

# The Future of Humankind and of the Universe

Ivica Puljak

