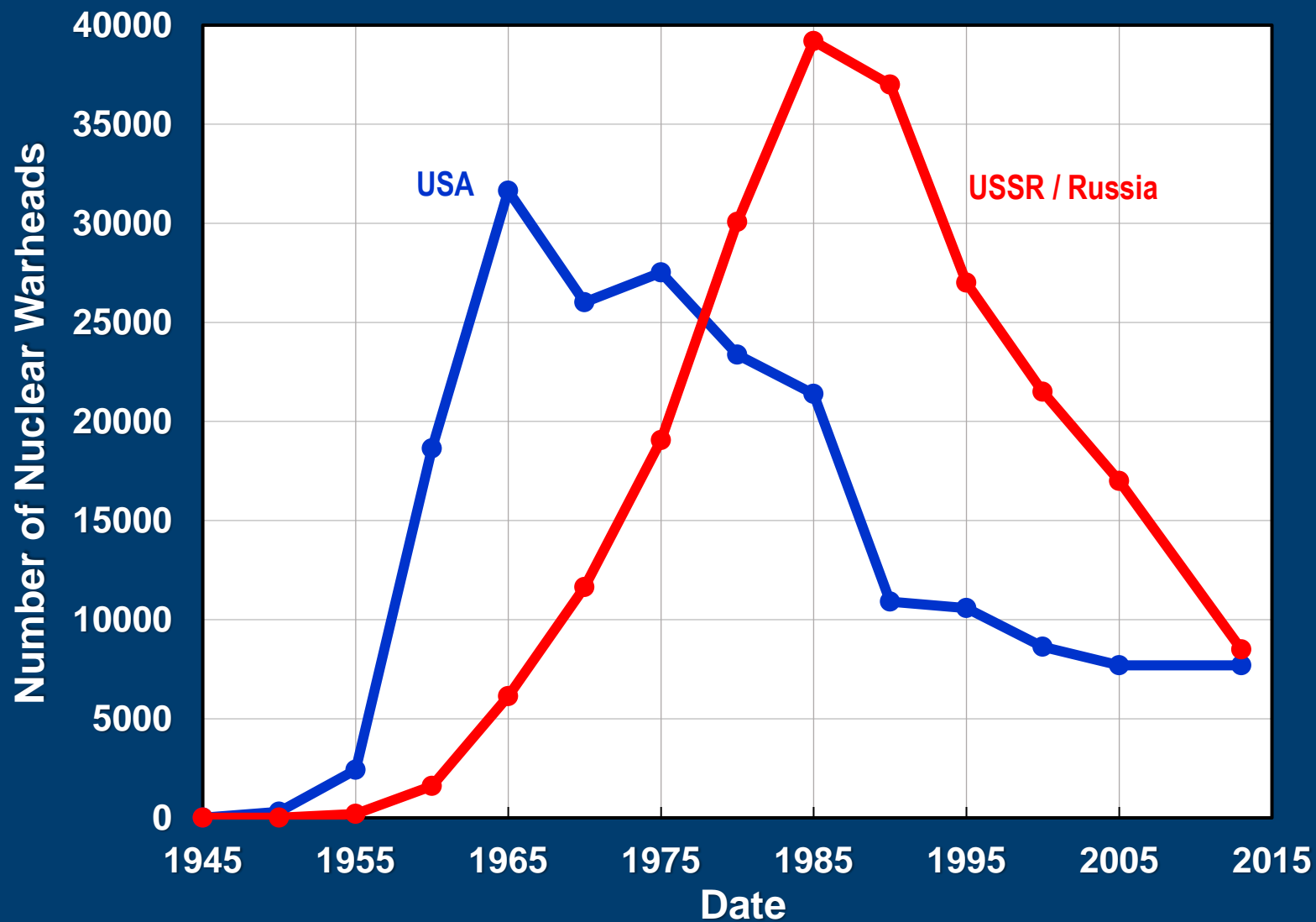
Three Major Blows to Human Ego

Blow	Discoverer	Date
Humans not at center of solar system	Nicolas Copernicus	1514
Humans not specially created, but primarily result of random mutations plus natural selection, like any other lifeform	Charles Darwin*	1859
Our galaxy only tiny speck in staggeringly large universe	Edwin Hubble**	1924

Dates tied to publications. *Alfred Wallace was a co-discoverer of evolution, although he believed in a non-material origin of higher mental faculties. **Others had speculated that the universe was vast, such as Immanuel Kant, who characterized nebulae poetically as "island universes", but Hubble's quantitative placement of Andromeda outside the Milky Way was the first solid evidence

More on faraway / big things in Pseudoscience below
and in Universe presentation

Arming for Armageddon – Nuclear Stockpiles



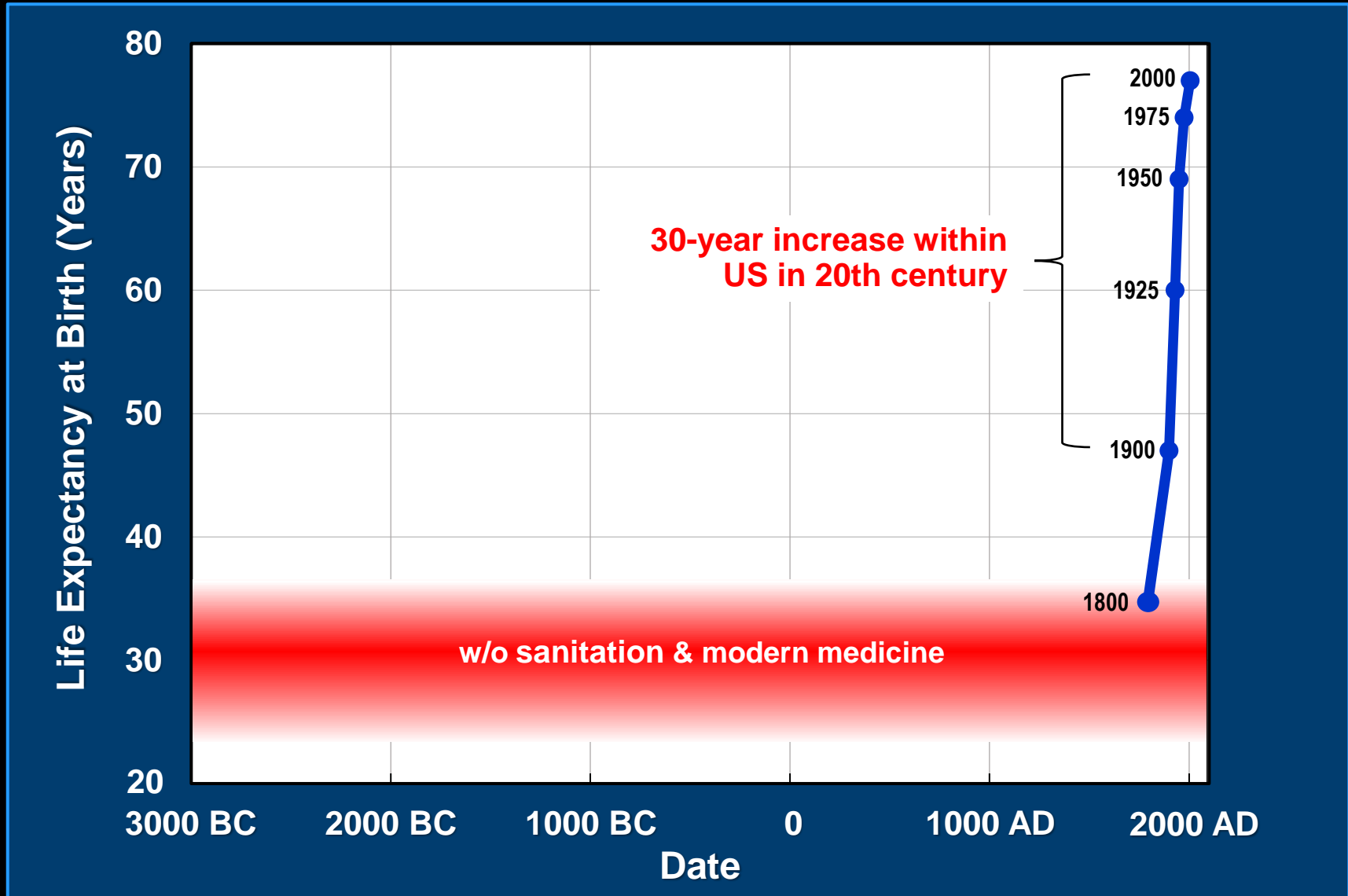
Data from Wikipedia article "Historical nuclear weapons stockpiles and nuclear tests by country"

Potential Magnitude of Armageddon

Consider 1977, when US & Soviet warhead stockpiles each totaled 25,000. Suppose each warhead had killing capability of bombs dropped on Japan in 1945, which averaged 90,000 acute deaths per bomb.* Product of 50,000 warheads and 90,000 deaths per warhead is 4.5 billion people, roughly total population of world in 1977

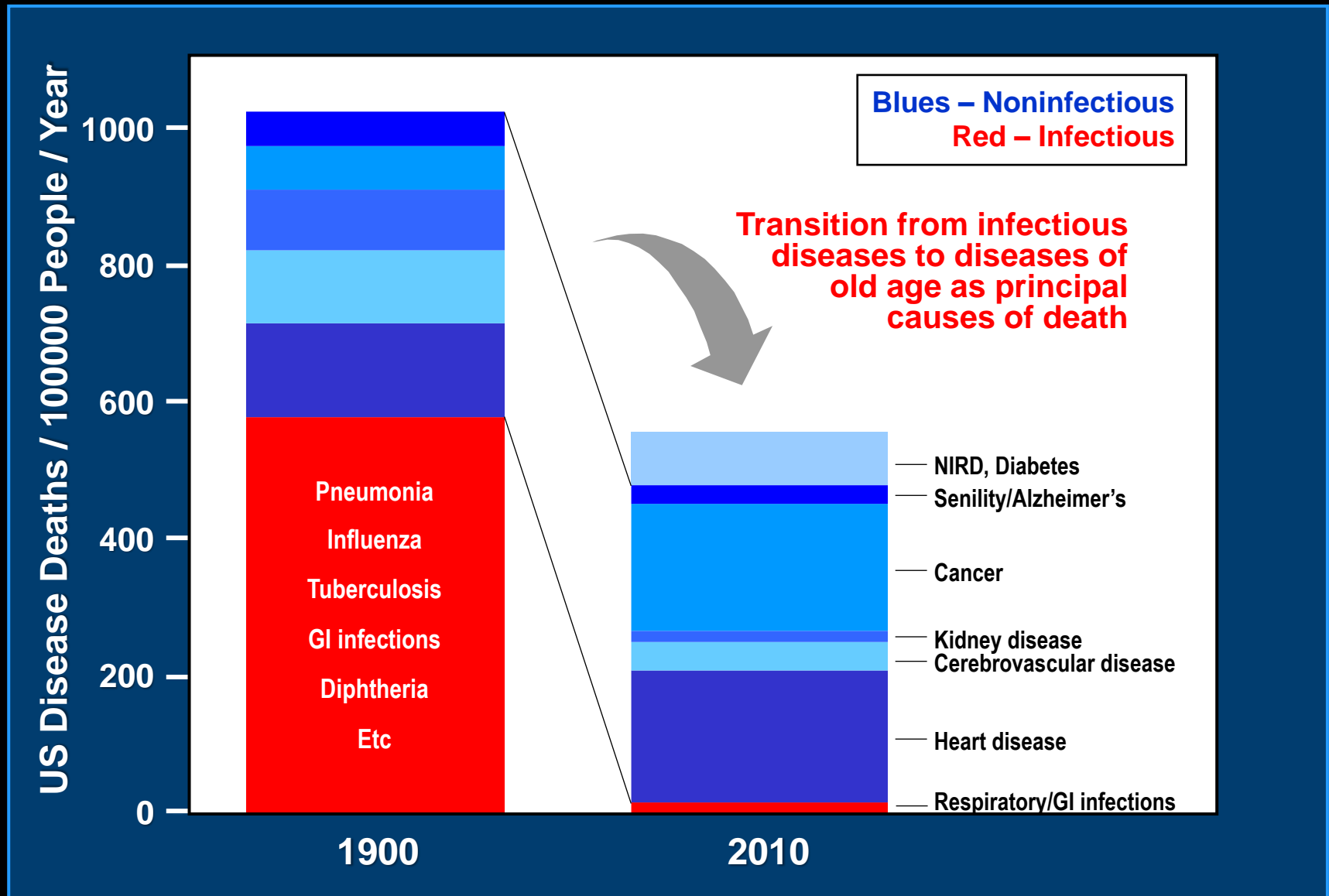
*Acute deaths being those that occurred within a few months of the bombing

Diminishing Disease – Increased Life Expectancy



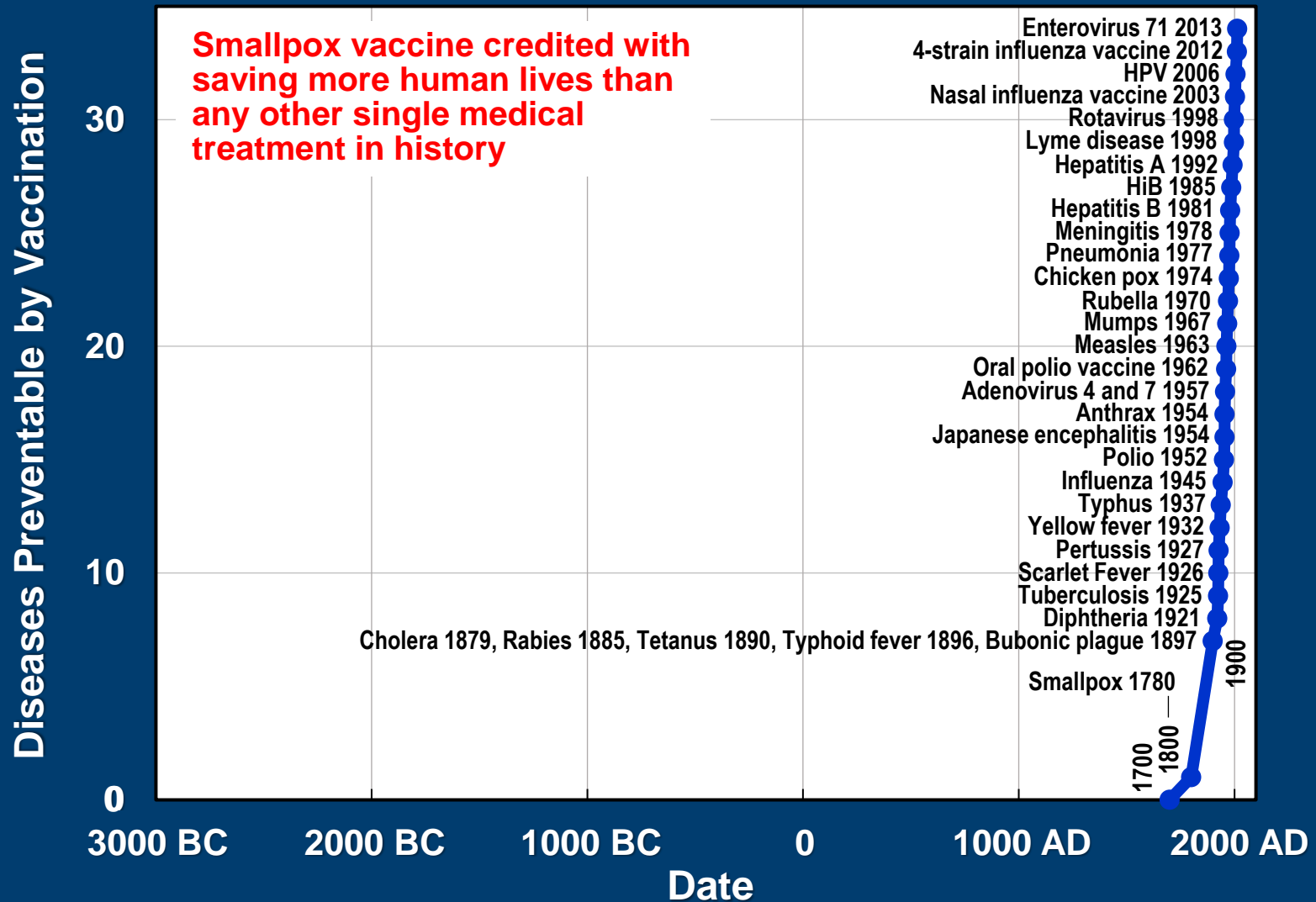
Dramatic rise, due to reductions in child bearing deaths, infant mortality and infectious diseases, from Simon & Moore (1999) *The Greatest Century That Ever Was: 25 Miraculous Trends of the Past 100 Years*. Red band from Donald R. Prothero (2013) *Reality Check : How Science Deniers Threaten Our Future* (2013). Maximum life span (not shown) probably unchanged

Diminishing Disease – Epidemiological Transition



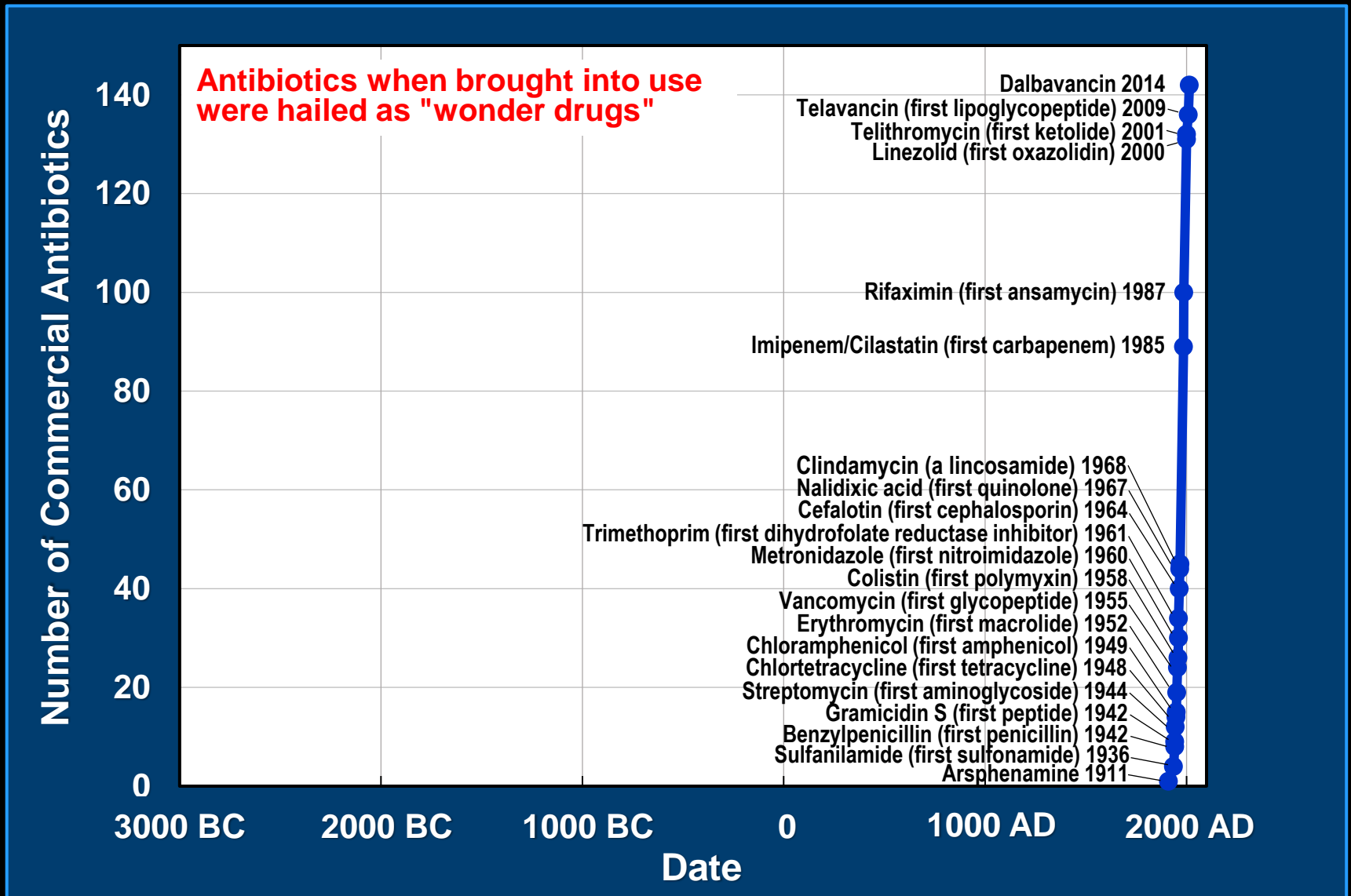
Adapted from Jones et al, "The Burden of Disease and the Changing Task of Medicine," *NEJM* (2012).
NIRD = Non-Infectious Respiratory Diseases

Diminishing Disease – Vaccines



Data from Wikipedia. Smallpox now appears to have been eradicated worldwide

Diminishing Disease – Antibiotics



Only a fraction of the 140+ antibiotics are located on the curve (primarily firsts). Data from Wikipedia

Recognizing Rights

- Rise of democracy
- Abolition of slavery
- Women's suffrage
- Additional examples
- Regression

Recognizing Rights

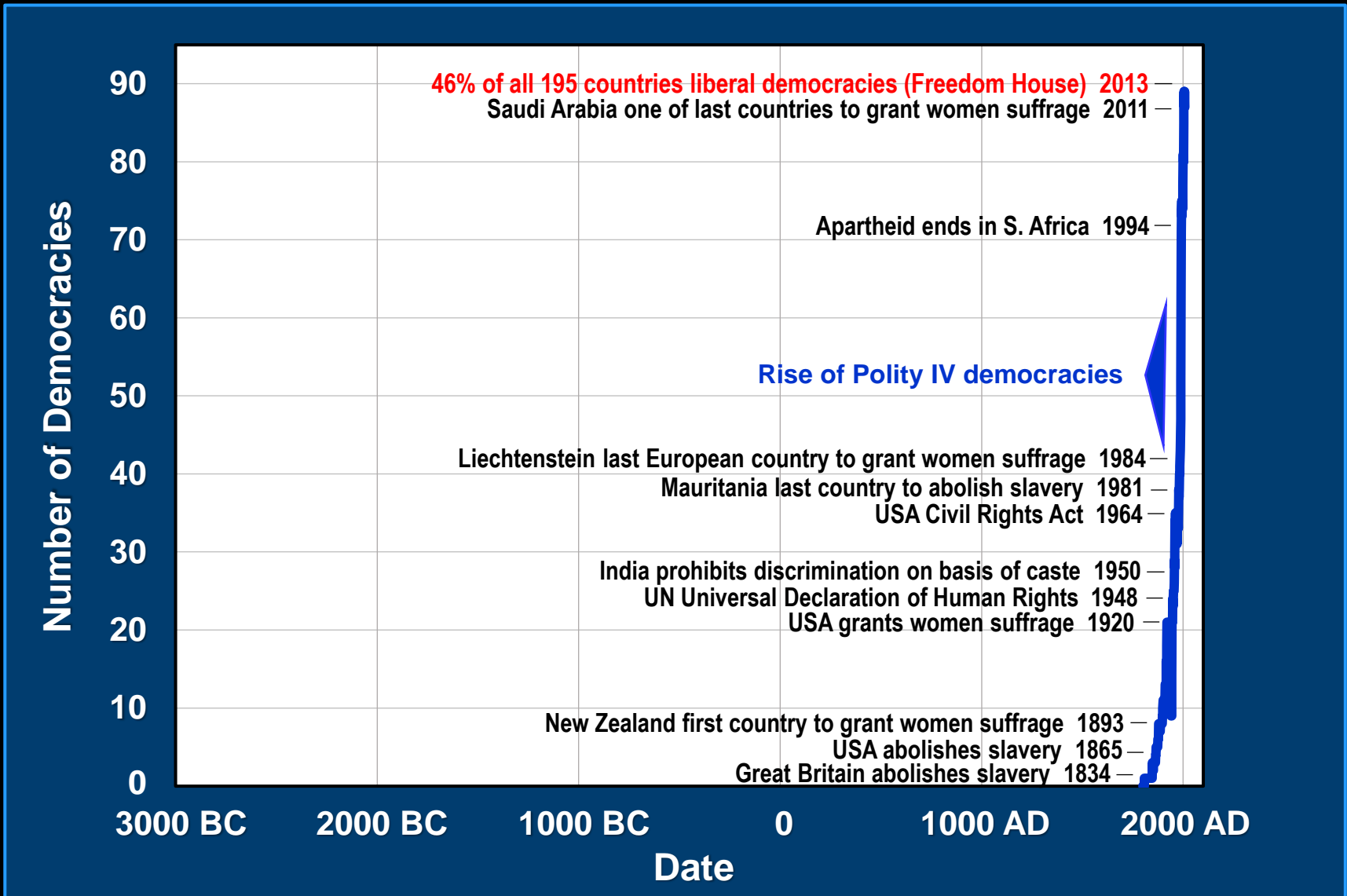
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Liberal Democracy

- Fair, free, competitive elections with distinct parties
- Separation of powers into branches of government
- Rule of law in everyday life
- Equal protection of human rights & freedoms for all

From Wikipedia "Liberal Democracy" article. A constitution often is used to spell out the powers of government and to enshrine the social contract. Note that liberal democracy is distinct from cultural liberalism. Also, there are a number of corrupt regimes that are democracies in name only

Recognizing Rights – Rise of Democracy



Monarchies by far most common form of government throughout most of history. They were largely replaced by democracies in the 20th century. Polity IV and Freedom House are organizations that track democracies throughout the world and over time

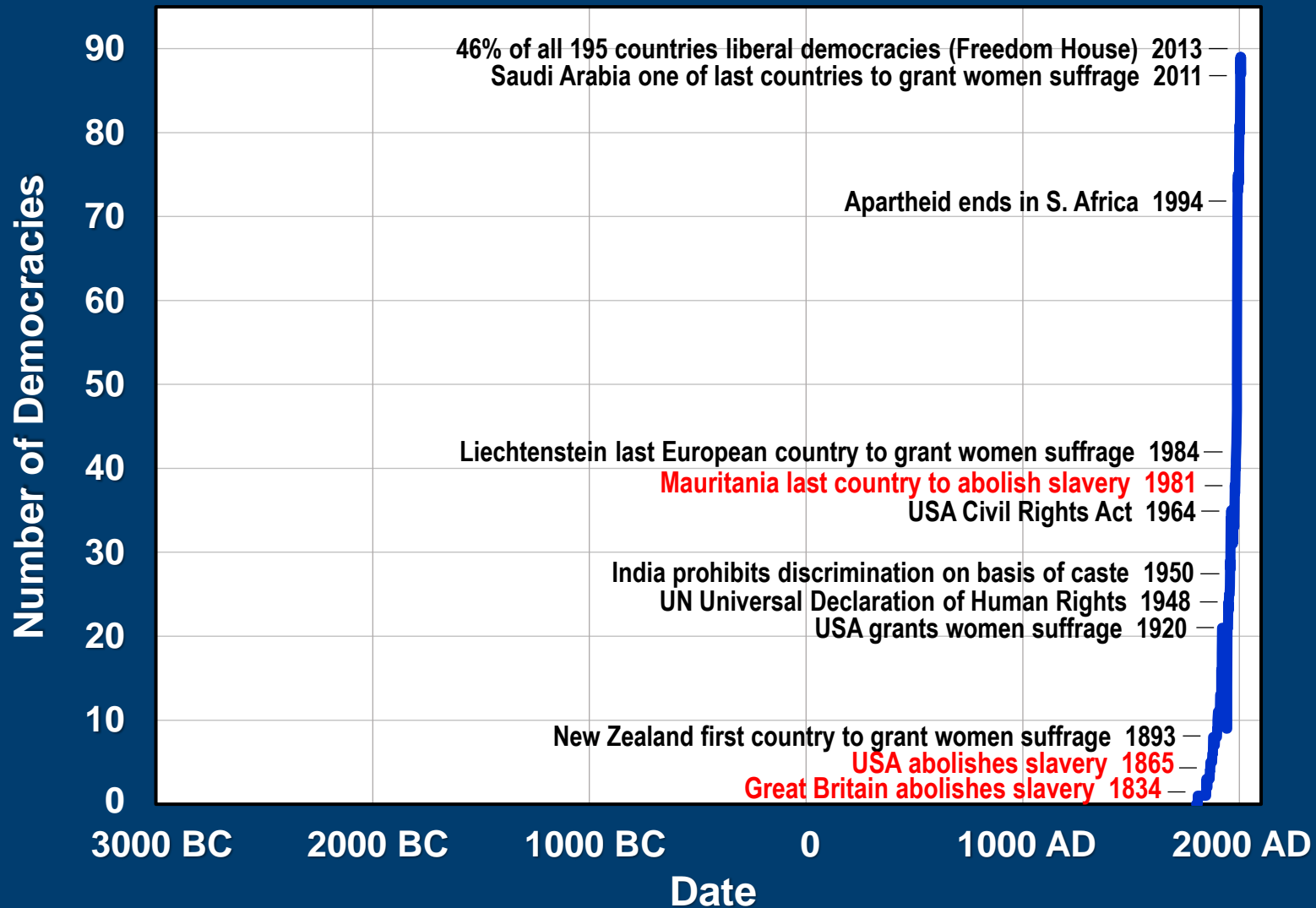
Recognizing Rights

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Slavery

- **Not present in early (hunter-gatherer) societies**
- **Proliferated after invention of agriculture, about 11 kya**
- **Estimated that roughly 75% of all people alive circa 1800 AD trapped in some form of bondage**
- **Estimated that 45 million people in 167 countries still trapped in modern forms of slavery**

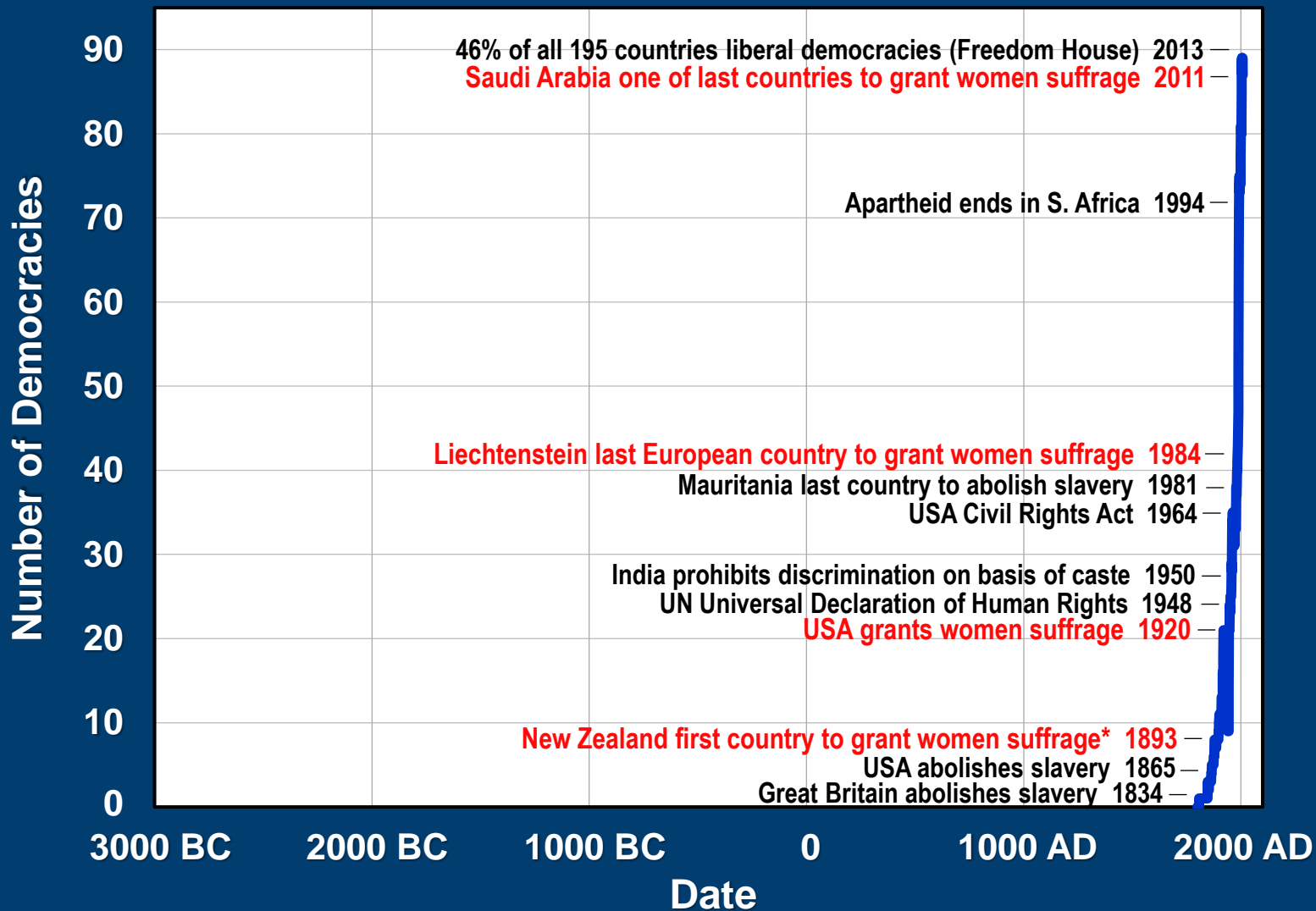
Recognizing Rights – Abolition of Slavery



Recognizing Rights

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Recognizing Rights – Women's Suffrage

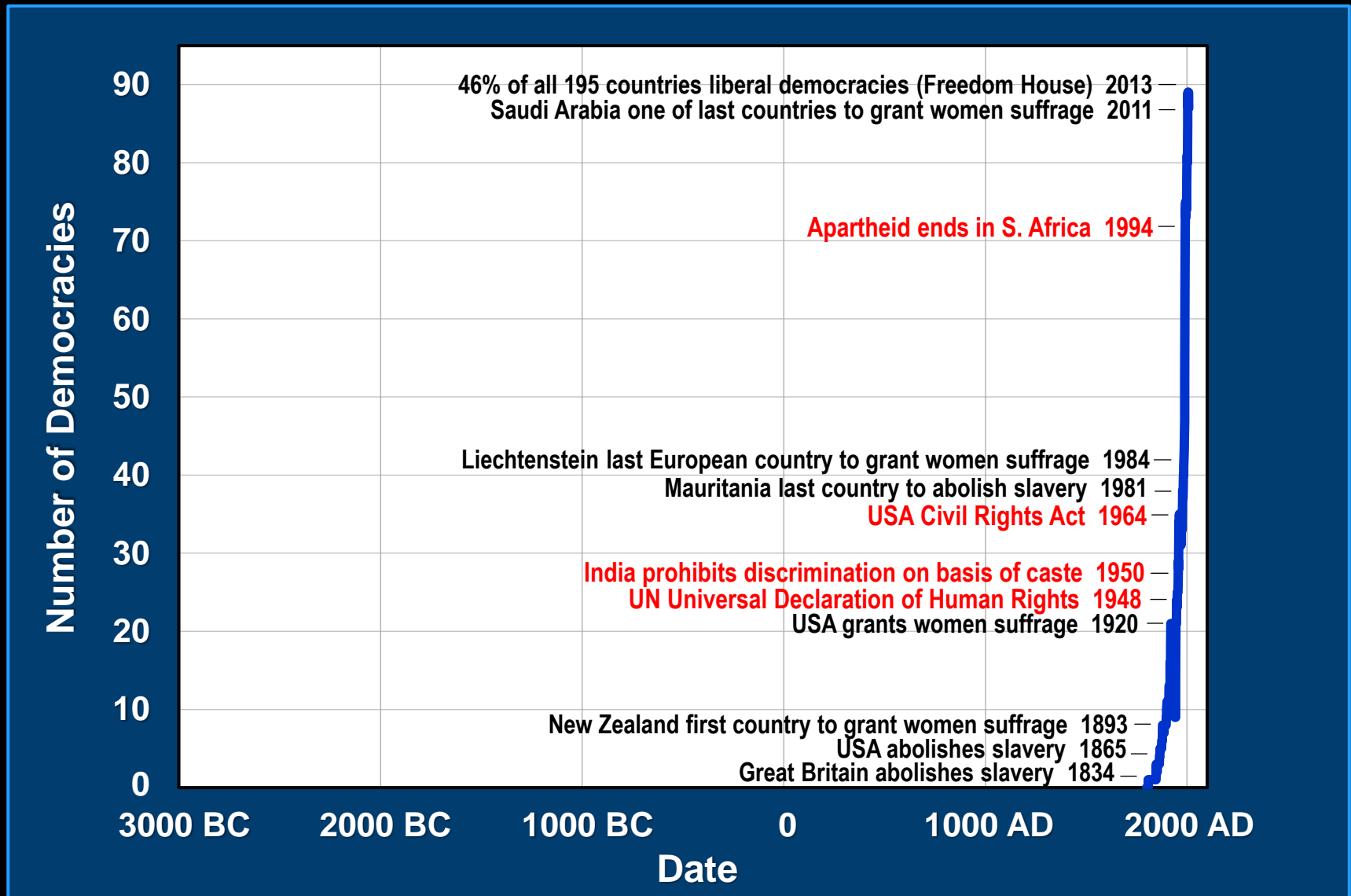


*Providing they were not Maori women

Recognizing Rights

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Recognizing Rights – Additional Examples



It took roughly 100 years for descendants of blacks freed by the Civil War to be granted the same rights as white people under federal law

Recognizing Rights

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Recognizing Rights – Regression

- Islamic states never completely happy with UN Universal Declaration of Human Rights, particularly its freedom to change religion (if that change involves leaving Islam). Most also prefer some form of Sharia (Islamic law), which treats men and women differently (generally less rights & freedom for women). One result: 1990 Cairo Declaration on Human Rights in Islam (CDHRI)*
- Although democracy achieved dramatic gains in the 20th century, by the end of 2019 it had experienced 14 years of decline**
- In the US, the Trump administration has "failed to exhibit consistent commitment to a foreign policy based on the principles of democracy" **

*CDHRI supersedes UN Declaration in 45 Islamic states. **Last two bullets from "Democracy and pluralism are under assault" Sarah Repucci, Freedom House

Contents

Introduction

Misbelief Acquisition – 4 I's

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Intuition

Indoctrination

Empirical Truths

Scientific Consensus

Historical Knowledge

Benefits of Modern Medicine

Popularity of Liberal Democracy

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Probable Misbeliefs

Resources

Pseudohistory

Pseudoscience

Paranormal

Belief Surveys

Wrap-up

Quotes

Insecurity

Paraphrasing what was said earlier, people usually require closure on the Big Questions and will accept ready answers* even absent evidence

*Usually from some form of religion

Examples of Big Questions

- How did we get here?
- Why is life so unfair?*
- How should we behave?
- Is death the end?
- Is there a God?
- And so on

*Some born poor, others rich. Bad people prosper, good people suffer

Healthy Attitude Toward Uncertainty

I think it's much more interesting to live not knowing than to have answers which might be wrong

— Richard Feynman

Metaphysical Insecurity

The most fundamental human problem is metaphysical insecurity, that is, insecurity about reality itself

– Elliot D. Cohen

Contents

Introduction

Misbelief Acquisition – 4 I's

Ignorance

Insecurity

Intuition

Indoctrination

Empirical Truths

Scientific Consensus

Historical Knowledge

Benefits of Modern Medicine

Popularity of Liberal Democracy

Reliability of Modern Technology

Probable Misbeliefs

Resources

Pseudohistory

Pseudoscience

Paranormal

Belief Surveys

Wrap-up

Quotes

Intuition

- Intuition here is shorthand for System 1 thinking in the Dual Process Model of Cognition
- It could also be called (loosely) the "gut"
- Without pertinent facts, a sense of certainty arising from intuition can be completely unwarranted
- Unfortunately, same is true, to a lesser extent, even with relevant facts in hand*

*Due to cognitive biases, for example

Overwhelming conviction by itself is never assurance of truth

For example, residents of psychiatric hospitals can have intense but demonstrably false convictions

Dual Process Model of Cognition

- Conceptual model of information processing
- Components termed System 1 and System 2
- System 1 calls most of the shots, unbeknown to System 2 (our conscious selves)

Problem Illustrating System 1 and System 2 Thinking

Answer the following question as quickly as you can:

Together a cup of coffee and a biscuit cost \$1.10. The coffee costs \$1.00 more than the biscuit. How much does the biscuit cost?

Answers

The System 1 answer is 10 cents, which is false. The true, System 2, answer is 5 cents, as can be verified by first writing the problem statement in mathematical form:

$$C + B = 1.10$$

$$C - B = 1.00$$

Subtracting the second equation from the first,

$$2 B = 0.10$$

or

$$B = 0.05$$

System 1 and 2 Characteristics

Characteristic	S1	S2
Level of awareness	Subconscious (output becomes conscious in S2)	Conscious
Processing	Fast	Slow
	Parallel	Serial
Thinking	Intuitive	Logical
	Automatic	Controlled
	Associative	Rule-based
	Heuristic*	Analytic
	Contextualized	Decontextualized
Level of alertness (waking hours)	Normally high. Reduced if S2 engaged	Normally low. High if engaged by S1
Cognitive demands and energy consumption	Low	High when engaged
Evolutionary status	Old (shared across species)	New (unique to humans)

After "The Magical Number Two, Plus or Minus: Dual-Process Theory as a Theory of Cognitive Kinds"
 Richard Samuels (2009) DOI 10.1093/acprof:oso/9780199230167.003.0006. *Commonsensical

System 1 and 2 Tasks – Contrasting Examples

System 1

System 2

Perceive that object A is more distant than object B	Demonstrate that object A is more distant than object B
Glance quickly toward the source of a sudden loud sound	Focus on the voice of a particular person in a crowded room
Complete the phrase "bread and _____"	Complete an IRS tax form
Stroll at a comfortable pace	Hike at a strenuous pace
Acquire an immediate dislike of a person for no apparent reason	Control your temper when a friend is behaving like an asshole
Answer $2 \times 2 = \underline{\quad}$	Answer $12 \times 24 = \underline{\quad}$
Read words in big letters on billboards	Count occurrences of a particular letter on a page of text
Just "know" that something is true	Convince a skeptic that something is true
Cruise along a straight empty road under perfect driving conditions	Look for a street address while driving in heavy traffic and bad weather (no GPS)
Recognize that "my cat is a dog" is a false statement	Recognize that "all As are Bs; C is a B; therefore C must be an A" is false
As an experienced MD, quickly narrow likely causes of a set of symptoms	Develop a cure for cancer
Recall from algebra that $ax^2 + bx + c = 0$ is satisfied by $x = \frac{-b \pm (b^2 - 4ac)^{1/2}}{2a}$	Verify the solution of the quadratic equation on the left

Cognitive Biases

- **Inherent thinking errors that preclude accurate understanding of reality, even when confronted with evidence needed to do so**
- **Roughly 200 such biases identified by cognitive psychologists**
- **Quite a few have logical fallacy counterparts discovered earlier by philosophers**
- **Sampling of cognitive biases that can impact beliefs identified immediately below. Subset described thereafter. Excluded are cognitive bases having to do with faulty memories and decision making under uncertainty**

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Some Cognitive Biases that Impact Beliefs*

Apophenia, patternicity, pareidolia

- **Definition** Seeing patterns or significance in random data or images
- **Examples** False perceptions by gamblers of patterns in numbers appearing in lotteries, card games and roulette wheels
- **Examples** Seeing images on surfaces of celestial bodies, pieces of food (toast, pizza), or smoke rising from Twin Towers on 9/11

Agenticity, hyperactive agency detection

- **Definition** Attributing phenomena to conscious agent. Possibly selected by evolution due to relatively low cost of false positives (false alarms) and relatively high cost of false negatives (getting eaten)
- **Examples** Supernatural beliefs arising from combination of patternicity and agenticity**
- **Ultimate manifestation** "Everything happens for a reason"

*From variety of sources, including Wikipedia "List of Cognitive Biases" article. **Michael Shermer *The Believing Brain* (2011). Shermer introduced names "patternicity" and "agenticity"

"Virgin Mary" on Grilled Cheese Sandwich



**Patternicity
+ Agenticity
= \$28,000
Grilled-Cheese
Sandwich**

Some Cognitive Biases that Impact Beliefs

Authority bias

- **Definition** Being unduly influenced by authority figures
- **Example** 1961 Milgram obedience study, which established existence of bias. Based on calm instructions from person running experiment, over 60% of test subjects willing to inflict (what they thought were) increasing powerful & potentially lethal electric shocks to person who failed to answer questions correctly ("shocked" person faking agony). Some subjects refused to participate after a point, but majority did not

Availability heuristic

- **Definition** Estimating what is more likely based on what is more available in memory, which tends toward vivid, unusual, & emotionally charged recollections
- **Example** Afraid to swim in ocean for fear of sharks? You might, based on media coverage of few horrific attacks. But you are more likely to be killed toppling a vending machine while trying to remove stuck change (rare, Darwin-award-worthy event) than to be killed by a shark*

*According to Consumer Product Safety Commission

Some Cognitive Biases that Impact Beliefs

Availability cascade

- **Definition** Adopting a belief because of its increasing repetition in public discourse. Availability heuristic on steroids. "Repeat something long enough and it will become true" (part of brainwashing)
- **Example** Extreme political views acquired by getting one's news exclusively from politically aligned news sources, which provide an endless bombardment of ideological mantra and catch phrases
- **Example** Satanic ritual abuse (SRA) daycare panic of 1980s & 1990s*, mostly in United States, but spread to other countries as well. Scary in how easily large numbers of people can accept ridiculous propositions

Early claim of abuse in 1980 "autobiography" *Michelle Remembers*, by Michelle Smith and her psychiatrist (later husband) Lawrence Pazder. It included tales of abuse and sex orgies, now known to be fabrications

Panic began in earnest in Kern County, Ca with claims of pedophile-sex-ringing Satanic ritual abuse. Overzealous district attorney Ed Jagels was able to convict at least 36 people. 34 convictions overturned on appeal

*Wikipedia "Kern County Child Abuse Cases", "McMartin Preschool Trial" & "Satanic Ritual Abuse" articles.
x Russell (1999), Introduction to *The Secret Trauma* (revised edition). Romano (2016), "The History of Satanic
x Panic in the US - and Why It's Not Over Yet," *Vox*. Grant (2011) *Denying Science : Conspiracy Theories, Media Distortions, and the War Against Reality*

Some Cognitive Biases that Impact Beliefs

Availability cascade (continued)

SRA case that received most attention involved the McMartin preschool in wealthy Manhattan Beach, California. In 1983 a mother claimed her son had been sodomized by her estranged husband and a male teacher at the school. She also made other accusations against school staff. Pretrial investigation took place from 1984 to 1987

During pretrial investigation, aggressive, leading & repeated questioning of children by social workers led to stories from 369 students of

1. Ingestion of human excrement, semen, flesh and blood
2. Disinterment and mutilation of corpses
3. Infant sacrifices
4. Orgies with school staff (dressed as devils and witches) in various locations, including classrooms, tunnels beneath the school, car washes, cemeteries, gourmet food stores, local gyms, churches, airplanes and hot air balloons

Identified as abusers by the children were the McMartin daycare providers, parents and neighbors, soccer coaches, babysitters, local business people (including mayor's wife), reporters covering the story, celebrities (e.g. film star Chuck Norris) and members of Anaheim Angels baseball team

Some Cognitive Biases that Impact Beliefs

Availability cascade (continued)

Accusing mother found to be paranoid schizophrenic. She died in 1986 from complications of chronic alcoholism

Propelled by widespread and initially credulous media coverage of the McMartin case, roughly 100 other SRA daycare scandals emerged from 1984 to 1991. During that period a number of adult women claimed to have experienced SRA as children

Media coverage began turning skeptical in 1987

McMartin trial nonetheless went forward and lasted from 1987 to 1990. Most expensive criminal trial in U.S. history at that time. By the end, all charges had been dropped

In the early 1990s a 4-year study by U.C. Davis, University of Illinois and National Center on Child Abuse and Neglect, having examined more than 12,000 accusations of SRA, found no sound basis for any. FBI investigation published in 1992 reached same conclusion. By mid-1990s panic was over

Some Cognitive Biases that Impact Beliefs

Availability cascade (continued)

In 1995 reporter Geraldo Rivera, who played major role in promoting the scare, apologized, saying

*I want to announce publicly that as a firm believer of the "Believe The Children" movement of the 1980's, that started with the McMartin trials in CA, . . . Now I am convinced that I was terribly wrong . . . and many innocent people were convicted and went to prison as a result . . . and I am equally positive (that the) "Repressed Memory Therapy Movement" is also a bunch of CRAP**

As in Kern County, most convictions reversed, but not always right away. One couple, Dan and Fran Keller, convicted in Austin, TX, were not freed until 2013, and only in 2017 fully exonerated and compensated to tune of 3.4 million dollars. Some of those convicted are still in prison

Some McMartin students, as adults, have recanted their testimony

*Indeed, Repressed Memory Therapy, used to coax accusations from thin air, appears to be a pseudoscience

Some Cognitive Biases that Impact Beliefs

Backfire effect

- **Definition** Reacting to evidence against one's beliefs by believing more strongly. Scary aspect of unconditional faith
- **Example** 1954 case that led to term "cognitive dissonance." Members of small cult were convinced by their leader that world would end at midnight on December 21 and that faithful members would be carried to safety in a flying saucer. Many members quit their jobs and gave away all their possessions, including their homes. Unsurprisingly, nothing happened at 12:00 AM on the 21st and after a few hours members were becoming seriously concerned. Then the leader had a new vision. Due to the faith of the cult members, the entire world had been spared. That revelation caused the members to become more committed than ever to the cult, despite the dramatic prophesy failure
- **Cognitive dissonance** Mental discomfort experienced when simultaneously holding contradictory beliefs, ideas, or values. Avoided in above case by leader's ingenious new vision

Some Cognitive Biases that Impact Beliefs

Bandwagon effect, herd instinct

- **Definition** Doing or believing something because of what many others do or believe. Rallying to the majority opinion. Very powerful bias
- **Example** "God must exist. Billions of people couldn't be wrong." But they could, easily. Until recently everyone was wrong about the history of the Universe, Earth, and life on Earth, relying on religious narratives now contradicted by science. Views of the gods also have changed. Through most of history most people were polytheists. Roughly a billion (mainly Hindus) still are. But about two-thirds of the overall population today is nominally monotheistic (although there is that Trinity thing). Also, no one religion is accepted by the majority, so most believers (billions) must be wrong in some way. And all could be wrong, because there is no broadly compelling evidence for the truth of any religion. Christianity commands the largest following today, in part because Christian Europeans with a technology edge and some diseases took over the Western Hemisphere a few centuries ago*. Nowadays Islam is the fastest growing religion and appears likely to overtake Christianity. The two are not compatible. And then there are those who believe in no gods at all

*As detailed in Jared Diamond's *Guns, Germs, and Steel*

Some Cognitive Biases that Impact Beliefs

Base rate bias, base rate fallacy, base rate neglect

- **Definition** Inferring the probability of a condition (e.g., having a disease) from test results, without taking into account the prevalence of the condition (base rate, prior probability) in the population of interest
- **Example** Suppose a virus has spread within a population such that

$$P(I) = 1 \text{ in } 500 = 0.002$$

where $P(I)$ is the fraction of the population infected (base rate of the disease or prior probability)

In addition, suppose that there is a screening test for the virus with the following characteristics:

$$P(+ | I) = 1.00$$

$$P(+ | N) = 0.05$$

$P(+ | I)$ is the fraction of infected people who test positive (the sensitivity of the test). $P(+ | N)$ is the fraction of non-infected people who test positive (false positive rate of the test)

Some Cognitive Biases that Impact Beliefs

Base rate fallacy, base rate neglect (continued)

You take the test and the results come back positive. What is the probability $P(I|+)$ that you are infected? [$P(I|+)$ is not the same as $P(+|I)$]. People typically answer 95%, assuming that

$$P(I|+) = 1 - P(+|N) = 0.95$$

Even 60 doctors at four Harvard Medical School teaching hospitals gave that answer [Kida (2006)]. But the last equation is incorrect. The correct probability on the left side is the fraction of non-infected people who test negative (the test specificity)

$$P(-|N) = 1 - P(+|N) = 0.95$$

How then does one calculate $P(I|+)$? The answer is by making use of Bayes' theorem. The binary version that applies here takes the form

$$P(I|+) = \frac{P(+|I)P(I)}{P(+|I)P(I) + P(+|N)P(N)}$$

Some Cognitive Biases that Impact Beliefs

Base rate fallacy, base rate neglect (continued)

where

$$P(N) = 1 - P(I) = 0.998$$

$P(N)$ is the non-infected fraction of the population. Note that the base rate $P(I)$ now enters the picture. Substituting values in Bayes' theorem,

$$P(I|+) = \frac{(1.00)(0.002)}{(1.00)(0.002) + (0.05)(0.998)} \simeq 0.04$$

Thus the probability of being infected when testing positive is only about 4%, not 95%. Clearly, a doctor who ignores the base rate can scare the hell out of a patient*

*In his book *The Drunkard's Walk: How Randomness Rules Our Lives*, physicist Leonard Mlodinov recalls being informed by his doctor in 1989 that chances were 999 out of a 1000 that he would be dead within a decade. Mlodinov had tested HIV-positive in a screening test for an insurance policy. The false-positive rate of the test was 1 in 1000. But the doctor had neglected the very low base rate of AIDS in Mlodinov's demographic (white, heterosexual, non-IV-drug-abusing, American male). After almost three decades Mlodinov remains, unsurprisingly, symptom free

Some Cognitive Biases that Impact Beliefs

Belief bias

- **Definition** Evaluating strength of argument based on believability of conclusion instead of how well argument supports belief. Intuition trumps evidence

Causation bias

- **Definition** Assuming from correlation or association that a cause-effect relationship exists. Correlation does not necessarily indicate causation
- **Example** Perhaps most common example is taking A to be cause of B because B came after A (known in logic as the *cum hoc ergo propter hoc* fallacy). There are countless incidents of B's following A's with no causal connection. Unfortunately, once causal link is suspected, there is strong tendency for another bias, the confirmation bias (below), to come into play. Many misbeliefs arise and proliferate through this combination of biases, such as belief in power of prayer, belief in efficacy of homeopathy, and belief that childhood MMR vaccinations are responsible for autism

Some Cognitive Biases that Impact Beliefs

Confirmation bias, counting hits but not misses, cherry picking, myside bias

- **Definition** Collecting and interpreting evidence in way that supports preconceived notions. Key means by which false beliefs sustained. Similar to selective perception and self-fulfilling prophecy. Crucial aspect is ignoring contrary evidence
- **Example** "Global warming is nonsense! We just had our coldest winter in years!" This is cherry picking. Local temperatures can fluctuate enormously. Global average temperature smoothed over several years far more diagnostic
- **Example** Consider person pondering whether God answers prayers. Quick answer might be "Yes, because I've prayed for things and gotten them." Stopping there, person would be exhibiting confirmation bias, focusing on result "asked and received" while ignoring other results, such as "asked but did not receive" and "received but did not ask"

The confirmation bias is closely related to motivated reasoning and cognitive dissonance

Some Cognitive Biases that Impact Beliefs

Confirmation bias (continued)

To be more quantitative, suppose a farmer in the tropics needs rain 40 weeks each year. He prays for rain when needed and collects following data on rainy weeks over one year period

	Got Rain	Did Not Get Rain
Prayed	30	10
Did Not Pray	10	2

Farmer thinks data support power of prayer. After all, he got rain in 30 of 40 weeks in which he prayed. He also got rain in additional 10 weeks, for total of 40 that he needed

But the data do not support belief in power of prayer. The farmer is exhibiting the confirmation bias

Critical comparisons in this case are ratios of rainy weeks to dry weeks when rain was prayed for and when it was not. Values of those ratios are

Some Cognitive Biases that Impact Beliefs

Confirmation bias (continued)

With prayer: 30 wet weeks /10 dry weeks = 3 wet weeks per dry week

Without prayer: 10 wet weeks /2 dry weeks = 5 wet weeks per dry week

Such results indicate prayer had no positive effect. Better case could be made for opposite. Of course, one year's worth of such data is statistically meaningless. In the absence of more extensive data, most sensible conclusion is that it simply rains roughly 40 out of every 52 weeks where farmer lives, regardless of who's praying and who's not

Best scientific test of intercessory prayer efficacy is double-blind "Templeton Foundation prayer study" or "Great Prayer Experiment" (2006). Prayers were offered for successful heart surgery and recovery of 1802 patients. No statistical benefit. Patients prayed for actually did slightly worse

Early Description of Confirmation Bias

Before Concept of Cognitive Biases Formalized

The human understanding, when it has once adopted an opinion (either as being the received opinion or as being agreeable to itself) draws all things else to support and agree with it. And though there be a greater number and weight of instances to be found on the other side, yet these it either neglects and despises, or else by some distinction sets aside and rejects; in order that by this great and pernicious predetermination the authority of its former conclusions may remain inviolate And such is the way of all superstition, whether in astrology, dreams, omens, divine judgements, or the like; in such vanities, mark the events where they are fulfilled, but where they fail, though this happens much oftener, neglect and pass them by

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– Francis Bacon (1620)

Bacon has been called the "father of empiricism" and the "father of the scientific method." It appears he also was a keen observer of human behavior. Quote from Bacon's *Novum Organum*

Some Cognitive Biases that Impact Beliefs

Confidence heuristic

- **Definition** Tending to be most persuaded by the person exhibiting the most confidence
- **Example** Placing blind trust in stream of nonsense generally emanating from Donald Trump

Dunning-Kruger effect

- **Definition** False sense of competence felt by incompetent people, whose lack of competence prevents them from distinguishing competence from incompetence
- **Example** Donald Trump's bloated confidence in his ability to make good, bold decisions on topics he unknowingly lacks rudimentary knowledge of, essentially banking on his intuition and crude sense of showmanship

The above biases are only the tip of the iceberg regarding Trump. See, for example, (i) *Rocket Man: Nuclear Madness and the Mind of Donald Trump* (2018) by John Gartner, who claims Trump suffers from malignant narcissism and (ii) *The Dangerous Case of Donald Trump: 37 Psychiatrists and Mental Health Experts Assess a President. Updated and Expanded with New Essays* (2019) by Brandy X. Lee

Some Cognitive Biases that Impact Beliefs

Forer effect

- **Definition** Readily agreeing that a personality description, allegedly tailored for oneself, is accurate, when in fact description is vague and general enough to apply to almost anyone
- **Example** Widespread acceptance of astrology, fortune telling and certain personality tests
- **Demonstration** Psychology professor Bertram Forer gave personality quiz to his students. He later handed each student a personality profile he claimed was derived from answers to quiz, and asked each to rate its accuracy. Average rating very high (85%). But in fact each student had received identical profile, synthesized by Forer from various horoscopes

Bertram Forer Personality Profile

You have a great need for other people to like and admire you. You have a tendency to be critical of yourself. You have a great deal of unused capacity which you have not turned to your advantage. While you have some personality weaknesses, you are generally able to compensate for them. Your sexual adjustment has presented problems for you. Disciplined and self-controlled outside, you tend to be worrisome and insecure inside. At times you have serious doubts as to whether you have made the right decision or done the right thing. You prefer a certain amount of change and variety and become dissatisfied when hemmed in by restrictions and limitations. You pride yourself as an independent thinker and do not accept others' statements without satisfactory proof. You have found it unwise to be too frank in revealing yourself to others. At times you are extroverted, affable, sociable, while at other times you are introverted, wary, reserved. Some of your aspirations tend to be pretty unrealistic. Security is one of your major goals in life

Some Cognitive Biases that Impact Beliefs

Groupthink

- **Definition** Communal reinforcement that overrides full consideration of possibilities. "Don't rock the boat"
- **Examples** Bias believed by some to have influenced the following
 - Unpreparedness for Japanese attack on Pearl Harbor (1941)
 - Failure of CIA-backed Bay of Pigs invasion (1961)
 - Escalation of Vietnam conflict in 1960s
 - Space Shuttle Challenger disaster (1986)
 - Collapse of Enron (2001)
 - Collapse of Swissair (2002)
 - Failure of US invasion of Iraq (2003)
 - Subprime mortgage crisis (2007-2010)
 - Failure of pollsters to predict election of Donald Trump (2016)

Halo effect

- **Definition** Allowing few positive traits of person to dominate overall assessment of person
- **Example** Overvaluing opinions of celebrities on subjects they have no expertise in, such as Jenny McCarthy and Bill Maher on MMR vaccinations as cause of autism

Some Cognitive Biases that Impact Beliefs

Rosy retrospection

- **Definition** Remembering the past as better than it actually was
- **Example** "The 1950s were golden years in America." Blacks might not agree, particularly those who lived in the Deep South

Semmelweis reflex

- **Definition** Rejecting new evidence that contradicts a paradigm. Flip side of confirmation bias. Exemplifies the adage "If the facts don't fit the theory, throw out the facts"

Stereotyping

- **Definition** Assuming, without any specific evidence, that a member of a group has certain characteristics. Classic prejudice

Texas Sharpshooter Fallacy

- **Definition** Interpreting clusters in small data sets as non-random. Named after fictitious Texan who fires shots at the side of a barn, paints a target centered on the biggest cluster of hits, then claims to be a sharpshooter

Some Cognitive Biases that Impact Beliefs

Texas Sharpshooter Fallacy (continued)

- Example Prophecies of Nostradamus. For example

*Beasts wild with hunger will cross the rivers,
The greater part of the battle will be against Hister.
He will cause great men to be dragged in a cage of iron,
When the son of Germany obeys no law*

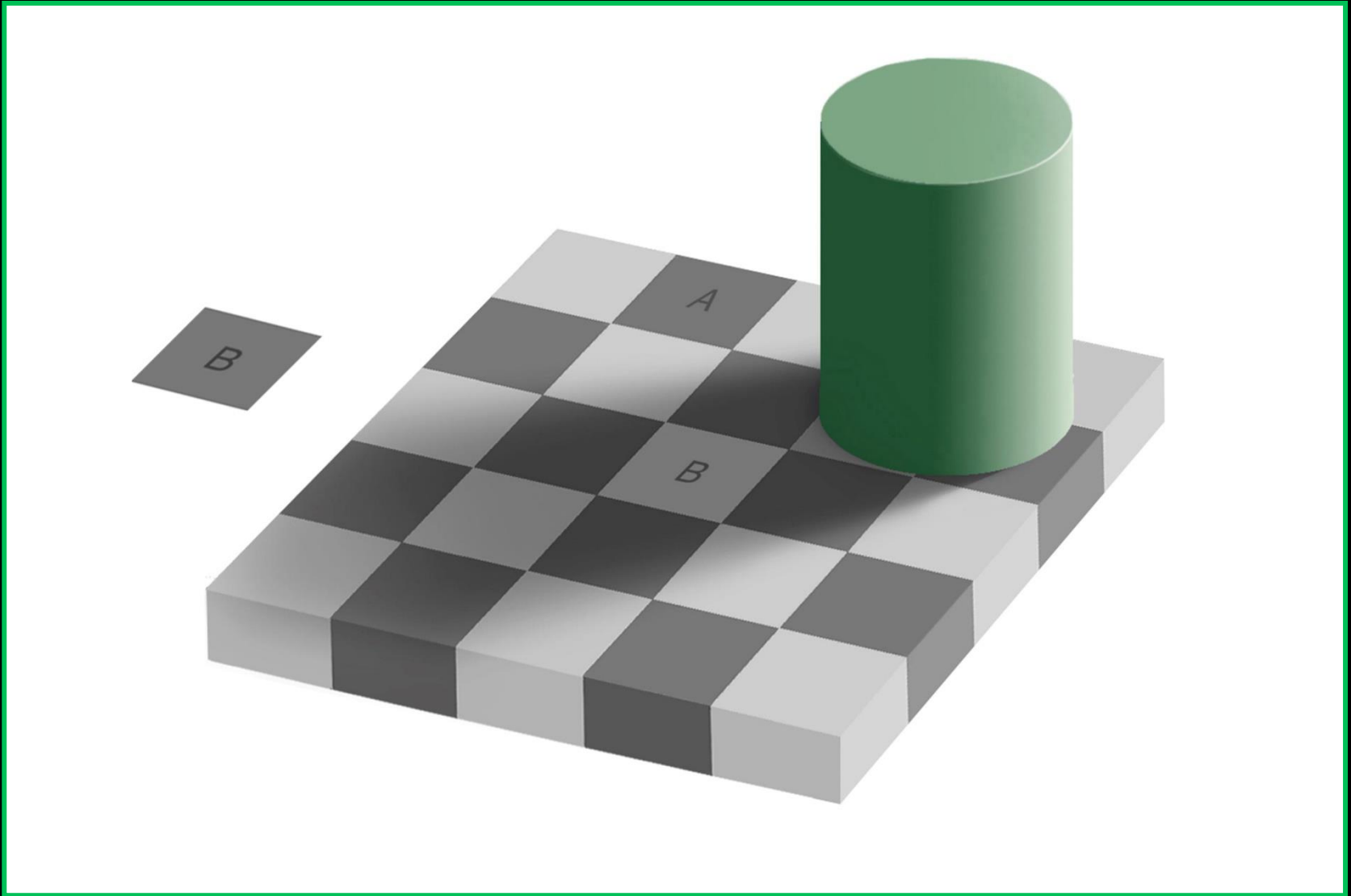
This vague passage has been taken to prophesy the rise of Hitler. But "Hister" is Latin for the Danube, not a variant of Hitler. More generally, not one of the 1000+ prophecies of Nostradamus is sufficiently specific to be considered predictive of anything

- Example Prophecies from hidden codes in the Bible, invariably found after the predicted events have occurred. To illustrate the fallaciousness of the method, skeptics extracted similar prophecies from *Moby Dick*

Other Cognitive Biases : Visual Illusions

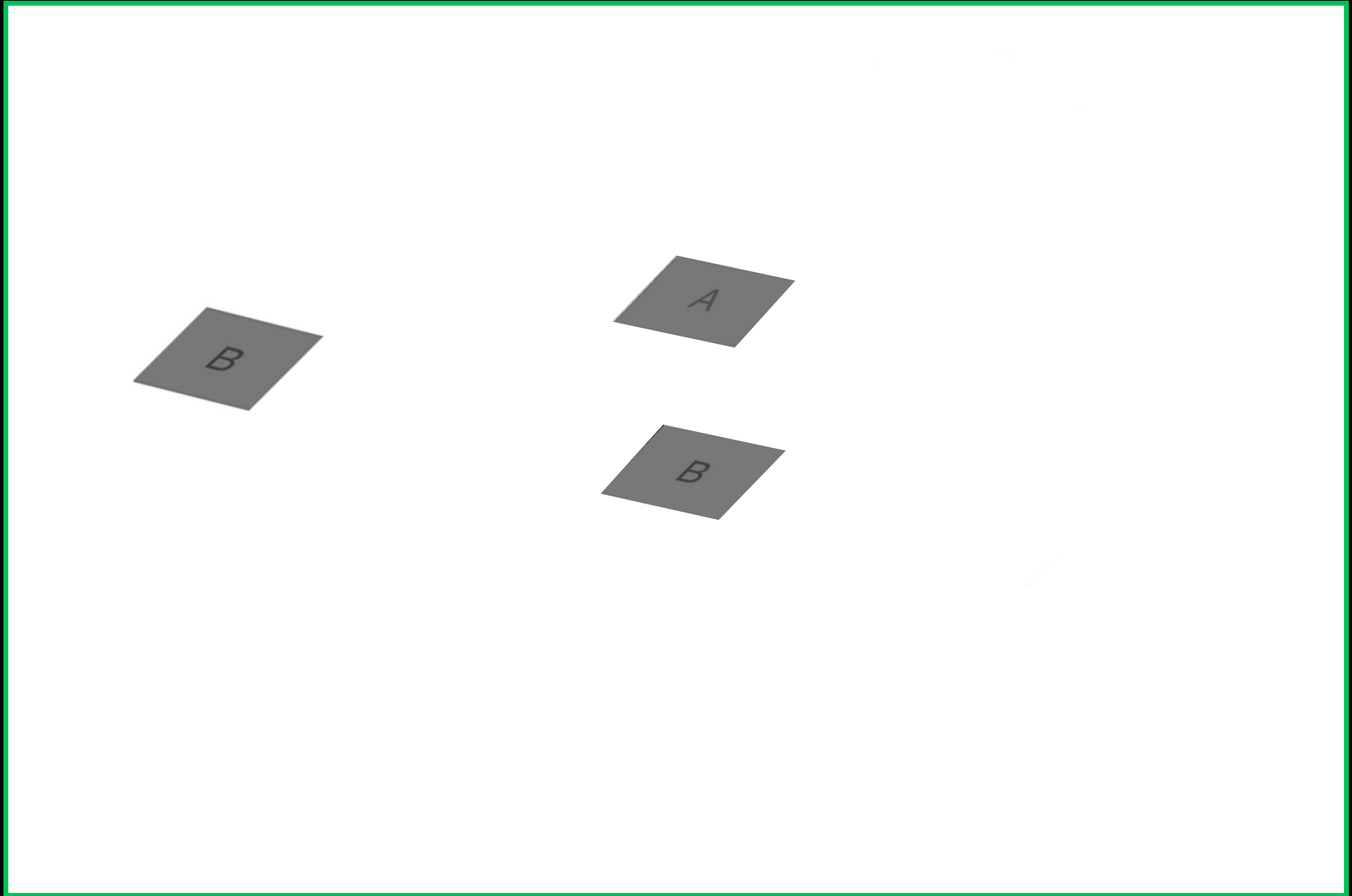
- Even our most trusted sense, sight ("seeing is believing") is easily deceived
- Just watch any good magical act, or a video of the Simons and Chablis "Invisible gorilla" experiment demonstrating inattention blindness
- Three examples of visual illusions follow

Checkerboard Illusion 1



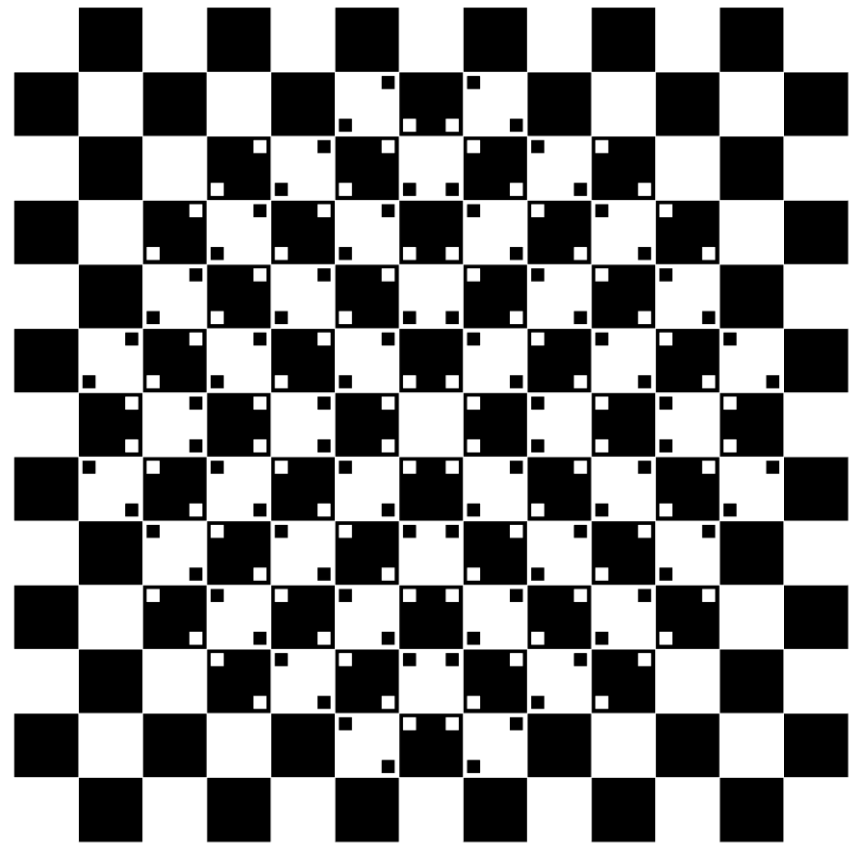
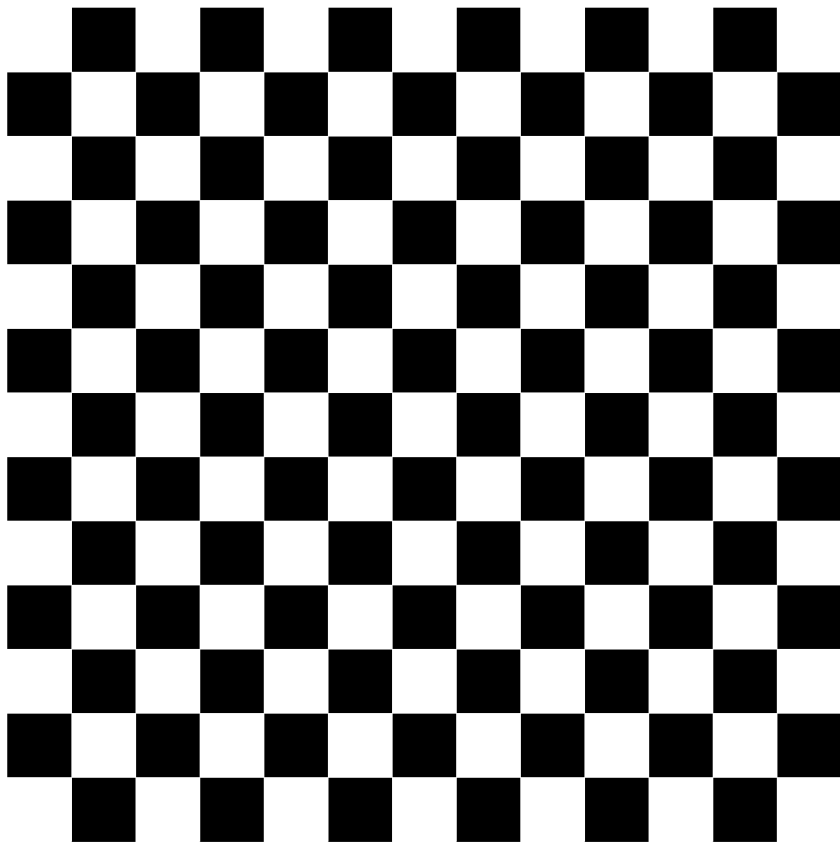
The three squares with letters in them are all exactly the same shade of grey. Image (minus B square to left of board) by Edward H. Adelson

Checkerboard Illusion 1



All parts except the three lettered squares have been removed from the preceding picture

Checkerboard Illusion 2



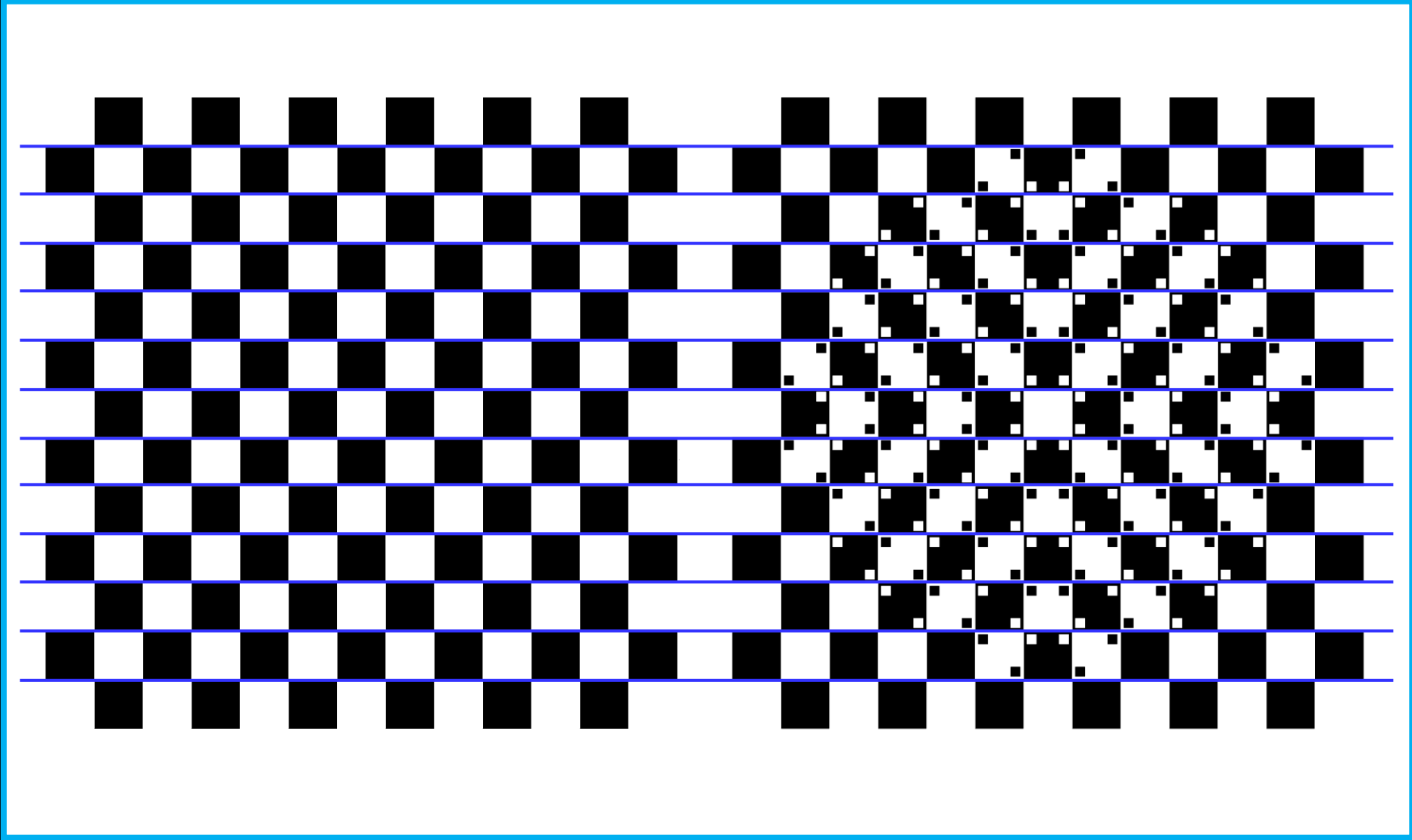
The only difference between the two pictures is the presence of tiny squares on the right. The larger square patterns are identical. Akiyoshi Kitaoka © 2000

Checkerboard Illusion 2



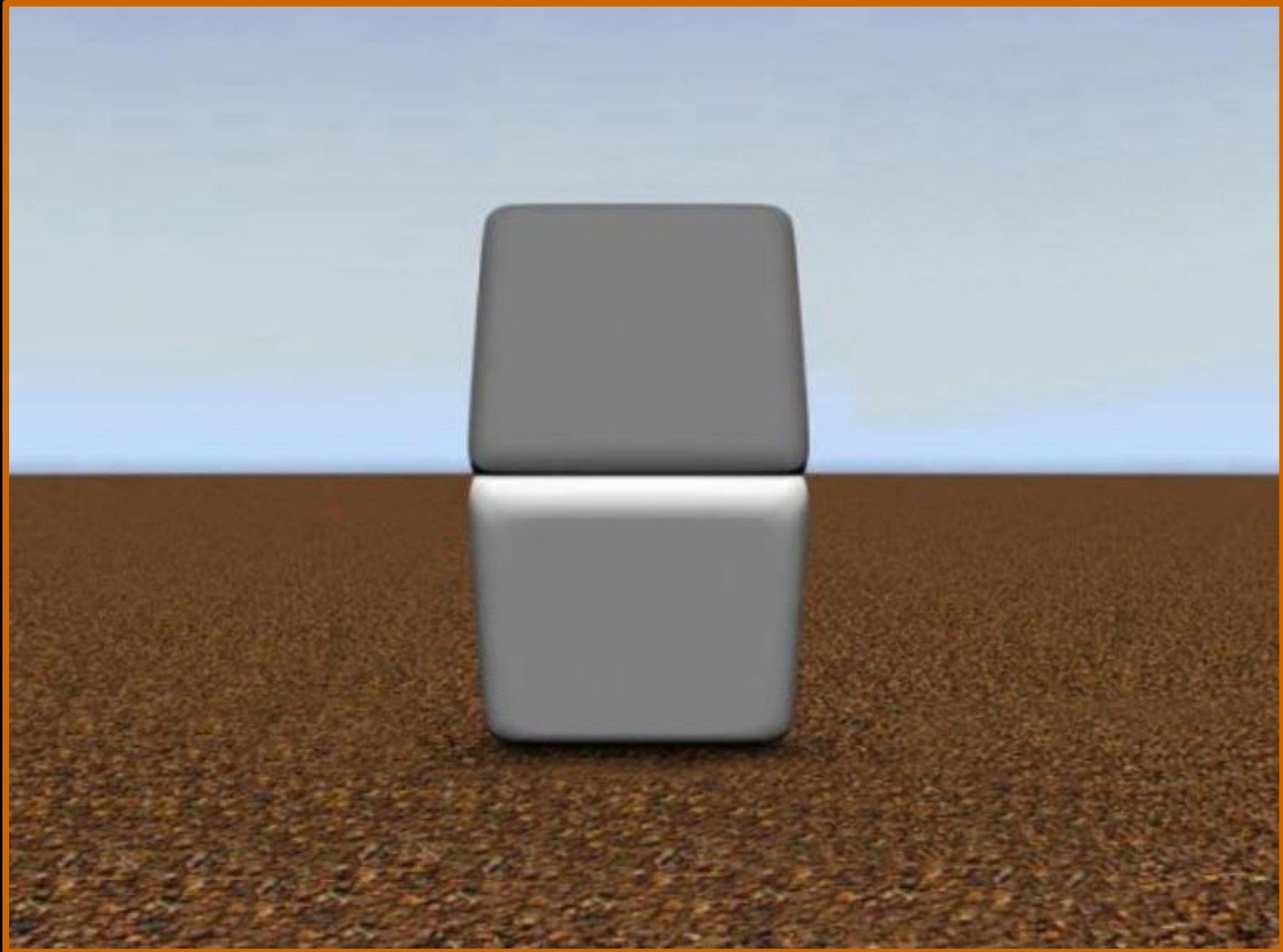
Series of straight, parallel, blue lines

Checkerboard Illusion 2



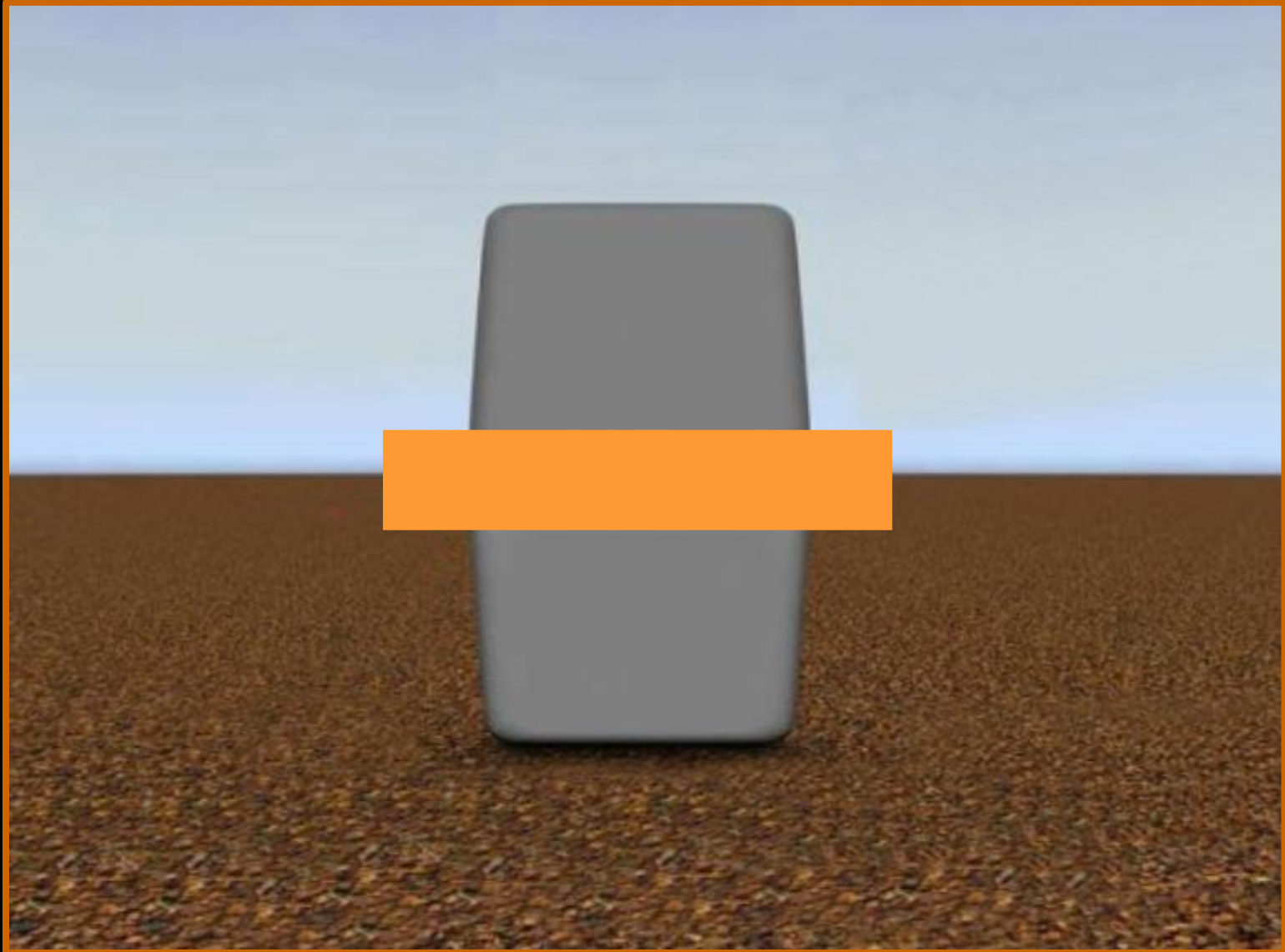
Copied onto the checkerboards, the blue lines now appear curved on the right side (my addition)

Suitcase Illusion



Except near where they join along the horizon, the upper and lower halves of suitcase are identical shades of grey. From BBC documentary "Is Seeing Believing?"

Suitcase Illusion



Contents

Introduction

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Ignorance

Insecurity

Intuition

Indoctrination

Empirical Truths

Scientific Consensus

Historical Knowledge

Benefits of Modern Medicine

Popularity of Liberal Democracy

Reliability of Modern Technology

Probable Misbeliefs

Resources

Pseudohistory

Pseudoscience

Paranormal

Belief Surveys

Wrap-up

Quotes

Indoctrination

- Consists of instilling ideas not to be questioned
- Religious instruction often involves indoctrination
- Political indoctrination can result from prolonged, one-sided exposure to views of trusted sources: family members, religious leaders, political leaders, talk show hosts, reports from politically aligned think tanks, etc
- Education that incorporates critical thinking helps minimize indoctrination, except to those who view critical thinking itself as liberal indoctrination*

*Such as the 2012 Republican Party of Texas

Texas Messes with Critical Thinking

The Knowledge-Based Education – We oppose the teaching of Higher Order Thinking Skills (HOTS) (values clarification), critical thinking skills and similar programs that are simply a relabeling of Outcome-Based Education (OBE) (mastery learning) which focus on behavior modification and have the purpose of challenging the student's fixed beliefs and undermining parental authority

– Republican Party of Texas 2012. Platform Part of Section on Education Indoctrination & Religious Beliefs

*Give me a child until he is seven
and I will give you the man*

– Attributed to Francis Xavier*
Jesuit Order cofounder

*Also to (i) Ignatius of Loyola and (ii) Aristotle

Fables should be taught as fables, myths as myths, and miracles as poetic fantasies. To teach superstitions as truths is a most terrible thing. The child mind accepts and believes them, and only through great pain and perhaps tragedy can he be in after years relieved of them

— Hypatia of Alexandria

Written roughly sixteen centuries ago. Hypatia was a philosopher, astronomer and mathematician who lived in Alexandria. Also a pagan, she was brutally murdered by a Christian mob

Indoctrination in School

Ideally, what should be said to every child, repeatedly, throughout his or her school life is something like this:

"You are in the process of being indoctrinated. We have not yet evolved a system of education that is not a system of indoctrination. We are sorry, but it is the best we can do. What you are being taught here is an amalgam of current prejudice and the choices of this particular culture. The slightest look at history will show how impermanent these must be. You are being taught by people who have been able to accommodate themselves to a regime of thought laid down by their predecessors. It is a self-perpetuating system. Those of you who are more robust and individual than others will be encouraged to leave and find ways of educating yourself – educating your own judgements. Those that stay must remember, always, and all the time, that they are being molded and patterned to fit into the narrow and particular needs of this particular society"

– Doris Lessing

Indoctrination & Religious Beliefs

The main conclusion to be drawn from the history and geography of religious beliefs is not metaphysical but psychological
Indoctrination works

For example, the single best predictor of a person's religion is the culture they were born into

Contents

Introduction

Misbelief Acquisition – 4 I's

Ignorance

Insecurity

Intuition

Indoctrination

Empirical Truths

Scientific Consensus

Historical Knowledge

Benefits of Modern Medicine

Popularity of Liberal Democracy

Reliability of Modern Technology

Probable Misbeliefs

Resources

Pseudohistory

Pseudoscience

Paranormal

Belief Surveys

Wrap-up

Quotes

Empirical Truths

Concepts / products that evidence has shown to be tentatively true / effective

Some examples follow, to set stage for subsequent examples of misbeliefs. Certain purely rational truths also exist, examples of which can be found in mathematics and logic

Contents

Introduction

Misbelief Acquisition – 4 I's

Ignorance

Insecurity

Intuition

Indoctrination

Empirical Truths

Scientific Consensus

Historical Knowledge

Benefits of Modern Medicine

Popularity of Liberal Democracy

Reliability of Modern Technology

Probable Misbeliefs

Resources

Pseudohistory

Pseudoscience

Paranormal

Belief Surveys

Wrap-up

Quotes

Scientific Consensus

- **Broadly accepted understanding (theory) of some phenomenon, tied to observations replicated / validated by peers**
- **Where a conflict exists between a scientific consensus and some other way of knowing, science is always the best bet***

*This is not to say that the current scientific consensus is always right or the final word. Scientific knowledge continues to evolve. That is one of its strengths

Some Areas of Natural Science

Touched On In Other Humanity Presentations

Big Picture Science

- Observable Universe
- Planet Earth
- Life on Earth

} Separate presentations

Basic Science

- Quantum Physics
- Special Relativity
- General Relativity
- Thermodynamics

} Single presentation

Contents

Introduction

Misbelief Acquisition – 4 I's

Ignorance

Insecurity

Intuition

Indoctrination

Empirical Truths

Scientific Consensus

Historical Knowledge

Benefits of Modern Medicine

Popularity of Liberal Democracy

Reliability of Modern Technology

Probable Misbeliefs

Resources

Pseudohistory

Pseudoscience

Paranormal

Belief Surveys

Wrap-up

Quotes

Historical Knowledge

- Despite postmodernist claims to the contrary, we do have some knowledge of human history
- Working with primary sources (writings and other artifacts from the period under study), historians and archaeologists construct glimpses of the past*
- Most of us get our history from secondary sources (school books, encyclopedias, documentaries . . .), which integrate primary source materials. If based on solid primary sources and not compromised by present ideologies,** secondary sources provide a valuable, if less than perfect, record of what actually happened

*Richard Evans, *In Defense of History* (1997) and Arthur Marwick, *The New Nature of History: Knowledge, Evidence, Language* (2001). **Such as those of certain members of the Texas School Board, at times

Contents

Introduction

Misbelief Acquisition – 4 I's

Ignorance

Insecurity

Intuition

Indoctrination

Empirical Truths

Scientific Consensus

Historical Knowledge

Benefits of Modern Medicine

That is, science-based, or at least evidence-based, medicine

Popularity of Liberal Democracy

Reliability of Modern Technology

Probable Misbeliefs

Resources

Pseudohistory

Pseudoscience

Paranormal

Belief Surveys

Wrap-up

Quotes

Modern Medicine

Saved many millions of lives and dramatically increased average life expectancy in the 20th century

As shown in century hopping exercise. Alternative medicine is another matter

Contents

Introduction

Misbelief Acquisition – 4 I's

Ignorance

Insecurity

Intuition

Indoctrination

Empirical Truths

Scientific Consensus

Historical Knowledge

Benefits of Modern Medicine

Popularity of Liberal Democracy

Reliability of Modern Technology

Probable Misbeliefs

Resources

Pseudohistory

Pseudoscience

Paranormal

Belief Surveys

Wrap-up

Quotes

Popularity of Liberal Democracy

Rose from rarity to predominant form of government worldwide in single century

Democracy is the worst form of government, except for all the others

– Winston Churchill

With knowledgeable voters might be the best system

On the Other Hand . . .

Democracy is a system where two idiots outvote one smart person

– RationalWiki

With ignorant / deluded voters government can become populated by corrupt / incompetent elected officials and appointees

Contents

Introduction

Misbelief Acquisition – 4 I's

Ignorance

Impatience

Intuition

Indoctrination

Empirical Truths

Scientific Consensus

Historical Knowledge

Benefits of Modern Medicine

Popularity of Liberal Democracy

Reliability of Modern Technology

Probable Misbeliefs

Resources

Pseudohistory

Pseudoscience

Paranormal

Belief Surveys

Wrap-up

Quotes

Reliability of Modern Technology

Technology today is ubiquitous and for the most part overwhelmingly reliable. Our lives routinely depend on that reliability

Contents

Introduction

Misbelief Acquisition – 4 I's

Ignorance

Insecurity

Intuition

Indoctrination

Empirical Truths

Scientific Consensus

Historical Knowledge

Benefits of Modern Medicine

Popularity of Liberal Democracy

Reliability of Modern Technology

Probable Misbeliefs

Resources

Pseudohistory

Pseudoscience

Paranormal

Belief Surveys

Wrap-up

Quotes

Probable Misbeliefs

**Claims that lack commensurate evidence
and/or contradict firmly established facts**

Contents

Introduction

Misbelief Acquisition – 4 I's

Ignorance

Insecurity

Intuition

Indoctrination

Empirical Truths

Scientific Consensus

Historical Knowledge

Benefits of Modern Medicine

Popularity of Liberal Democracy

Reliability of Modern Technology

Probable Misbeliefs

Resources

Pseudohistory

Pseudoscience

Paranormal

Belief Surveys

Wrap-up

Quotes

Some Online Misbelief Resources

Broad-Coverage References

- **Wikipedia** Topics include conspiracy theories, denialism, manufactured controversy, paranormal, pseudomedicine, pseudohistory, pseudoscience, superseded scientific theories
- **RationalWiki** Topics include conspiracy theories, denialism, manufactroversy, parapsychology, pseudopsychology, pseudoscience
- **Skeptic's Dictionary** Topics include alternative medicine, conspiracies, cryptozoology, ETs, frauds, hoaxes, junk science, new age, paranormal, supernatural, UFOs. 400+ examples of probable misbeliefs

Fact-Checking

- Fact Check
- Flack Check
- Hoax Slayer
- Media Matters
- Open Secrets
- PolitiFact
- Poynter Institute
- ProPublica
- PunditFact
- Snopes
- Sunlight Foundation
- Truth or Fiction

Fact-checking services are particularly useful for distinguishing legitimate news from fake news

Next three slides provide a sampling of books on misbeliefs and faulty thinking

Various Misbeliefs

- **Fantasyland : How America Went Haywire, a 500-Year History (2017)** Kurt Andersen
- **Reality Check : How Science Deniers Threaten Our Future (2013)** Donald R. Prothero
- **50 Popular Beliefs that People Think Are True (2012)** Guy P. Harrison
- **Denying Science : Conspiracy Theories, Media Distortions, and the War Against Reality (2011)** John Grant
- **Merchants of Doubt : How a Handful of Scientists Obscured the Truth on Issues from Tobacco Smoke to Global Warming (2010)** Naomi Oreskes and Erik M. Conway
- **Bad Science : Quacks, Hacks, & Big Pharma Flacks (2010)** Ben Goldacre
- **Voodoo Histories : The Role of the Conspiracy Theory in Shaping Modern History (2009)** David Aaronovitch
- **Pseudoscience and the Paranormal 2nd ed (2003)** Terence Hines

Corrupted Science : Fraud, Ideology, and Politics in Science, a companion to *Denying Science*, was updated by John Grant in 2018

Faulty Thinking

- **The Skeptics' Guide to the Universe : How to Know What's Really Real in a World Increasingly Full of Fake (2018)** Steven Novella
- **Think : Why You Should Question Everything (2013)** Guy P. Harrison
- **The Believing Brain : From Ghosts and Gods to Politics and Conspiracies – How We Construct Beliefs and Reinforce Them as Truths (2011)** Michael Shermer
- **Thinking, Fast and Slow (2011)** Daniel Kahneman
- **Why We Make Mistakes : How We Look Without Seeing, Forget Things in Seconds, and Are All Pretty Sure We Are Way Above Average (2009)** Joseph T. Hallinan
- **Don't Believe Everything You Think : The 6 Basic Mistakes We Make in Thinking (2006)** Thomas Kida

Religion

- **Faith Versus Fact : Why Science & Religion Are Incompatible (2015)** Jerry A. Coyne
- **God and the Folly of Faith : The Incompatibility of Science & Religion (2012)** Victor Stenger
- **The Christian Delusion : Why Faith Fails (2010)** John W. Loftus (editor)
- **50 Reasons People Give for Believing in a God (2008)** Guy P. Harrison
- **What's God Got to Do with It? : Robert Ingersoll on Free Thought, Honest Talk and the Separation of Church and State** 2005 compilation of material from late 1800s. Edited by Tim Page

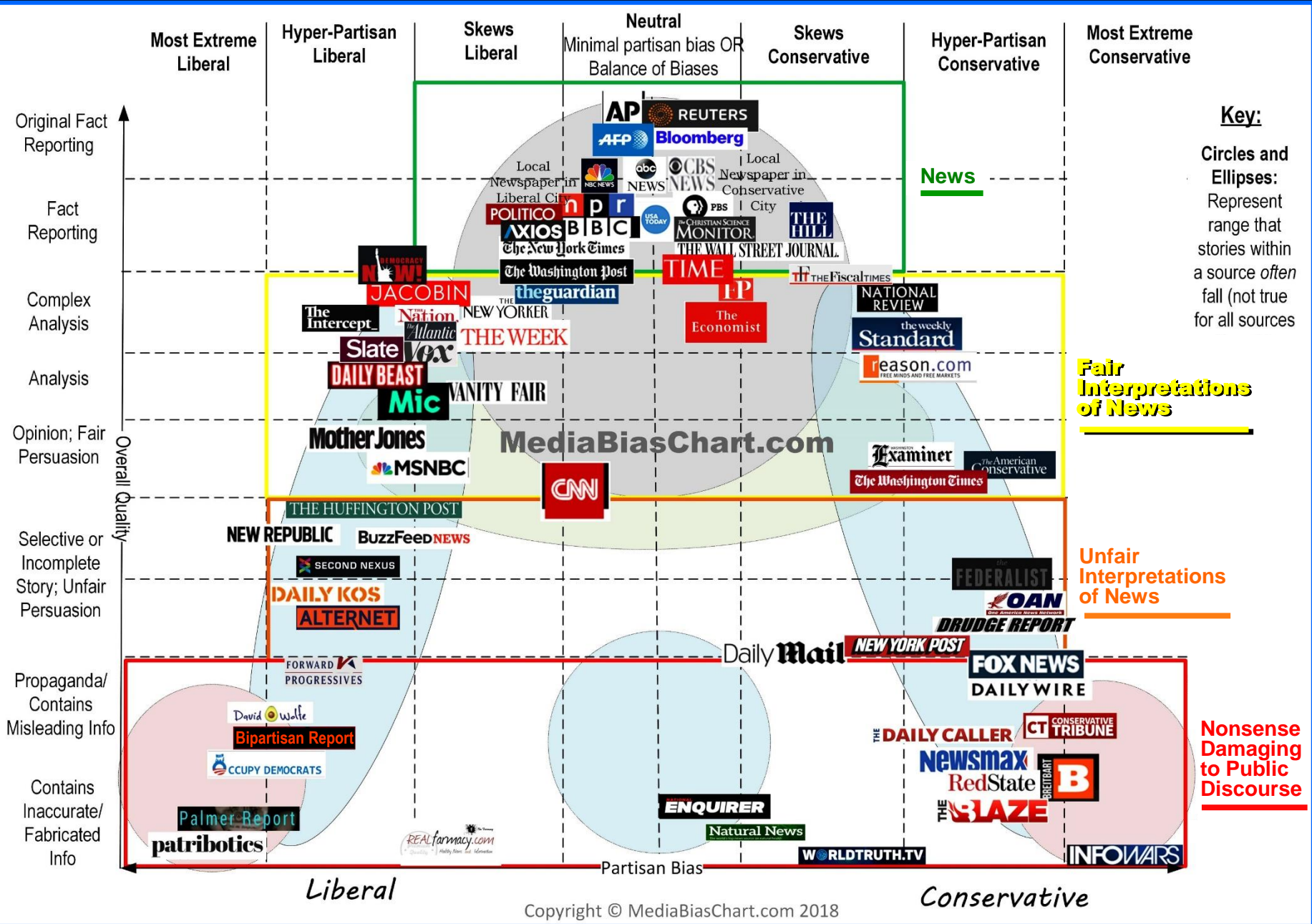
Best-selling critiques of religion include *God Is Not Great : How Religion Poisons Everything* (2007) by Christopher Hitchens, *The God Delusion* (2006) by Richard Dawkins, *Letter to a Christian Nation* (2006) and *The End of Faith : Religion, Terror, and the Future of Reason* (2005), both by Sam Harris

Reliable News Sources

Top two tiers of Vanessa Otero
Media Bias Chart

"News" and "Fair Interpretations of News"

Media Bias Chart



Key:
Circles and Ellipses: Represent range that stories within a source often fall (not true for all sources)

Fair Interpretations of News

Unfair Interpretations of News

Nonsense Damaging to Public Discourse

Media Bias Chart

Top Two Tiers

← Increasing Liberalism

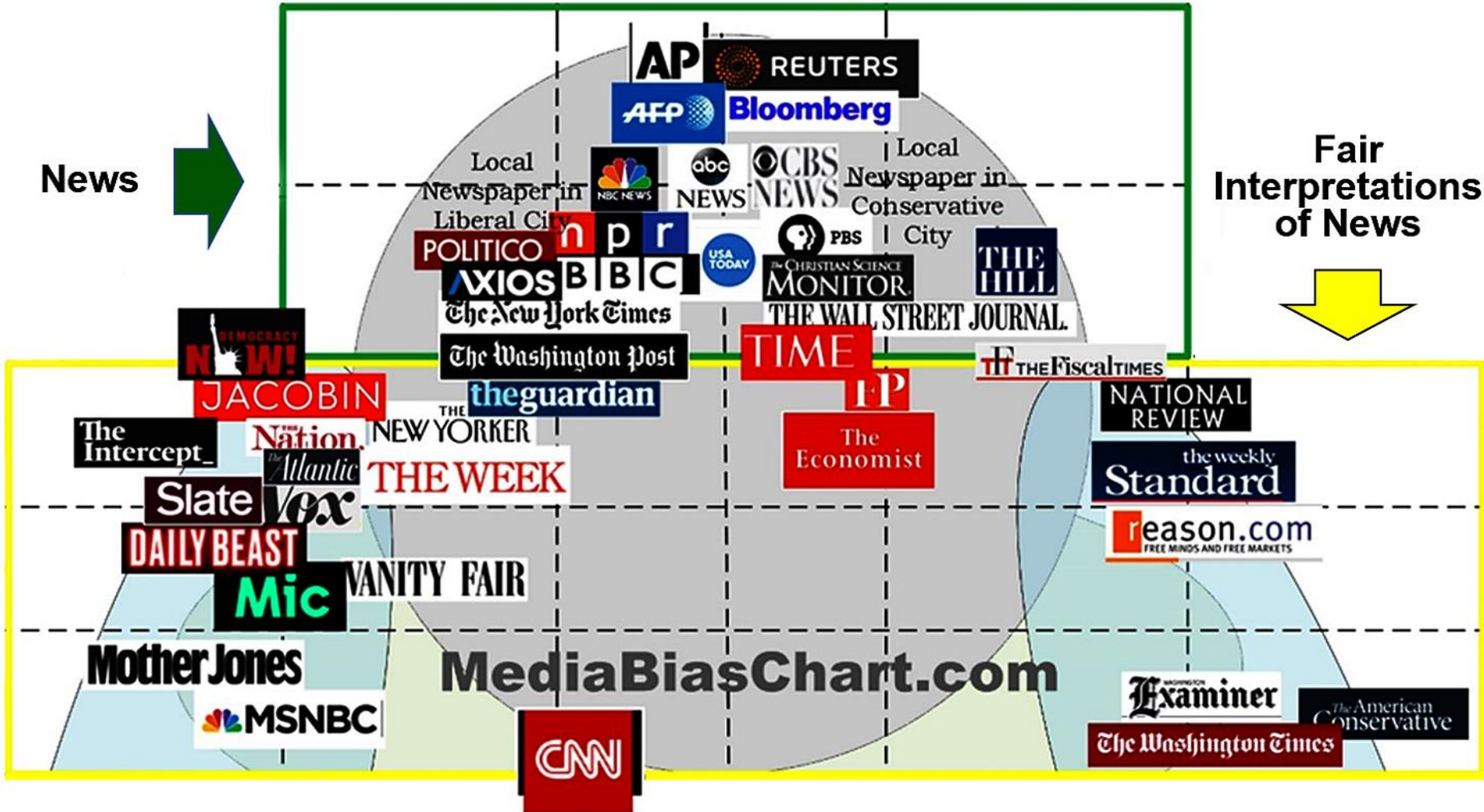
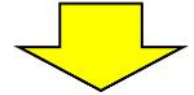
Neutral

Increasing Conservatism →

News

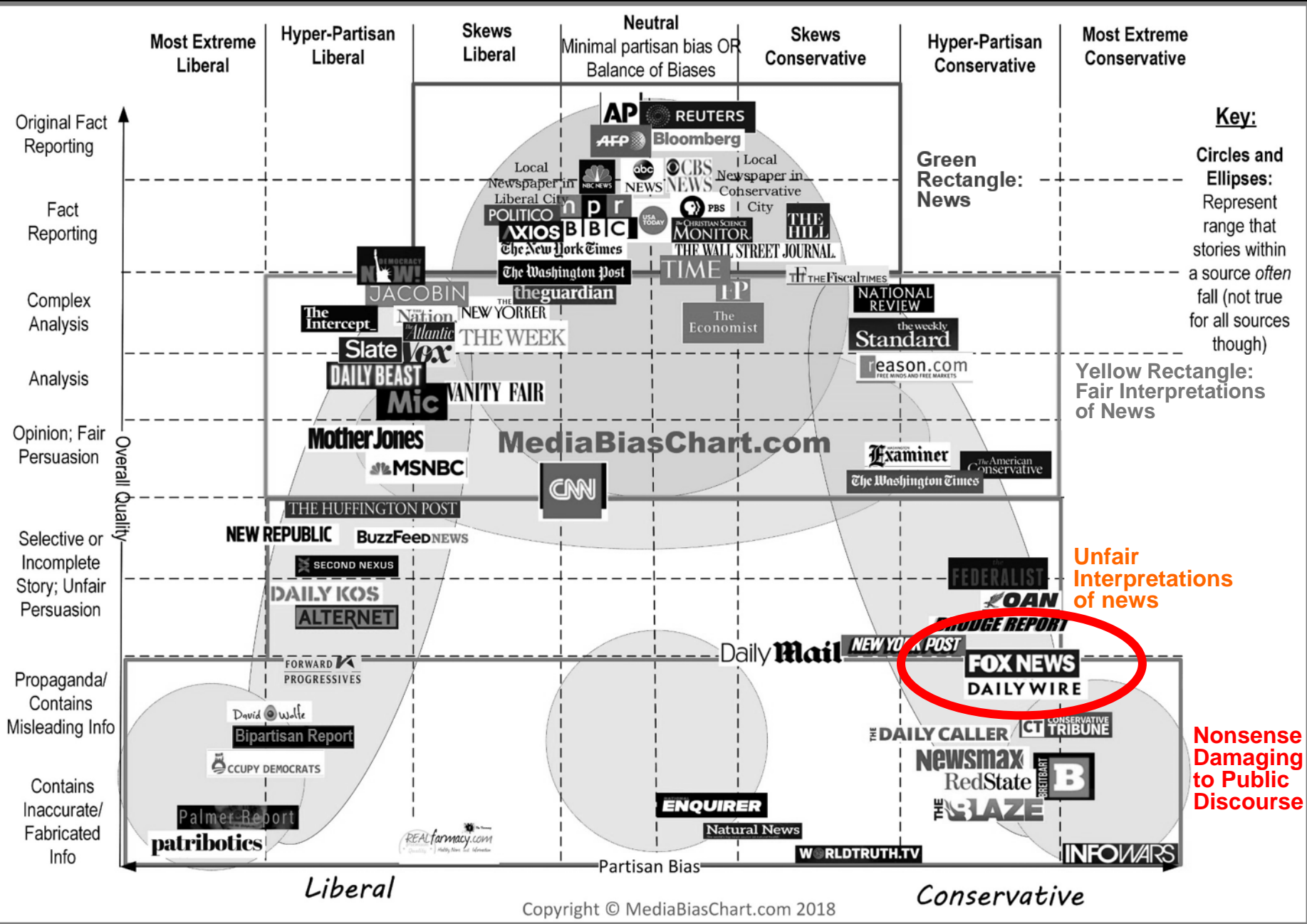


Fair Interpretations of News



Note inclusion of local city newspapers. Note also absence of Fox News

Media Bias Chart



False Pundit Claims

Three Big Cable News Organizations

News Organization	Inaccurate Claims (%)
CNN	21
MSNBC & NBC	44
Fox & Fox News	61

From PunditFact (September 2015). Fox accuracy might be even worse since election of Trump

Fake News Sites

70 News	Firebrand Left	News Examiner
ABCnews.com.co	Global Associated News	News Hound
American News	GlobalResearch.ca	The News Nerd
Before It's News	Gossip Mill Mzansi	NewsWatch33
bizstandardnews.com	Gummy Post	The New York Evening
Bloomberg.ma	Huzlers	Now 8 News
The Boston Tribune	InfoWars (Alex Jones)	Prntly
Celebtricity	KMT 11 News	React 365
cnn-trending.com	The Last Line of Defense	Red Flag News
Conservative 101	Liberal Society	The Reporterz
Conservative Frontline	Liberty Writers News	Stupid
CountyNewsroom.info	LinkBeef	TrueTrumpers.com
Daily Buzz Live	Media Mass	UndergroundNewsReport.com
DC Gazette	Naha Daily	United Media Publishing
Denver Guardian	NationalReport.net	usatoday.com.co
Disclose TV	Natural News	washingtonpost.com.co
DrudgeReport.com.co	NBCNews.com.co	World Truth TV
Empire Herald	Neonnettle.com	World News Daily Report
Empire News	News Breaks Here	YourNewsWire.com
Empire Sports	The News Buzz Daily	Trending Viral

From Wikipedia "List of Fake News Websites" article. Names often resemble those of legitimate news sites

On Fake News Sites

2016 NPR interview with Jestin Coler,
operator of several fake news sites*

According to Coler, sites pandering to right wing conspiracy thinking do far better than those aimed at the left. Liberals appear to fact-check and avoid taking the bait **

*Including Conservative Front Line, Denver Guardian, DrudgeReport.com.co, Firebrand Left, xxNationalReport.net, United Media Publishing and washingtonpost.com.co

**This assertion comes from a person whose business consists of telling lies, but it agrees with xx polls and psychological studies regarding beliefs in conspiracy theories

Think Tanks

- Provide views on various subjects
- Content often ideologically biased

There are roughly 400 think tanks in the Washington DC area and over 7000 worldwide

"Global Go-To"

US Think Tanks – Examples

Non-Partisan

RAND Corporation
Council on Foreign Relations
National Bureau for Economic Research
Peterson Institute for International Economics
World Resources Institute
Carnegie Council for Ethics in International Affairs

Unbiased

Centrist

Brookings Institution
Carnegie Endowment for International Peace
Center for Strategic and International Studies
Woodrow Wilson International Center for Scholars
Pew Research Center
Center for a New American Security

Liberal Leaning

Center for American Progress
Center on Budget and Policy Priorities
Human Rights Watch
Open Society Foundations
Inter-American Dialogue

Biased

Conservative Leaning

Heritage Foundation
American Enterprise Institution
The Hoover Institution
Freedom House
Hudson Institute
Foreign Policy Institute

Source: LibGuides, Bethel College. There are many more biased think tanks (mostly conservative)

Unethical Use of Biased Think Tanks and Other Propaganda Machines

- Promotion of political / religious / business agendas through falsehoods, one-sided accounts of issues, ad hominem attacks, etc
- Major examples are tobacco risk denialism (dominant effort in past) and global warming denialism (present)

Number of former tobacco risk deniers now earn a living at anthropogenic global warming denial. See, for example, *Merchants of Doubt* by Oreskes and Conway

Global Warming

- **Key issue of our time**
- **The science is fairly clear that such warming is real, due to human activity (anthropogenic) and a threat to much life on Earth***
- **But certain organizations, for philosophical, religious and/or economic reasons, persist in denying that global warming is occurring, that it is harmful and/or that is caused by human activity**

*Anthropogenic damage to the biosphere covered in Life on Earth presentation

Climate change denial covered under Pseudoscience

Contents

Introduction

Misbelief Acquisition – 4 I's

Ignorance

Insecurity

Intuition

Indoctrination

Empirical Truths

Scientific Consensus

Historical Knowledge

Benefits of Modern Medicine

Popularity of Liberal Democracy

Reliability of Modern Technology

Probable Misbeliefs

Resources

Pseudohistory

Pseudoscience

Paranormal

Belief Surveys

Broad misbelief
categories used here

Wrap-up

Quotes

Contents

Introduction

Misbelief Acquisition – 4 I's

Ignorance

Insecurity

Intuition

Indoctrination

Empirical Truths

Scientific Consensus

Historical Knowledge

Benefits of Modern Medicine

Popularity of Liberal Democracy

Reliability of Modern Technology

Most examples on next slide might be considered "current events" rather than "history" by many historians

Probable Misbeliefs

Resources

Pseudohistory

Pseudoscience

Paranormal

Belief Surveys

Wrap-up

Quotes

Pseudohistory Examples

More recent



Older

- Parkland, Florida shootings as hoax*
- Sandy Hook shootings as hoax*
- Barack Obama as non-US citizen**
- 9/11 as inside job*
- Apollo Moon landings as faked**
- Oswald as part conspiracy to kill JFK*
- Alien artifacts stored at Area 51*
- Holocaust as fabrication**
- FDR awareness / inaction regarding imminent Pearl Harbor attack*
- Protocols of Learned Elders of Zion*
- Civil war as all about states rights***

Pseudohistory Examples

- Parkland, Florida shootings as hoax
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- Alien artifacts stored at Area 51
- Holocaust as fabrication
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Death threats
to survivors &
victim relatives

More
recent



Older

Pseudohistory Examples

More recent



Older

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- Civil war as all about states rights

JFK Assassination Conspiracy

Recommended References

- "JFK conspiracy theories at 50: How the Skeptics Got It Wrong and Why It Matters" David Reitzes, *Skeptic Magazine* (Issue 18.3, 2013)
- NOVA "Cold Case JFK" episode featuring forensic analysis that supports single-shooter two-bullet theory (2013)

See also coverage of JFK assassination in *Voodoo Histories* by Aaronovitch (2009)

Pseudohistory Examples

Newer



Older

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Visit to Gotha

I saw my first horror camp (on 12 April 1945). It was near the town of Gotha. I have never been able to describe my emotional reactions when I first came face to face with indisputable evidence of Nazi brutality and ruthless disregard of every shred of decency. Up to that time I had known about it only generally or through secondary sources. I am certain however, that I have never at any time experienced an equal sense of shock

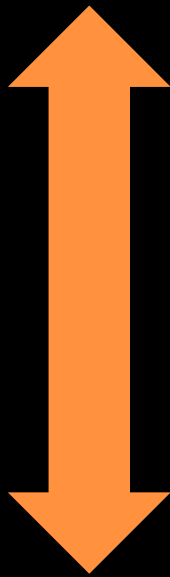
I visited every nook and cranny of the camp because I felt it my duty to be in a position from then on to testify at first hand about these things in case there ever grew up at home the belief or assumption that "the stories of Nazi brutality were just propaganda"

..... as soon as I returned to Patton's headquarters that evening I sent communications to both Washington and London, urging the two governments to send instantly to Germany a random group of newspaper editors and representative groups from the national legislatures. I felt that the evidence should be immediately placed before the American and the British publics in a fashion that would leave no room for cynical doubt

— Dwight D. Eisenhower

Pseudohistory Examples

Newer



Older

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Civil War as All About States Rights

- **Not according to the declarations of causes of the succeeding states**
- **Right to own slaves of paramount importance**

Contents

Introduction

Misbelief Acquisition – 4 I's

Ignorance

Insecurity

Intuition

Indoctrination

Empirical Truths

Scientific Consensus

Historical Knowledge

Benefits of Modern Medicine

Popularity of Liberal Democracy

Reliability of Modern Technology

Probable Misbeliefs

Resources

Pseudohistory

Pseudoscience

Paranormal

Belief Surveys

Wrap-up

Quotes

Pseudoscience Categories

- Earth & Space
- Archaeological
- Biological
- Medical
- Psychological

Pseudoscience Categories

- Earth & Space
- Archaeological
- Biological
- Medical
- Psychological

Earth & Space Pseudoscience Examples

- Global warming denialism
- Lunar effect
- Biblical account of creation
- Astrology

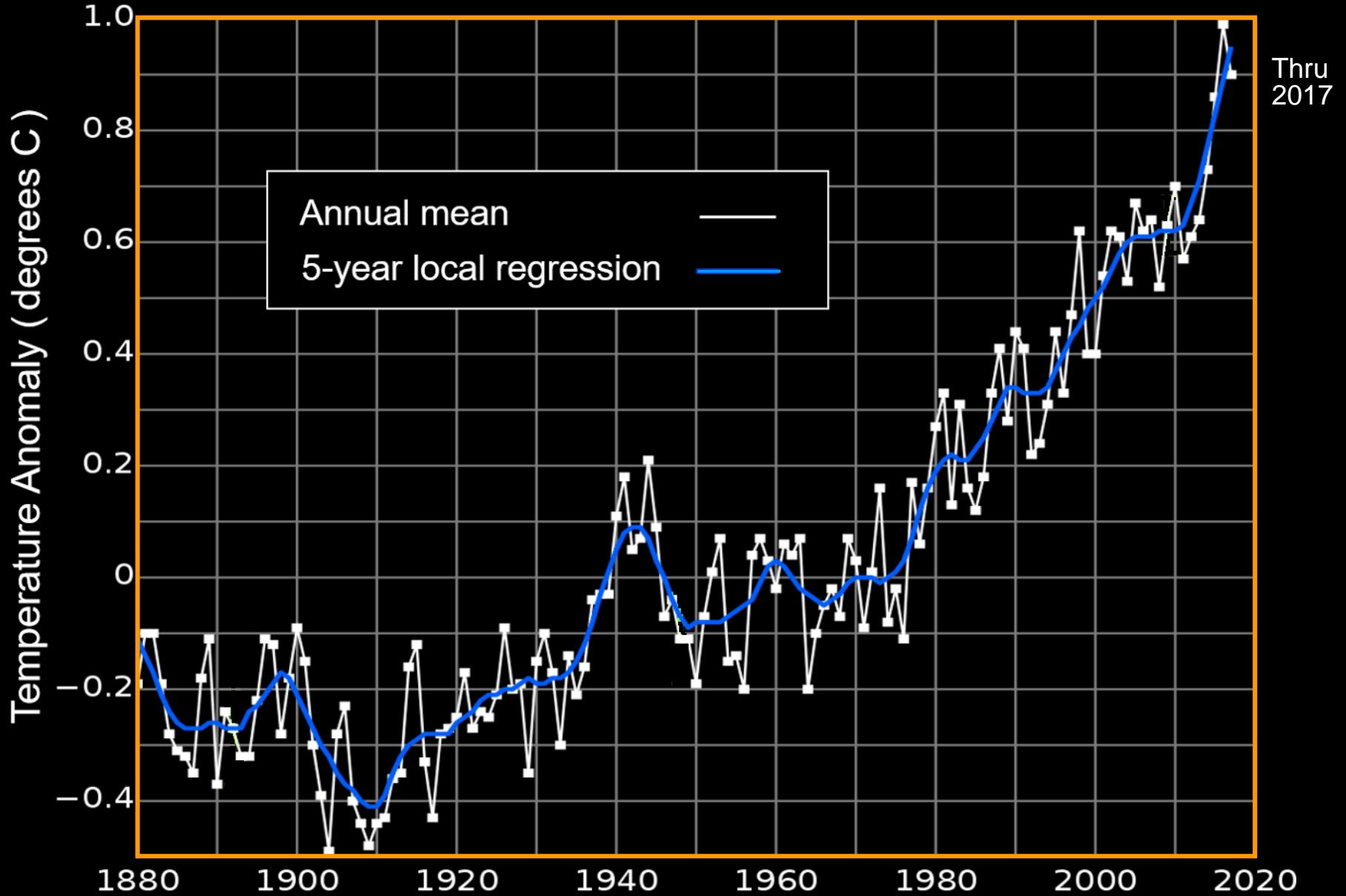
Anthropogenic Global Warming

- Global-average temperature fluctuates from year to year. El Niños raise it. La Niñas and volcanoes lower it
- 5-year local regression temperature has risen dramatically since 1960s. Some other factor must be responsible
- Major culprit is increasing CO₂ presence in atmosphere due, in large part, to burning of fossil fuels
- Other changes include rising sea level, melting polar ice, thawing permafrost, more extreme weather events and damage to the biosphere

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Global Mean Atmospheric Temperature Rise

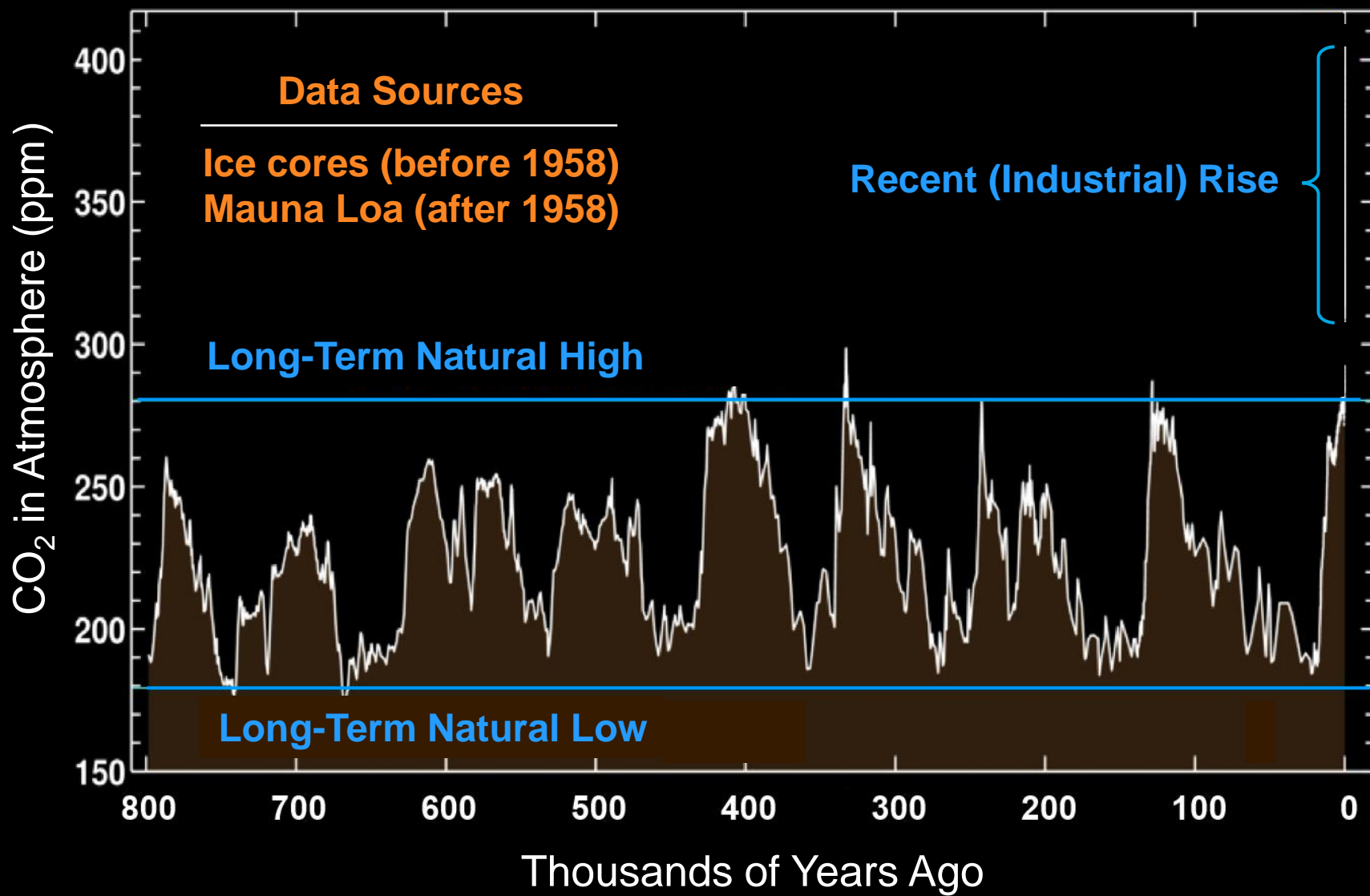


From Wikipedia "Global Warming" article via Berkeley Earth. Blue curve has barely dipped since 1960s

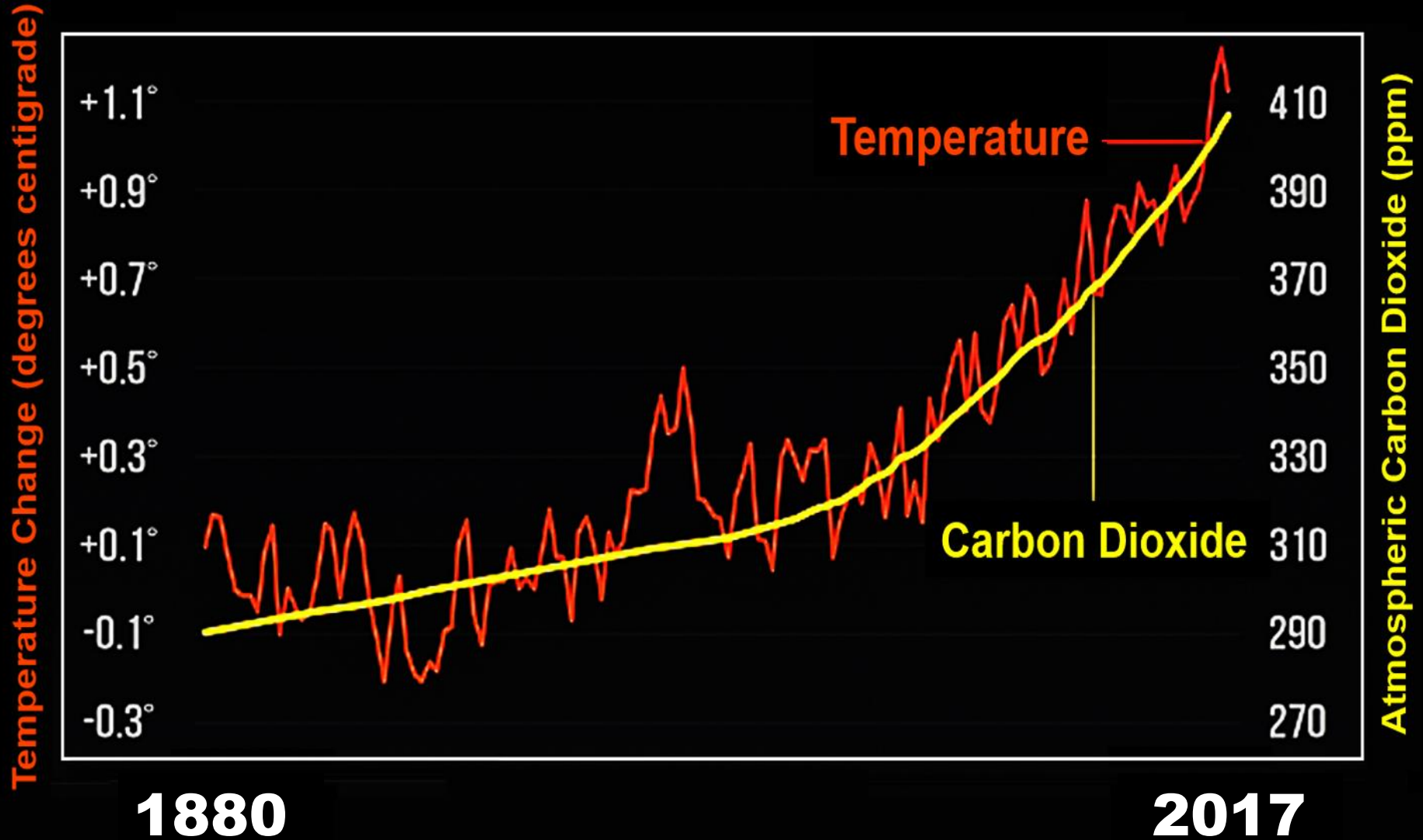
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Long-Term Atmospheric CO₂ Concentration



Anthropogenic Global Warming and Atmospheric CO₂ Content



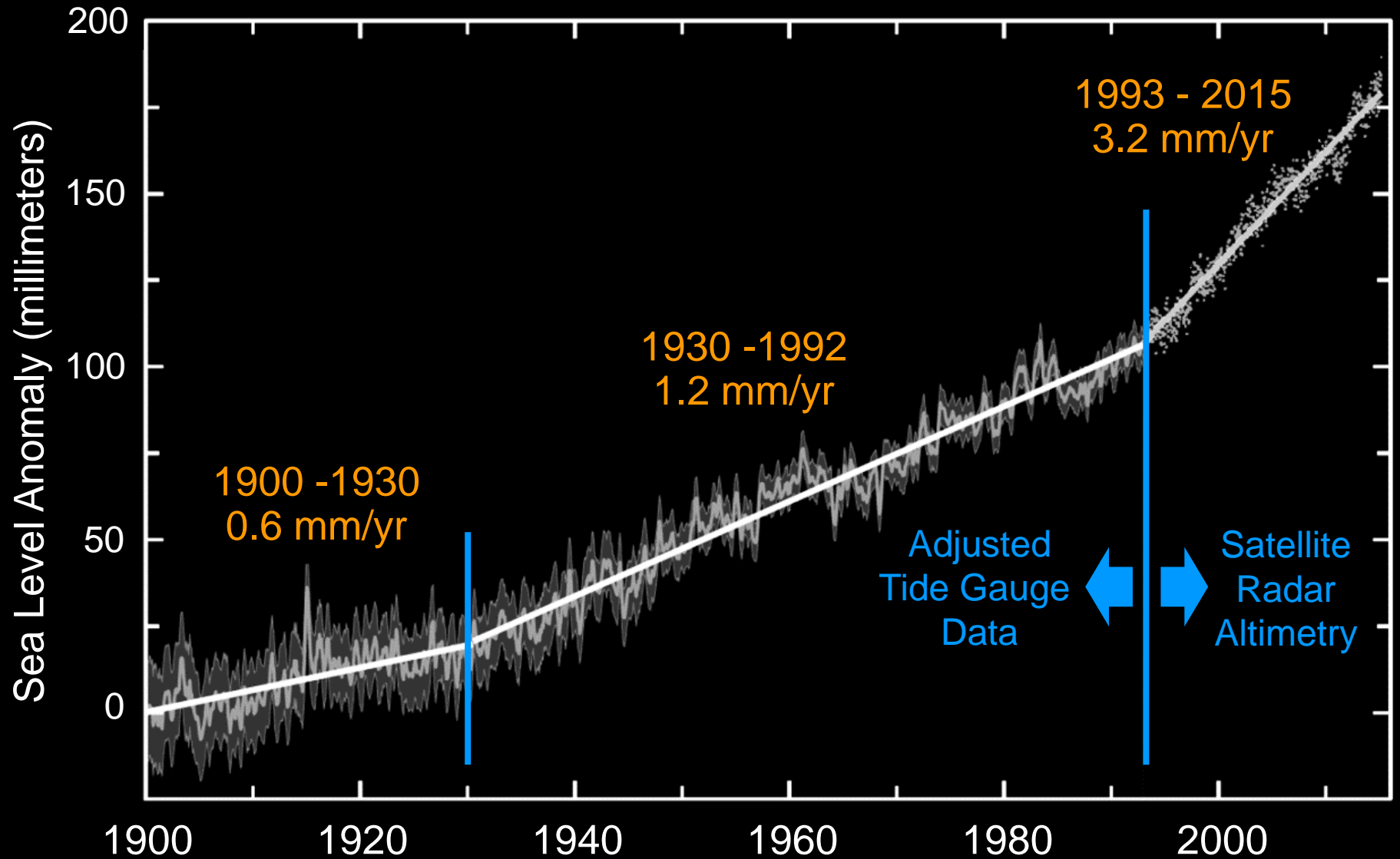
Graph from Climate Central. Data from NASA GISS, NOAA NCEL, ESRL

Anthropogenic Global Warming

- **Global-average temperature fluctuates from year to year. El Niños raise it. La Niñas and volcanoes lower it**
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Thawing permafrost, caused by global warming, is releasing methane, a greenhouse gas much more potent than CO₂, into the atmosphere

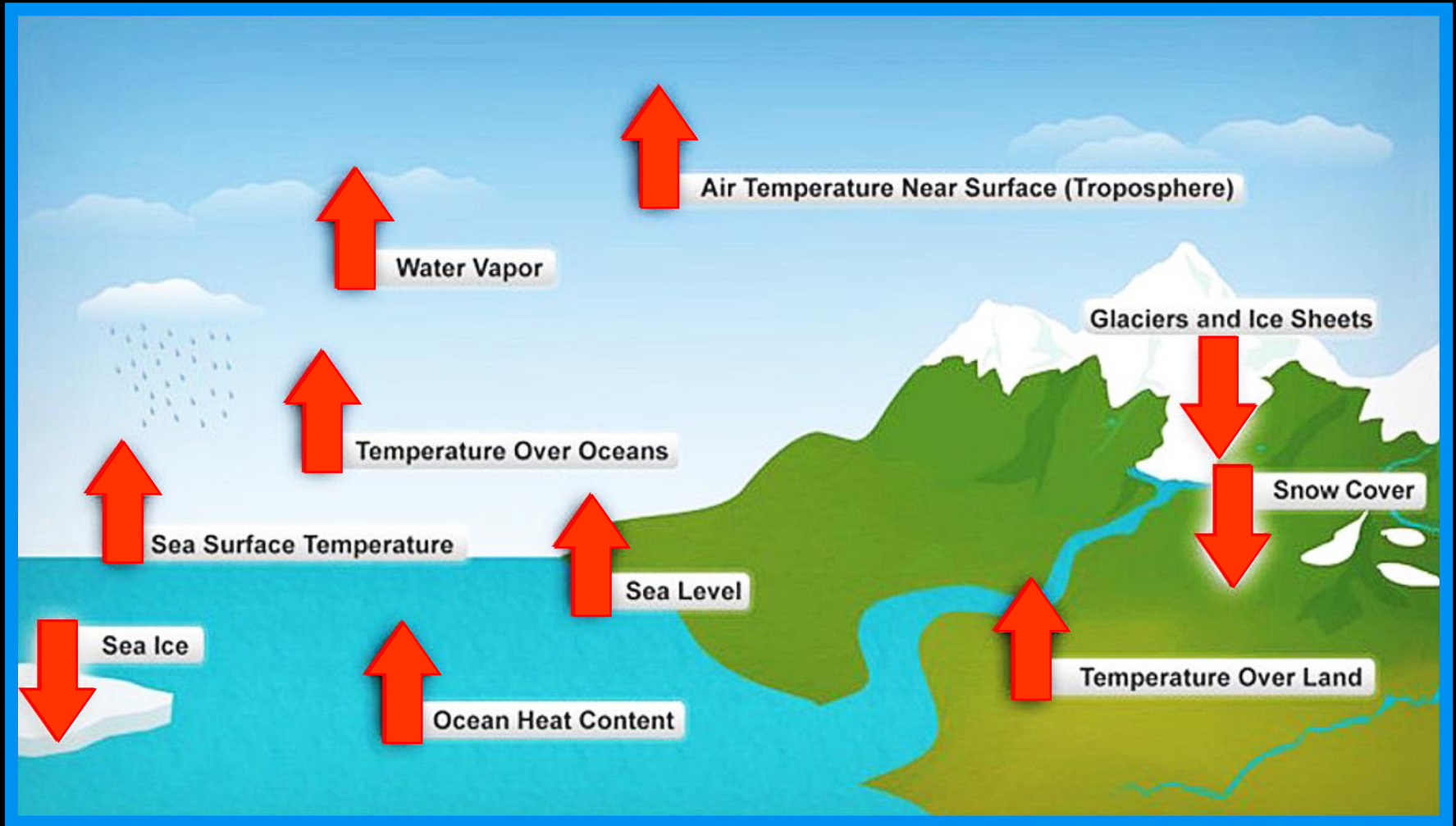
Global Mean Sea Level Rise



From Hawaii.gov. Rising ocean level is caused by (i) increases in ocean mass from melting glaciers / ice sheets and (ii) thermal expansion associated with increasing ocean temperatures

Ten Indicators of a Warming World

All Observed



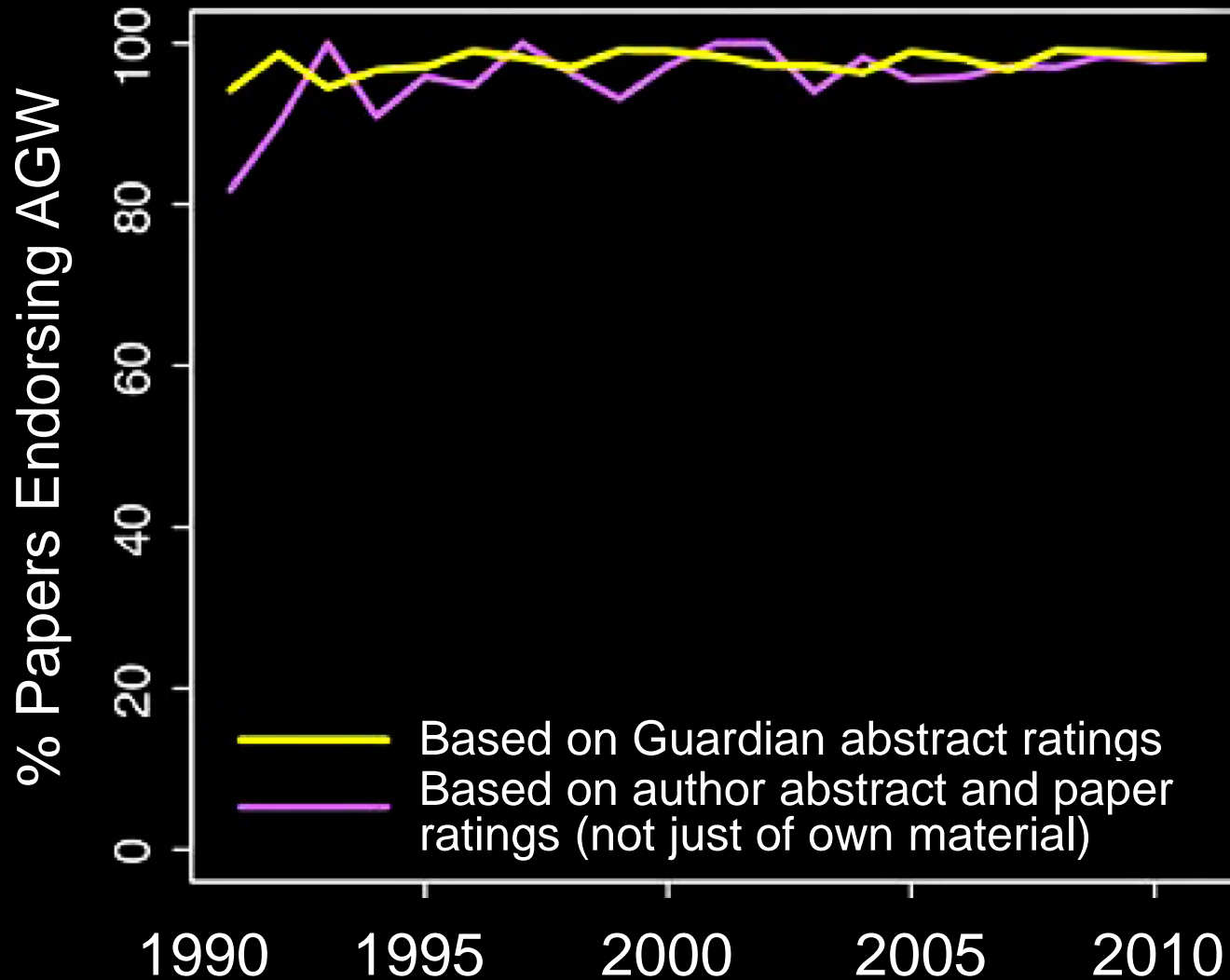
Global Warming Acceptance and Denialism

- **Existence or nonexistence of global warming is an empirical question, properly addressed by science**
- **Worldwide consensus of climate scientists (97%) is that recent warming is real and due to human activity. The pace also appears to be accelerating**
- **Loud contrary opinions driven primarily by political, business and / or religious concerns, as opposed to objective assessment of facts**

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97% Scientific Consensus on AGW



Guardian (2013). 12,000 abstracts examined. Physical evidence of anthropogenic global warming even stronger today. First abstract analysis (Oreskes) done in 2004

No national science academy anywhere in the world disputes
the anthropogenic nature of recent climate change

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Major contributors to global warming denial are Climate Change Counter Movement (CCCM) Organizations, a significant number of which are right-wing think tanks

Climate Change Counter Movement Organizations

60 Plus Association	American Legislative Exchange Council
Alliance for Climate Strategies	American Natural Gas Alliance Inc
American Coal Foundation	American Petroleum Institute
American Coalition for Clean Coal Electricity (ACCCE)	American Policy Center
American Conservative Union Foundation	Americans for Balanced Energy Choices
American Council for Capital Formation	Americans for Prosperity
American Energy Alliance	Annapolis Center for Science-Based Public Policy
American Energy Freedom Center	Association of Global Automakers
American Enterprise Institute	Atlas Economic Research Foundation
American Farm Bureau Federation	Capital Research Center
American Friends of the Institute Of Economic Affairs	Cascade Policy Institute
American Gas Association	Center for the Defense of Free Enterprise

From LittleSis. Gold indicates think tank

Climate Change Counter Movement Organizations

Center for the Study of Carbon Dioxide and Global Change	Congress of Racial Equality
Citizen's Coalition on Global Climate Policy	Consumer Energy Alliance
Citizens for Affordable Energy	Cooler Heads Coalition
Climate Audit	Edison Electric Institute
Climate Science Coalition of America	Energy and Environment Legal Institute
Climate Strategies Watch	Energy Citizens
CO₂ Is Green	Energy Makes America Great
Coalition for American Jobs	Federation for American Coal Energy and Security
Coalition for Vehicle Choice	Free Enterprise Action Institute
Coalition to Preserve American Security and Sovereignty	Freedom Action
Collegians for a Constructive Tomorrow	FreedomWorks Foundation, Inc.
Competitive Enterprise Institute	Friends of Coal

From LittleSis. Gold indicates think tank

Climate Change Counter Movement Organizations

Frontiers of Freedom Institute	Independent Petroleum Association of America
George C. Marshall Institute	Independent Women's Forum
Global Climate Coalition	Industrial Energy Consumers Of America
Global Climate Information Project	Information Council on the Environment
Global Warming Initiative	Institute for Biospheric Research
Greening Earth Society	Institute for Energy Research
Heartland Institute	Institute for Liberty
Heritage Foundation	Institute For The Study of Earth And Man
Hoover Institution	Intermountain Rural Electric Association
Hudson Institute	International Climate Science Coalition
Ice Age Now	International Policy Network
Independence Institute	James Madison Institute

From LittleSis. Gold indicates think tank

Climate Change Counter Movement Organizations

John Locke Foundation	National Mining Association
Landmark Legal Foundation	National Petrochemical & Refiners Association
Manhattan Institute	National Petroleum Council
Manhattan Libertarian Party	National Rural Electric Cooperative Association
Media Research Center	National Taxpayers Union
Mercatus Center	National Taxpayers Union Foundation
Mountain States Legal Foundation	Oklahoma Council of Public Affairs Inc
National Association of Manufacturers	Oregon Institute of Science and Medicine
National Center for Policy Analysis	Pacific Research Institute
International Policy Network	National Center for Public Policy Research
National Center for Public Policy Research	Reason Public Policy Institute of Reason Foundation
National Consumer Coalition	Plants Need CO ₂

From LittleSis. Gold indicates think tank

Climate Change Counter Movement Organizations

Responsible Resources	Western Fuels Association
Science and Environment Policy Project	World Climate Report
Science and Public Policy Institute	World Coal Institute
Southeastern Legal Foundation	American Civil Rights Union
Sovereignty International	Cato Institute
State Policy Network	Doctors for Disaster Preparedness
Texas Public Policy Foundation	Family Research Council
The Advancement of Sound Science Center	Foundation for Economic Education
The Independent Institute	Friends of Science
Thomas Jefferson Institute for Public Policy	George Mason University
U.S. Chamber of Commerce	Institute of Public Affairs
Washington Policy Center	Investor's Business Daily
	Ludwig von Mises Institute

From LittleSis except last 10 (from RationalWiki). Gold indicates think tank

More than 90% of papers skeptical of climate change come
from right-wing think tanks

Some other noteworthy promoters of climate change
misinformation follow

Some Funders and Other Promoters of Climate Change Denial

- Koch Industries
- Major Oil Companies
- Donors Trust / Donors Capital
- News Corporation

Koch Industries has been a funder of climate change denial for decades

Some Funders and Other Promoters of Climate Change Denial

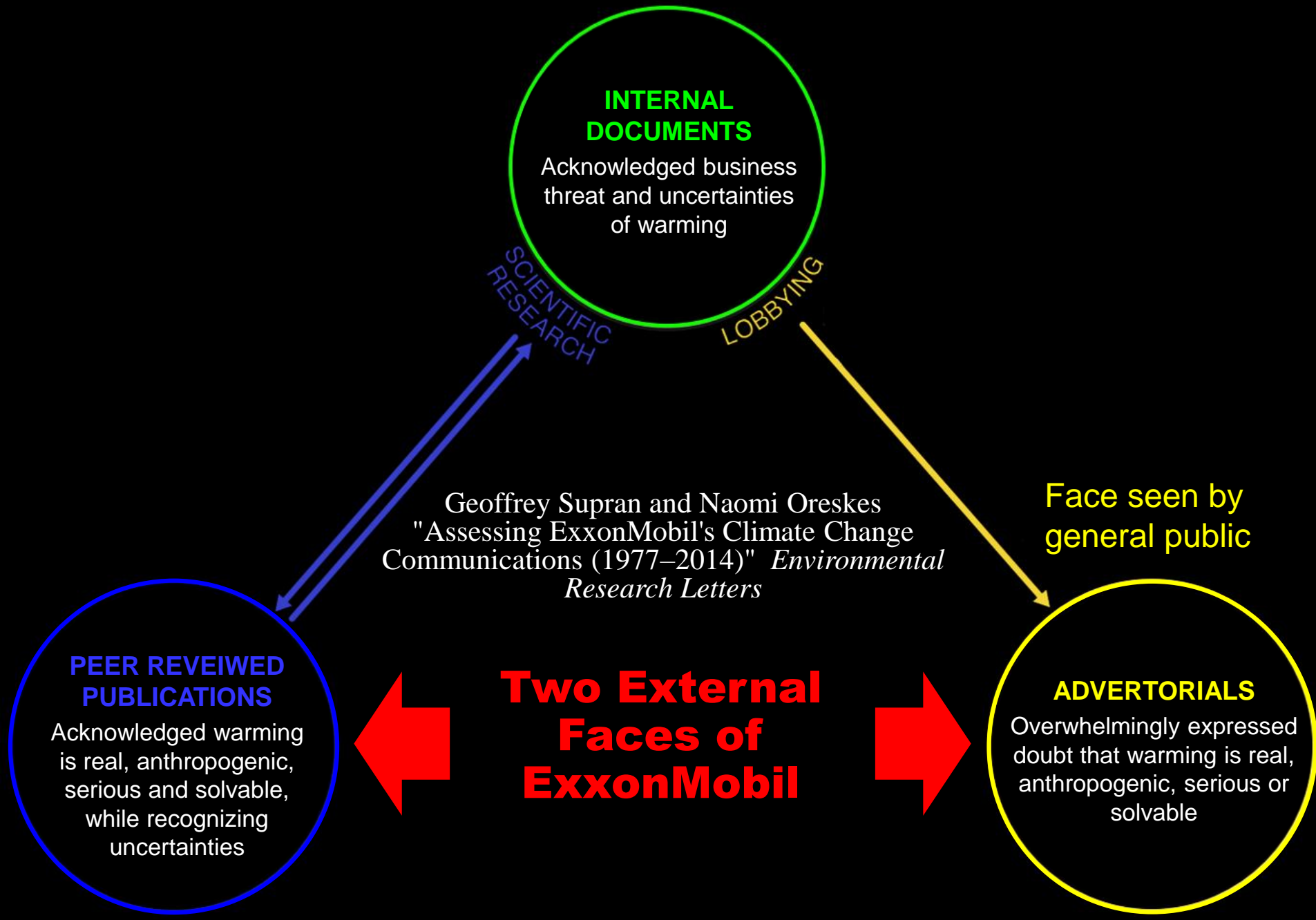
- Koch Industries
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In dealing with AGW risks, oil companies followed the tobacco companies' playbook in dealing with smoking risks (i.e., cast doubt). They also used the same PR firm and some of the same think tanks and researchers

Regarding ExxonMobil

- ExxonMobil became aware of anthropogenic global warming through its own research in the late 1970s*
- In external communications on global warming ExxonMobil has presented two contradictory faces

ExxonMobil & Anthropogenic Global Warming



Funders and Other Promoters of Climate Change Denial

- Koch Industries
- Major Oil Companies
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- News Corporation

Donors Trust & Donors Capital have offered anonymity to various funders of climate change denial. See, for example, Robert J. Brulle "Institutionalizing delay: foundation funding and the creation of U.S. climate change counter-movement organizations" *Climatic Change* DOI 10.1007/s10584-013-1018-7

Funders and Other Promoters of Climate Change Denial

- **Koch Industries**
- **Major Oil Companies**
- **Donors Trust / Donors Capital**
- **News Corporation**

News Corporation

Rupert Murdoch's News Corporation popular source of disinformation on climate change

- During six-month period in 2012, 93% of Fox News representations of climate science misleading
- During first three-quarters of 2012, 81% of climate science in opinion section of the Wall Street Journal misleading

More on anthropogenic global warming and other negative impacts of humanity can be found in Earth and Life on Earth presentations

Earth & Space Pseudoscience Examples

- **Global warming denialism**
- **Lunar effect**
- **Biblical account of creation**
- **Astrology**

Lunar Effect

- Supposed spikes during full moon in crime rate, birth rate, suicides, etc
- Hospital records do not support belief*

*Jean-Luc Margot. "No Evidence of Purported Lunar Effect on Hospital Admission Rates or Birth,"
×*Nursing Research* 2015 May; 64(3): 168–175

Earth & Space Pseudoscience Examples

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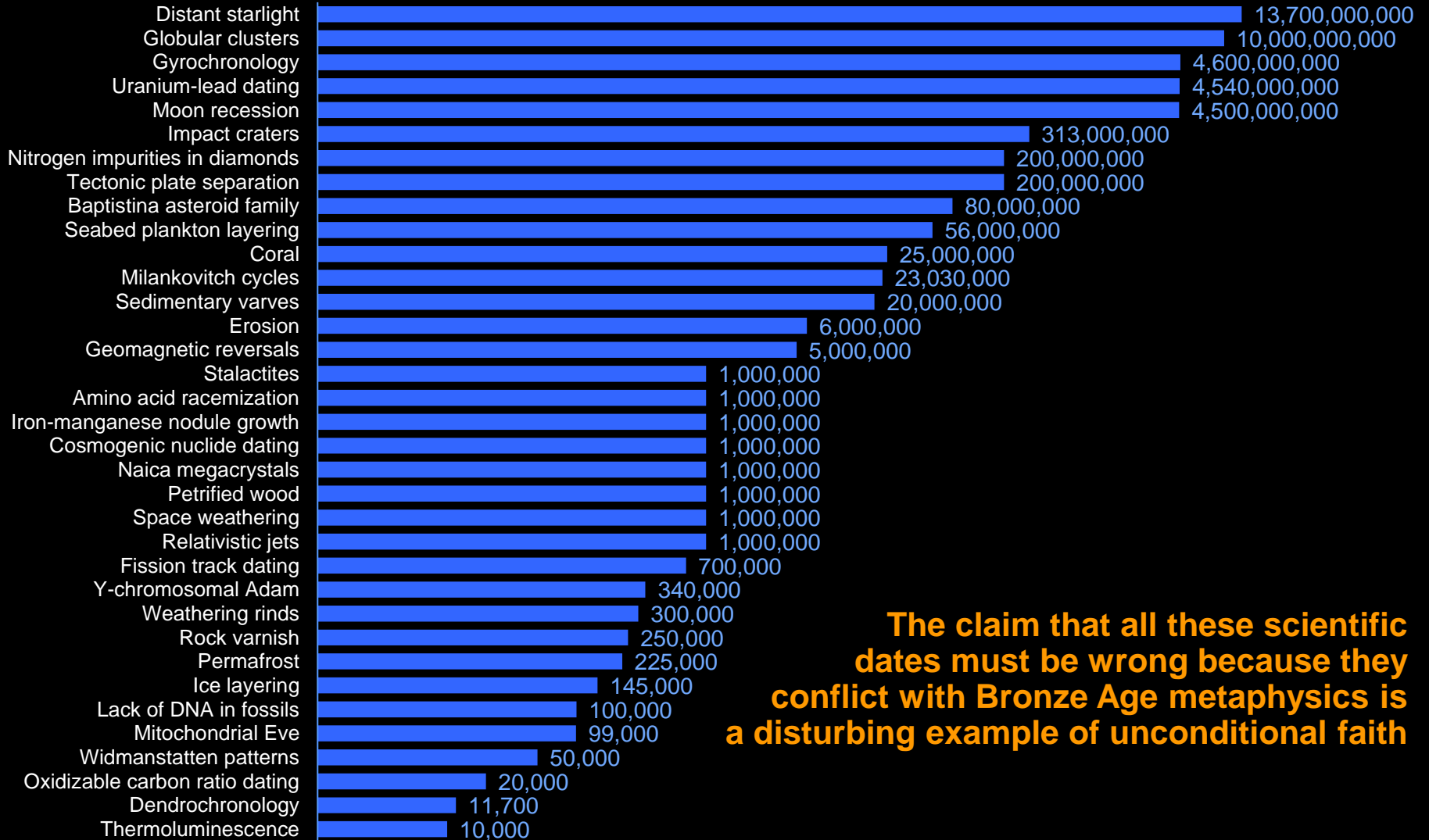
Also example of biological pseudoscience

Biblical Account of Creation

**Stationary flat Earth and its lifeforms
created roughly 6000 years ago**

Some contrary evidence already covered in century hopping exercise. More follows

Scientific Dating vs Bible



The claim that all these scientific dates must be wrong because they conflict with Bronze Age metaphysics is a disturbing example of unconditional faith

Blue bars are scientific dates from RationalWiki article "Evidence Against A Recent Creation". Red bar from Bible via William Ussher

Scientific World vs Biblical World

Scientific (bottom–up)

Biblical (top–down)

Simple universe born 13.8 billion years ago. Solar system formed 4.5 billion years ago	Earth, Sun, Moon and stars created by God in six days roughly 6000 years ago
Observable universe once tiny. Now 93 billion light-years in diameter	Universe small, consisting of Earth and nearby surroundings
Life on Earth evolved over billions of years from single common ancestor	Life on Earth created in forms similar to present ones several thousand years ago
Earth roughly spherical	Earth flat
Daily movement of Sun, Moon and stars across sky due to rotation of Earth	Sun, Moon and stars attached to rigid dome (firmament) that moves. Earth fixed
Moon 239 thousand miles from Earth. Sun 93 million miles away. Stars light-years away	Sun, Moon and stars all near Earth. Stars sometimes fall from firmament
Sun and stars much larger than Earth and Moon	Earth much larger than Sun and Moon. Sun and Moon much larger than stars
Earth one of several planets orbiting Sun	Planets "wandering stars"
Sun a nearby star and the source of daylight	Light, evening and morning, and days present before Sun created
200+ billion stars in our Milky Way galaxy. 100+ billion galaxies in observable universe	No concept of galaxies
Milky Way alone home to 10+ billion potentially habitable planets*	No concept of other earthlike bodies

Earth & Space Pseudoscience Examples

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Astrology

- Based on idea that foreknowledge of human and earthly events can be divined from the movements and positions of celestial objects
- Pure bullshit
- Survives due to ambiguity of predictions and Forer effect

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Nonetheless, advice from astrologer Joan Quigley to Nancy Reagan impacted President Reagan's appointment schedule, Cold War politics and even the timing of his cancer surgery. Shelby Grad and David Colker, *LA Times* (Mar 06, 2016)

Astrology

- **Based on idea that foreknowledge of human and earthly events can be divined from the movements and positions of celestial objects**
- **Pure bullshit**
- **Survives due to ambiguity of predictions and Forer effect**

Recall Bertram Forer's generic personality profile (cobbled from horoscopes), which test subjects rated on average as 85% accurate in describing them individually

Pseudoscience Categories

- Earth & Space
- Archaeological
- Biological
- Medical
- Psychological

Archaeological Pseudoscience Examples

- **Ancient astronaut visitations**
- **Ancient American history in the Book of Mormon**
- **Biblical pseudoarcheology**

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Ancient American History in BOM

Describes the history of two Old World people, one light-skinned and one dark-skinned, who came to America in large boats, bringing with them Old World crops (wheat, barley), animals (horses, elephants) & technology (iron, silk, chariots)

They multiplied into millions, built temples, and fought wars with each other. Eventually the good, light-skinned people were wiped-out by the bad, dark-skinned people (now known as American Indians)

No archaeological, linguistic, genetic or other evidence has been found to support such an account

Archaeological Pseudoscience Examples

- **Ancient astronaut visitations**
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the Book of Mormon**
- **Biblical pseudoarcheology**

Biblical Pseudoarcheology

Every year, "scientific" expeditions embark to look for the Garden of Eden, Noah's Ark, Sodom and Gomorrah, the Ark of the Covenant, and the Ten Lost Tribes of Israel. These expeditions are often supported by prodigious sums of money donated by gullible believers who eagerly accept tales spun by sincere but misguided amateurs or by rapacious confidence men

These ventures, which usually originate outside the confines of established scholarly institutions, engender confusion about what is real and what is fake. By practicing pseudo-archeology rather than by using established archeological principles and real science, the archaeological charlatans bring discredit to the field of biblical archaeology

– Eric H. Cline

Historicity of Exodus

Despite attempts by a number of biblical archaeologists – and an even larger number of amateur enthusiasts – over the years, credible direct archaeological evidence for the Exodus has yet to be found

While it can be argued that such evidence would be difficult to find, since nomads generally do not leave behind permanent installations, archaeologists have discovered and excavated nomadic emplacements from other periods in the Sinai desert

So if there were archaeological remains to be found from the Exodus, one would have expected them to be found by now. And yet, thus far there is no trace of the biblical "600,000 men on foot, besides children" plus "a mixed crowd . . . and live stock in great numbers" (Exod. 12:37-38) who wandered for forty years in the desert

– Eric H. Cline

Also absent is any sound evidence that
Hebrew slaves help build the pyramids

As always, new archeological discoveries could alter some of the above conclusions

Becoming less and less likely, however

Pseudoscience Categories

- Earth & Space
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Biological Pseudoscience Examples

- **Biblical creationism***
- **Intelligent design**
- **Lysenkoism**

*Already covered as example of Earth and space pseudoscience

Biological Pseudoscience Examples

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*Creationism masquerading as science, as revealed in 2005 Dover Trial. Still very much alive, however

Biological Pseudoscience Examples

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Lysenkoism

- **Application of Lamarckism* to Soviet agriculture by Trofim Lysenko**
- **Failed miserably, but deception and compatibility with Soviet political doctrine allowed Lysenko to keep program alive from 1930s through mid-1950s**
- **During that time both Soviet agriculture & Soviet biology suffered horribly (latter through political purges of opponents)**

*Falsified evolutionary theory that traits acquired in life are inherited by offspring

Pseudoscience Categories

- Earth & Space
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Medical Pseudoscience Examples

- Vaccines as unsafe
- Alternative Medicine

MMR Vaccine as Cause of Autism

- Seeds of belief sown in fraudulent paper by Andrew Wakefield et al (1998)*
- Causation bias and availability cascade then took over, augmented by crusading celebrities (halo effect)
- No scientific support for vaccinations as cause of autism

*Later retracted by publisher (*Nature*). A rare event

Medical Pseudoscience Examples

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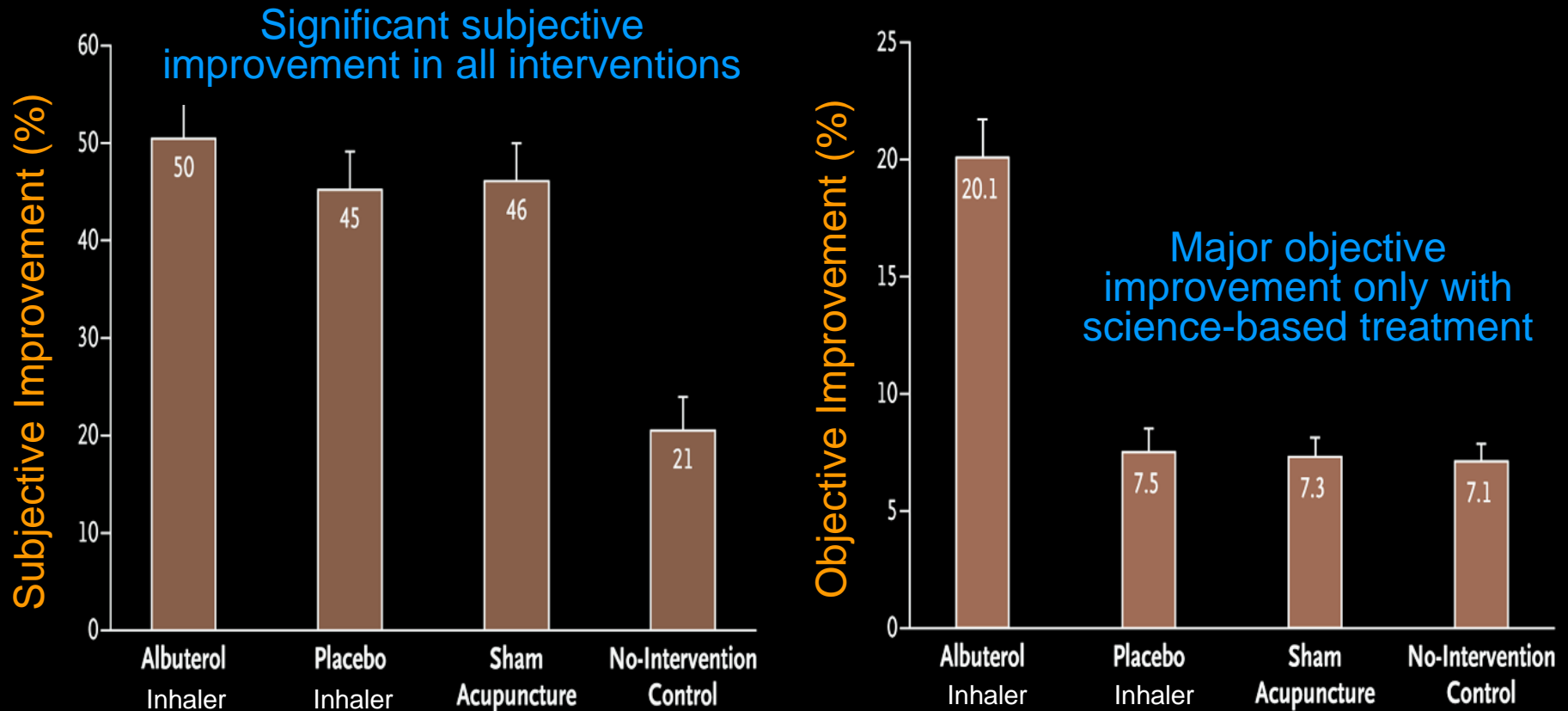
Also known as CAM (Complimentary and Alternative Medicine) and Integrative Medicine

How Most Alternative Medicine Works

- **Placebo effect – Patient expects treatment will help and consequently feels better. In some cases there is even a measurable improvement**
- **Regression to the mean – Patient often gets treatment when condition about to improve naturally. Attributes change to treatment**

In addition, most alternative medicine avoids nasty side effects sometimes associated with mainstream medicine (such as chemotherapy)

Placebo Effect – Double Blind Asthma Study



Participants try to expel air as fast as they can. All improve over their initial screening. Those who receive a treatment (intervention) – even sham one – sense greater improvement than those who do not (no-intervention control). But only those who receive Albuterol (science-based bronchodilator) show strong objective improvement. Objective Improvement consists of increase in FEV₁ (maximum forced expiratory volume in 1 second)
From Wechsler et al (2011) *New England Journal of Medicine*.

Alternative Medicine Examples

- Homeopathy
- Acupuncture
- Chiropractic
- Therapeutic touch / Reiki

Homeopathy

- Homeopathic solutions traditionally consist of water plus an "active" ingredient diluted out of existence
- The water is supposed to retain a "memory" of the active ingredient
- Useless apart from placebo effect

Homeopathy

Government Agency Assessments

Australian NHMRC

- There are no health conditions for which there is reliable evidence that homeopathy is effective

U.S. NCCIH

- There's little evidence to support homeopathy as an effective treatment for any specific health condition

NHMRC = National Health and Medical Research Council. NCCIH = National Center for Complementary & Integrative Health. FTC also getting involved ("FTC Steps In Where FDA Fears To Tread: On Homeopathy" *Forbes* (Nov 21, 2016))

The main thing homeopathy had going for it when first conceived (c. 1800) was that it was nothing but water, making it less harmful than most treatments at that time

Of course, being less harmful does not equate with being effective

Alternative Medicine Examples

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Acupuncture

- Involves sticking needles in certain parts of body (meridians)
- Apparent efficacy appears due to the placebo effect*

*Some studies have shown benefits from traditional acupuncture over sham acupuncture, but most seem to point to the placebo effect as dominating. See "5 scientists weigh in on acupuncture" *Scientific American* (July 1, 2014), "Research Casts Doubt on the Value of Acupuncture" *Scientific American* (Aug 1, 2016) and "Acupuncture" article in *Wikipedia*

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Chiropractic

- Typically involves manipulation of spinal column
- Can be useful for neuromusculoskeletal conditions, particularly lower back pain and for some types of headaches
- Chiropractors often oversell spectrum of benefits
- Traditional theory underlying chiropractic (subluxations) not supported by science

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Alternative Medicine Examples

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Therapeutic Touch / Reiki

- Therapeutic touch supposedly involves practitioner sensing and manipulating patient's "energy field" with hands
- In experiments by Emily Rosa practitioners could not sense which of their hands was close to one of hers, despite confidence beforehand that they could*
- Similar method, Reiki, almost certainly depends also on placebo effect for perceived effectiveness

*Rosa nine years old at time. Results eventually published in JAMA (1998)

Pseudoscience Categories

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Psychological Pseudoscience Examples

- **Psychoanalysis**
- **Scientology (& precursor Dianetics)**
- **Recovered memory therapy**
- **Polygraph tests**
- **Myers-Briggs personality indicator**

Use of Freudian psychoanalysis has declined as use of cognitive behavioral therapy has increased

Psychological Pseudoscience Examples

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Also a religious cult, whose principal goal is to separate adherents from their money. See RationalWiki "Church of Scientology" article and The Skeptic's Dictionary "Dianetics / Scientology" article

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One means used to obtain false evidence of supposed Satanic Ritual Abuse

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Lie detector tests known for a long time to be unreliable. Supreme Court has banned use in federal courts. Still used, however, by law enforcement to interrogate suspects and by federal agencies to screen employees

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Myers-Briggs Personality Indicator

- Outdated product of amateur psychoanalysis, unsupported by modern psychology
- Like horoscope, relies partially on Forer effect
- Myers-Briggs personality types often change upon subsequent testing

See (i) Adam Grant, *Psychology Today* (Sep 18, 2013), (ii) *The Personality Brokers: The Strange History of Myers-Briggs and the Birth of Personality Testing*, Merve Emre (2018), and (iii) review of Emre book by psychology professor Nick Haslam

Contents

Introduction

Misbelief Acquisition – 4 I's

Ignorance

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Empirical Truths

Scientific Consensus

Historical Knowledge

Benefits of Modern Medicine

Popularity of Liberal Democracy

Reliability of Modern Technology

Probable Misbeliefs

Resources

Pseudohistory

Pseudoscience

Paranormal

Belief Surveys

Wrap-up

Quotes

Paranormal

- Usually defined as beyond scope of science*
- Number of paranormal claims shown by scientific testing to be false. Now labeled "pseudoscience"
- Actual paranormal phenomena/entities probably non-existent. At least no good evidence. "Evidence" is of anecdotal / testimonial variety

*As used here, paranormal includes supernatural. Two terms are not clearly and consistently differentiated in the literature

Paranormal Examples

- ESP (precognition, clairvoyance, telepathy, telekinesis)
- Out of body experiences
- Dowsing
- Supernatural beings – gods, demons, angels, etc
- Faith healing
- Communication with the dead
- Ancient prophecies (Nostradamus, Bible code, Mayan 2012 apocalypse)

Evaluating Paranormal Claims

- **Thorough evaluation should involve a magician, at least up front**
- **Cognitive psychologists can be useful in spotting biased experimental protocols and understanding reasons why beliefs arise / persist**
- **Over 30 monetary prizes have been offered for demonstration of paranormal ability. None claimed**

Magicians far better than most scientists at spotting deception, often involved in such claims (faith healing, ghosts, mindreading, seances, psychokinesis, etc). Harry Houdini was a famous early debunker of paranormal claims. In more recent times James Randi and others have gotten involved

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A million dollar prize was offered by the James Randi Education Foundation from 1964 through 2015, when the challenge was terminated. Over 1000 people vied unsuccessfully. Most who claimed abilities would not even try (more money to be made by conning public)

Faith Healing

- All "evidence" of faith healing is anecdotal, at best. Many apparent healings are staged by con artists ("faith healers") for personal gain
- The best study of intercessory prayer has shown no impact*

*Templeton Foundation prayer study or "Great Prayer Experiment" (2006) involving 1800+ heart surgeries. Some others have yielded similar results. Still others have revealed falsification of results to claim efficacy

You have but to ask, supposedly

Therefore I tell you, whatever you ask for in prayer, believe that you have received it, and it will be yours

— Mark 11:24

Ask, and it will be given you; seek, and you will find; knock, and it will be opened to you. For every one who asks receives, and he who seeks finds, and to him who knocks it will be opened

— Matthew 7:7

*And I tell you, ask, and it will be given to you;
seek, and you will find; knock, and it will be
opened to you*

– Luke 11:9

*Whatever you ask in my name, this I will do,
that the Father may be glorified in the Son. If
you ask me anything in my name, I will do it*

– John 14:13-14

Prayer and Amputees

- **Why won't God heal amputees?***
- **Some animals regrow limbs, so phenomenon present in nature**
- **One can imagine humans someday acquiring ability through DNA modification**
- **But so far no record of any human regrowing a new limb, although many must have prayed for such to happen**

*Key question addressed on Marshall Brain's website of same name

Prayer and Child Abuse

Golden opportunities for divine intervention surely must have included answering prayers of children being sexually abused by Catholic, Baptist & other clergy. But such abuse went on and on

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*There are three kinds of lies: lies,
damned lies, and polls & surveys*

– Mark Twain

American Fantasyland

By my reckoning, the more or less reality-based [Americans] are a minority, maybe a third of us but almost certainly fewer than half

Why are we like this? . . . The short answer is because we're Americans, because being American means we can believe any damn thing we want, that our beliefs are equal to anyone else's, experts be damned

— Kurt Anderson

US Belief Surveys

In following belief survey tables red color indicates that 1/2 or more of respondents probably believe falsely. Green color means that 1/4 or less probably believe falsely. Yellow indicates belief in between. So, red = bad, yellow = better, green = better still, but not ideal

US Conspiracy Beliefs by Political Affiliation

Belief	Obama %	Romney %
Global warming as hoax	12	61
JFK assassination a conspiracy that included Oswald	47	54
Secretive power elite conspiring to build New World Order	16	38
Saddam Hussein involved in 9/11 attacks	19	36
Existence of aliens	29	28
UFO crashed at Roswell, NM (1947)	16	27
Link between childhood vaccines and autism	19	22
Barack Obama as anti-Christ	5	22
Bush administration lied about WMDs in Iraq	12	18
Government adds mind-controlling signals to TV broadcasts	12	18
Pharmaceutical & medical industries creating new diseases	11	17
Bigfoot / Sasquatch exists	12	15

Public Policy Polling (2013). Numbers are percent of Obama and Romney voters holding belief. All beliefs probably are false. One assumes G. W. Bush administration actually believed there were WMDs in Iraq

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Global warming itself already discussed. Extensive denialism in US embarrassing and dangerous

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Conspiracy beliefs regarding the JFK assassination appear rooted in American culture

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Only belief in poll held by greater percent of Obama voters than Romney voters, and only by one percent

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But they voted for him?

On Belief in Conspiracy Theories

- **Believers apparently abhor Occam's razor*, opting for unrealistic explanations of events (staged moon landing and school shootings, 9/11 as false flag operation, etc)**
- **Affinity for conspiracy theories appears to correlate with general rejection of science**
- **The best predictor of belief in a conspiracy theory is belief in other conspiracy theories**
- **In recent decades Republicans more drawn to conspiracy theories than Democrats (as in above poll, for example)**

*Unofficial dictum of skeptical inquiry: Look for the simplest explanation that fits all the facts

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US Science & Medicine Beliefs

Statement	% Confident	% Doubtful
Universe began with a big bang 13.8 billion years ago	21	51
Complexity of universe requires a guiding creator	54	25
Earth is 4.5 billion years old	27	36
Earth is warming, mostly because of human activity	33	37
All life on earth evolved through natural selection	31	42
Genetic code in our cells helps determine who we are	69	8
Smoking causes cancer	82	4
Mental illness a medical condition that affects the brain	71	6
Overusing antibiotics leads to drug-resistant bacteria	65	9
Childhood vaccines are safe and effective	53	37

All statements except second one probably true. Assembled 2014 by Live Science staff. Sources: About.com, Gallup poll, Associated Press

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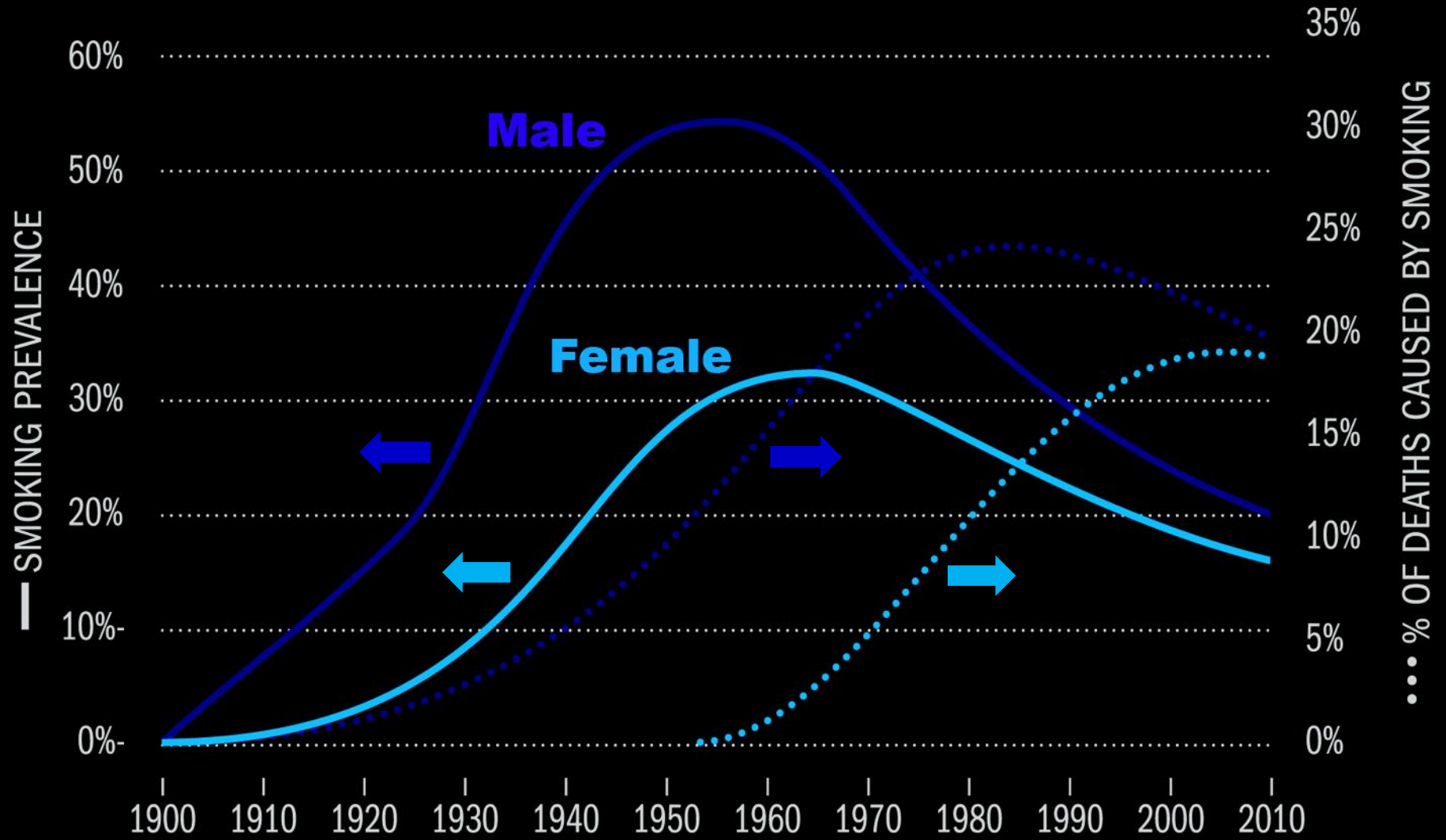
These beliefs religiously motivated. Dominant misbelief demographic in US: evangelicals. More data below

US Science & Medicine Beliefs

Statement	% Confident	% Doubtful
Universe began with a big bang 13.8 billion years ago	21	51
Complexity of universe requires a guiding creator	54	25
Earth is 4.5 billion years old	27	36
Earth is warming, mostly because of human activity	33	37
All life on earth evolved through natural selection	31	42
Genetic code in our cells helps determine who we are	69	8
Smoking causes cancer	82	4
Mental illness a medical condition that affects the brain	71	6
Overusing antibiotics leads to drug-resistant bacteria	65	9
Childhood vaccines are safe and effective	53	37

Cancer causing nature of tobacco discovered in Germany in 1930s. Now generally apparent, but it took decades for public awareness to develop due to orchestrated campaign of obfuscation by Big Tobacco

US Cigarette Smoking & Related Deaths



Source: tobaccoatlas.org. There is also more direct evidence of the carcinogenic nature of tobacco

US Alternative Medicine Beliefs

Therapy	% believing insurance should cover use
Chiropractic	67
Massage therapy	53
Acupuncture*	48
Herbs / herbal medicines	30
Electrotherapy*	23
Hypnotherapy*	19
Reflexology*	16
Meditation	15
Aromatherapy*	13
Cupping*	11
Reiki*	9

2016 Harris poll. *Therapies characterized as "useless" in RationalWiki "Alternative Medicine" article. Interesting that homeopathy did not even make the list

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Probably not effective beyond placebo. But less than 25% believe insurance should cover (good)

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As indicated earlier, acupuncture appears to depend primarily on the placebo effect (48% not so good)

US Paranormal Beliefs

Belief	% Yes	% No
Assorted Religious Beliefs	57-74	12-26
Creationism	36	31
UFO's	36	35
Astrology	29	50
Ghosts	42	37
ESP exists	41	59
Ouija boards are dangerous	65	35
Healing possible by psychic, spiritual or mental means	55	26
People sometimes possessed by the devil	42	44
Some people can communicate with the dead	21	55

First six results from Harris Interactive Poll (2013). Last five results assembled by Live Science staff (2011) from About.com, Gallup and AP

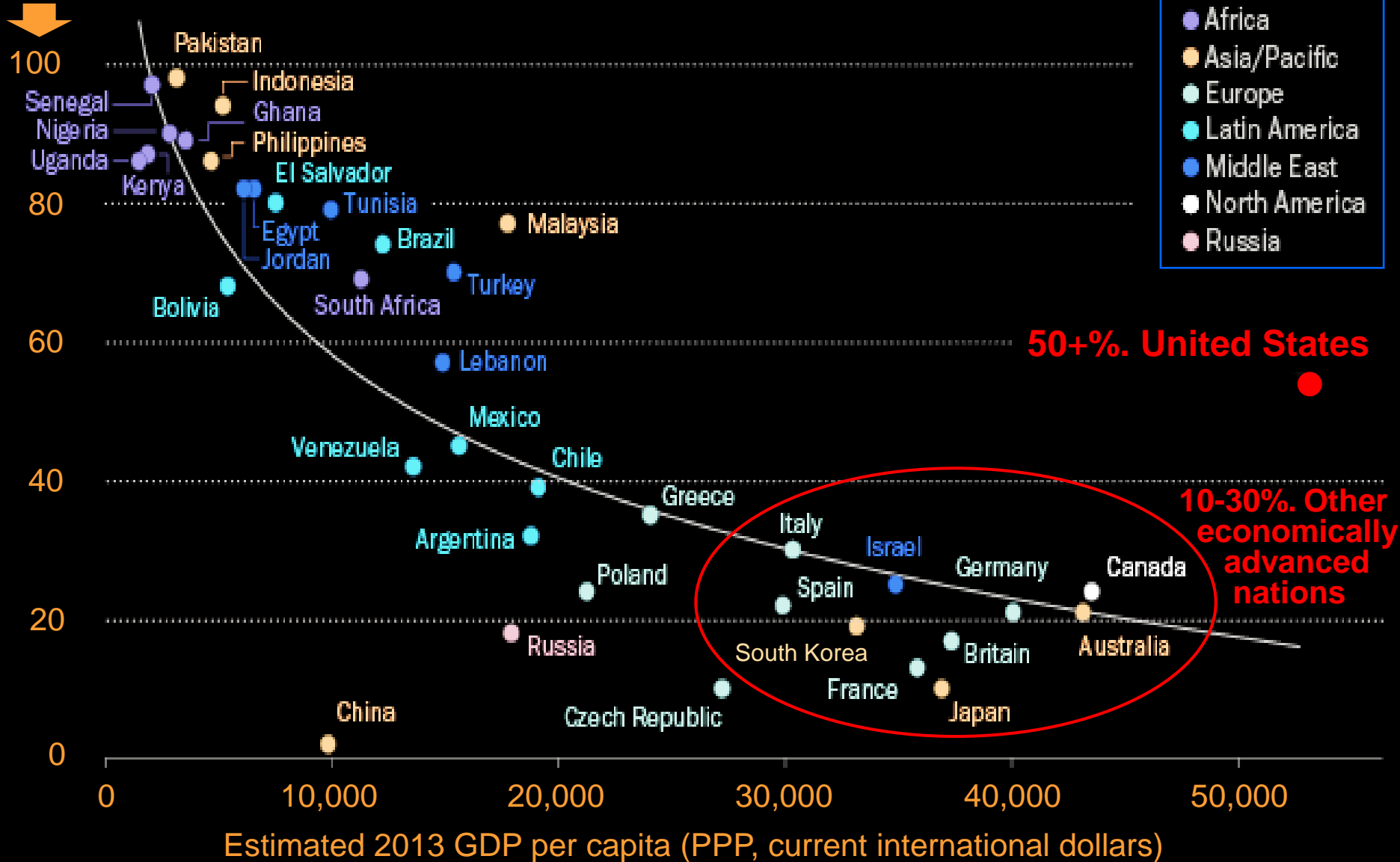
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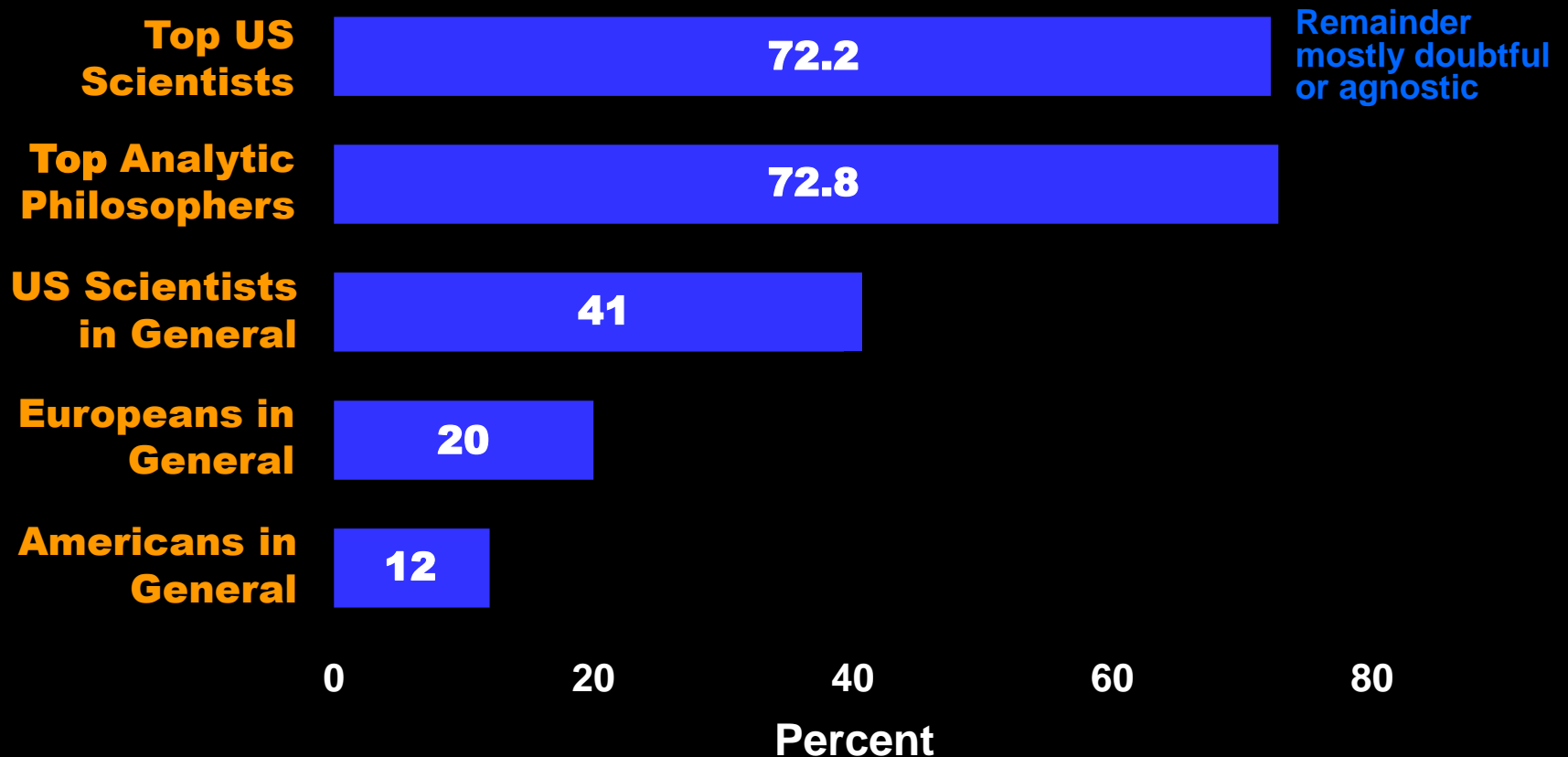
Beliefs include God, miracles, Heaven, Jesus as divine, angels, resurrection of Jesus, soul survival after death, Hell, Devil, virgin birth of Jesus. All probably fictional

US : Religious Anomaly

Percent of population for whom religion very important



Disbelief in God – Various Groups



Top US Scientists (NAS Members) - Larson & Witham (1998). Top analytic philosophers (target responders, Philpapers Survey) - Bourget & Chalmers (2009). US Scientists in General - Pew Poll (2009). Europeans in General - Eurobarometer Poll (2010). Americans in General - Pew Poll (2009) and Harris Poll (2013)

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65%!?

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Probably false apart from stress reduction / placebo effect

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Demographic primarily responsible identified on next slide

US Evolution Beliefs

Religious demographic	Humans have evolved (%)	Humans same as when created (%)
White Mainline Protestant	78	15
Unaffiliated	76	20
White Catholic	68	26
Hispanic Catholic	53	31
Black Evangelicals	44	50
White Evangelicals	27	64

Pew Research Center (2013). More than half of evangelicals hold a belief that is almost certainly false

Assorted US Beliefs – Scientists vs General Public

Belief	Scientist % Yes	Public % Yes
Humans have evolved over time	98	65
Favor use of animals in research	89	47
Safe to eat genetically modified (GM) foods	88	37
Climate change mostly due to human activity	87	50
Childhood vaccines (e.g. MMR) should be required	86	68
Growing world population will be a big problem	82	59
Favor increased use of bioengineered fuel	78	68
Safe to eat foods grown with pesticides	68	28
Favor more nuclear power plants	65	45
Favor more offshore drilling	32	52
Favor increased use of fracking	31	39

Pew Research Center (2015). Scientists probably more knowledgeable than general public on above topics. Red indicates biggest difference between scientists and public, green least, and yellow something in between. The quantitative significance of the colors differs somewhat from the preceding surveys

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Lack of public acceptance primarily among evangelicals

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Public opposition primarily by those with poor knowledge of science and by women

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Public disagreement primarily by younger adults and, to lesser extent, by women

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Twice as many republicans as democrats disagree

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Younger adults less likely to agree than older adults. Support highest among seniors

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Denial highest on political / religious right

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Public disagreement primarily from political left

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Public in favor probably dominated by political right

Contents

Introduction

Misbelief Acquisition – 4 I's

Ignorance

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Empirical Truths

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Historical Knowledge

Benefits of Modern Medicine

Popularity of Liberal Democracy

Reliability of Modern Technology

Probable Misbeliefs

Resources

Pseudohistory

Pseudoscience

Paranormal

Belief Surveys

Wrap-up

Quotes

Misbeliefs of US Citizens

- US citizens hold number of beliefs lacking support
- Some are results of religious indoctrination
- Some are simply products of intellectual laziness
- Still others arise from manipulative "news" sources

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- Still others arise from manipulative "news" sources

Many harmless and comforting, but others not, such as those that espouse hatred, propagate ignorance, prevent people from seeking proper medical care and use of contraception, or even fuel "satanic panics"

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- Some are results of religious indoctrination
- Some are simply products of intellectual laziness
- Still others arise from manipulative "news" sources

"Heard it somewhere" "Read it somewhere"

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- Some are results of religious indoctrination
- Some are simply products of intellectual laziness
- Still others arise from manipulative "news" sources

Sad example was belief by many Americans that Apollo 11 Moon landing, a watershed moment in human history, never happened. Fuel for that misbelief was a poorly researched but widely viewed documentary "Conspiracy Theory: Did We Land on the Moon?" aired uncritically by Fox in 2001 ("We report, you decide")

US as Nation

- **US on top of the world at end of WWII. Much less so nowadays**
- **Image as force for good tarnished by number of ill-conceived interventions around the globe**
- **Leadership in big science has declined somewhat**
- **In quantitative measures of societal health, US nowhere near where it could be**

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In 2015 government funding of basic research in US fell below 50% for the first time since WWII. Some key research on particle physics and space science has shifted to Europe

U S currently spends more on its military than next seven biggest-spending nations combined. Imagine what could be done if a significant chunk of that money was spent instead on general research, education and/or a healthier Earth

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As comparisons with other OECD countries reveal

OECD Countries

Mostly Western Cultures

Australia	France	S. Korea	Slovak Republic
Austria	Germany	Latvia	Slovenia
Belgium	Greece	Lithuania	Spain
Canada	Hungary	Luxembourg	Sweden
Chile	Iceland	Mexico	Switzerland
Czech Republic	Ireland	Netherlands	Turkey
Denmark	Israel	New Zealand	United Kingdom
Estonia	Italy	Norway	United States
Finland	Japan	Portugal	

US Rankings Among OECD Countries

Area	Desirable	Undesirable	US Ranking
Rate of poverty		X	2
Prevalence of obesity		X	2
Hospital beds per 1000 people	X		Below top quarter*
Life expectancy at birth	X		Below top quarter
Violence against women		X	Well above average
Women on major corporation boards	X		Below top quarter
Mandated maternity leave	X		No guarantee for all
Renewable electricity	X		Below average
Employment	X		Below top quarter
Foreign-born unemployment		X	Lowest
Infrastructure	X		Below top quarter
Car accident deaths per million cars		X	2
Voter turnout	X		Low for rich country
Deaths due to assault		X	5 times average**

2017 data. Green good. Red bad. Yellow in between. Not all results listed here. *US also only OECD nation without full population health coverage (although we spend the most). **Excluding Mexico

US Gun Deaths Per Capita Relative to World

Western Europe	Highest 5 times deaths per capita of Portugal, the highest in Western Europe
Central & E. Europe	Second Highest Behind only Albania
Americas	Thirteenth highest Behind El Salvador, Columbia, Venezuela, Guatemala, Honduras, Brazil, Ecuador, Mexico, Panama, Paraguay, Costa Rica & Nicaragua
N. Africa & M. East	Second Highest Behind only Iraq
Sub-Saharan Africa	Eighth highest Behind Lesotho, Swaziland, Cape Verde, Namibia, Malawi, S. Africa & Uganda
E. Asia, S.E. Asia & Australia	Third highest Behind Thailand & Philippines

"The U.S. is a World Leader in Gun Deaths," Anders Kelto, NPR (Dec 7, 2015). Deaths elsewhere probably under-reported. This slide is not restricted to OECD countries

PISA Scientific Literacy Scores – OECD Countries

Country	Score	Country	Score
Japan	538	Austria	495
Estonia	534	France	495
Finland	531	Sweden	493
Canada	528	Czech Republic	493
S. Korea	516	Spain	493
New Zealand	513	Latvia	490
Slovenia	513	Luxembourg	483
Australia	510	Italy	481
United Kingdom	509	Hungary	477
Germany	509	Lithuania	475
Netherlands	509	Iceland	473
Switzerland	506	Israel	467
Ireland	503	Slovak Republic	461
Belgium	502	Greece	455
Denmark	502	Chile	447
Portugal	501	Turkey	425
Norway	498	Mexico	416
United States	496		

2015 Results. PISA (Program for International Student Assessment) tests application of knowledge in science, reading and mathematics to real-life type problems by 15-year-olds

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American Schools vs World

Expensive, Unequal, Bad at Math

– Julia Ryan

General Recommendations

- Place evidence above tradition: education not indoctrination
- Judge people by thoughts and actions, not by circumstances of birth (genes, birthplace, etc)
- Be wary of extreme political and religious views and do not vote for politicians whose remarks frequently / flagrantly conflict with facts*
- Never lose your curiosity, imagination or sense of humor
- Keep an open mind, but not so open that your brains fall out**

Regarding Religion

- **If you believe in a higher power who:**
 - Demands frequent praise and strict observance of rituals
 - Is personally concerned about your diet, attire and sex life
 - Places constraints on how you can express yourself through words and art
 - Holds you accountable for your ancestors supposed actions
 - Has a horrible fate planned for nonbelievers
 - Has revealed a history of the world markedly different from that pieced together by scientists and scholarly historians

then you might ponder the possibility that such an entity is more likely a human construct than a creator

- **Religion does not appear essential for a happy / prosperous society. More secular states in the US and more secular free countries in the world tend to score higher on measures of societal health than more religious ones***

*Zuckerman, *Psychology Today* (Nov 23, 2014)

Worldwide, religion is a conflictual issue in
most armed conflicts today

"Rethinking Mediation: Resolving Religious Conflicts" Jonas Baumann, Daniel Finnbogason,
and Isak Svensson, Policy Perspectives, Vol. 6/1, February 2018, ICSS, ETH Zurich

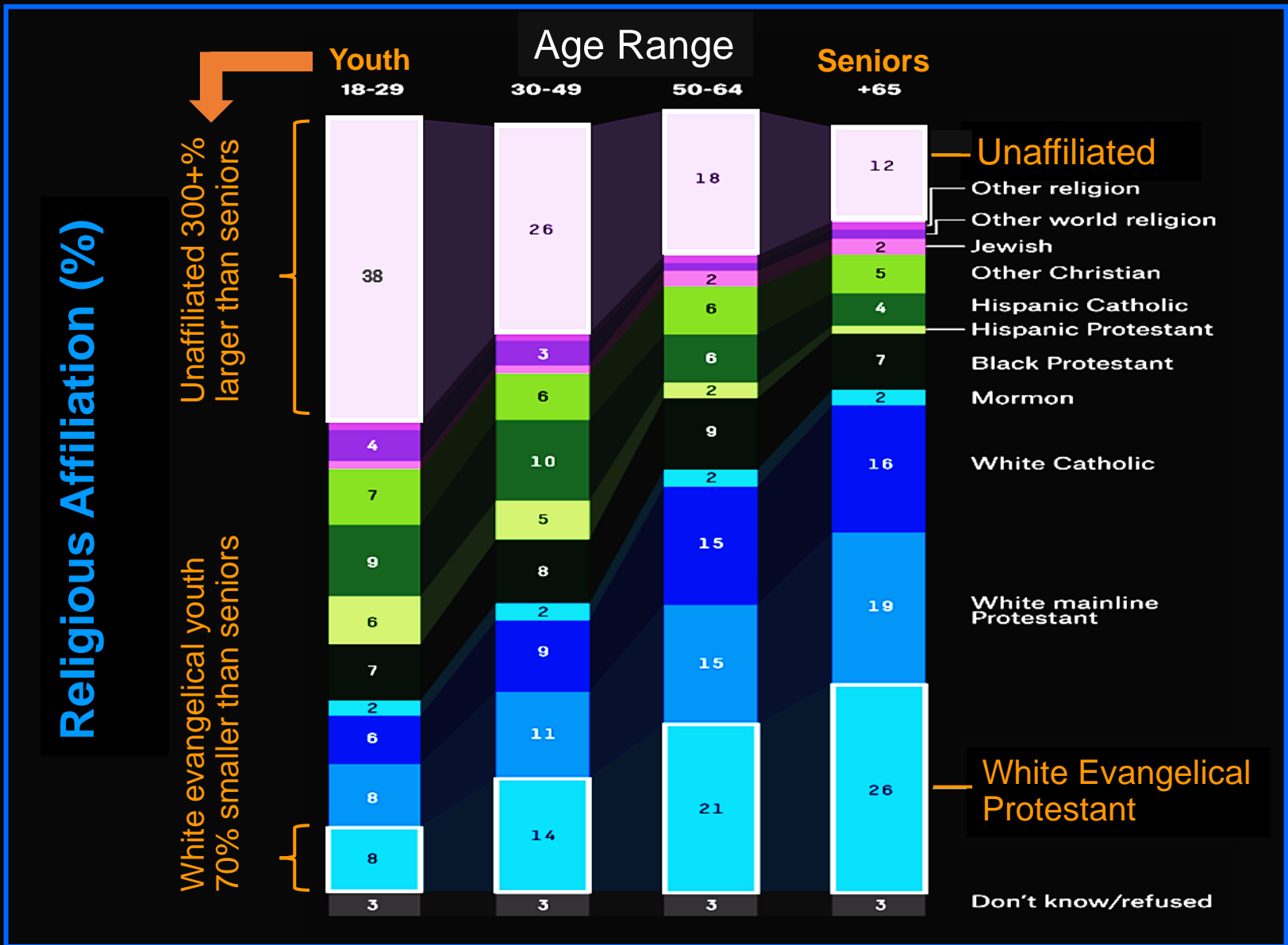
To be completely blunt . . .

The world would have a brighter future if those who believe that the universe is only several thousand years old, that every sperm is sacred, and similar such nonsense, would stop planting it in trusting young minds

Even though those planting such beliefs often do so with the best intentions

Ray of Hope?

Generational Differences in Religious Identity



Source: PRRI 2016 American Values Atlas. Biggest generational decline in young white evangelicals

Hope might be illusory. People tend to get more religious as they age & religious people tend to have larger families

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Reality

Reality is that which, when you stop believing in it, doesn't go away

– Philip K. Dick

Extraordinary Claims

Extraordinary claims require extraordinary evidence

– Carl Sagan

Unsupported Claims

*That which can be asserted without evidence,
can be dismissed without evidence*

– Christopher Hitchens

Miracles

No testimony is sufficient to establish a miracle unless the testimony is of such a kind that its falsehood would be more miraculous than the fact which it endeavors to establish

– David Hume

Smart People & Weird Beliefs

Smart people believe weird things because they are skilled at defending beliefs they arrived at for non-smart reasons

– Michael Shermer

Religious Complacency

The presence of those seeking the truth is infinitely to be preferred to the presence of those who think they've found it

– Terry Pratchett

Religion & Eternal Life

*Selling eternal life is an unbeatable business,
with no customers ever asking for their money
back after the goods are not delivered*

– Victor Stenger

Religious Faith

Intense, usually confident, belief lacking evidence sufficient to command assent from every reasonable person

– Walter Kaufmann

Bible Against Itself

*Properly read, the Bible is the most potent
force for atheism ever conceived*

— Isaac Asimov

Religion & Disbelief

The easy confidence with which I know another man's religion is folly teaches me to suspect that my own is also

— Mark Twain

Religion & Happiness

The fact that a believer is happier than a skeptic is no more to the point than the fact that a drunken man is happier than a sober one

– George Bernard Shaw

Also, the greater happiness of believers is by no means universal

Religion & Immorality

*Those who believe absurdities will
commit atrocities*

— Voltaire

Such as Christian Science parents who watch their children die protracted, agonizing deaths from infection rather than let them be treated with antibiotics (or any modern medicine)

Religion & Immorality

Why should I allow that same God to tell me how to raise my kids, who had to drown His own?

– Robert G. Ingersoll

Religion & Immorality

With or without religion, you would have good people doing good things and evil people doing evil things. But for good people to do evil things, that takes religion

– Steven Weinberg

Religion & Ignorance

Is it not better to place a question mark upon a problem while seeking an answer than to put the label "God" there and consider the matter closed?

– Joseph Lewis

Religion & Ignorance

In history lies the realization that religion is nothing but a collection of assumptions about the unknown that disappear with the advancement of human knowledge

– Thomas Swan

Religion & Ignorance

*Faith does not give you answers,
it just stops you asking questions*

– Frater Ravus

Science & Religion

*Science flies men to the moon,
religion flies men into buildings*

– Victor Stenger

Lastly . . .

The Demon-Haunted World

Science as a Candle in the Dark

I worry that, especially as the Millennium edges nearer pseudoscience and superstition will seem year by year more tempting, the siren song of unreason more sonorous and attractive. Where have we heard it before? Whenever our ethnic or national prejudices are aroused, in times of scarcity, during challenges to national self-esteem or nerve, when we agonize about our diminished cosmic place and purpose, or when fanaticism is bubbling up around us – then, habits of thought familiar from ages past reach for the controls

The candle flame gutters. Its little pool of light trembles. Darkness gathers. The demons begin to stir

– Carl Sagan (1996)

The End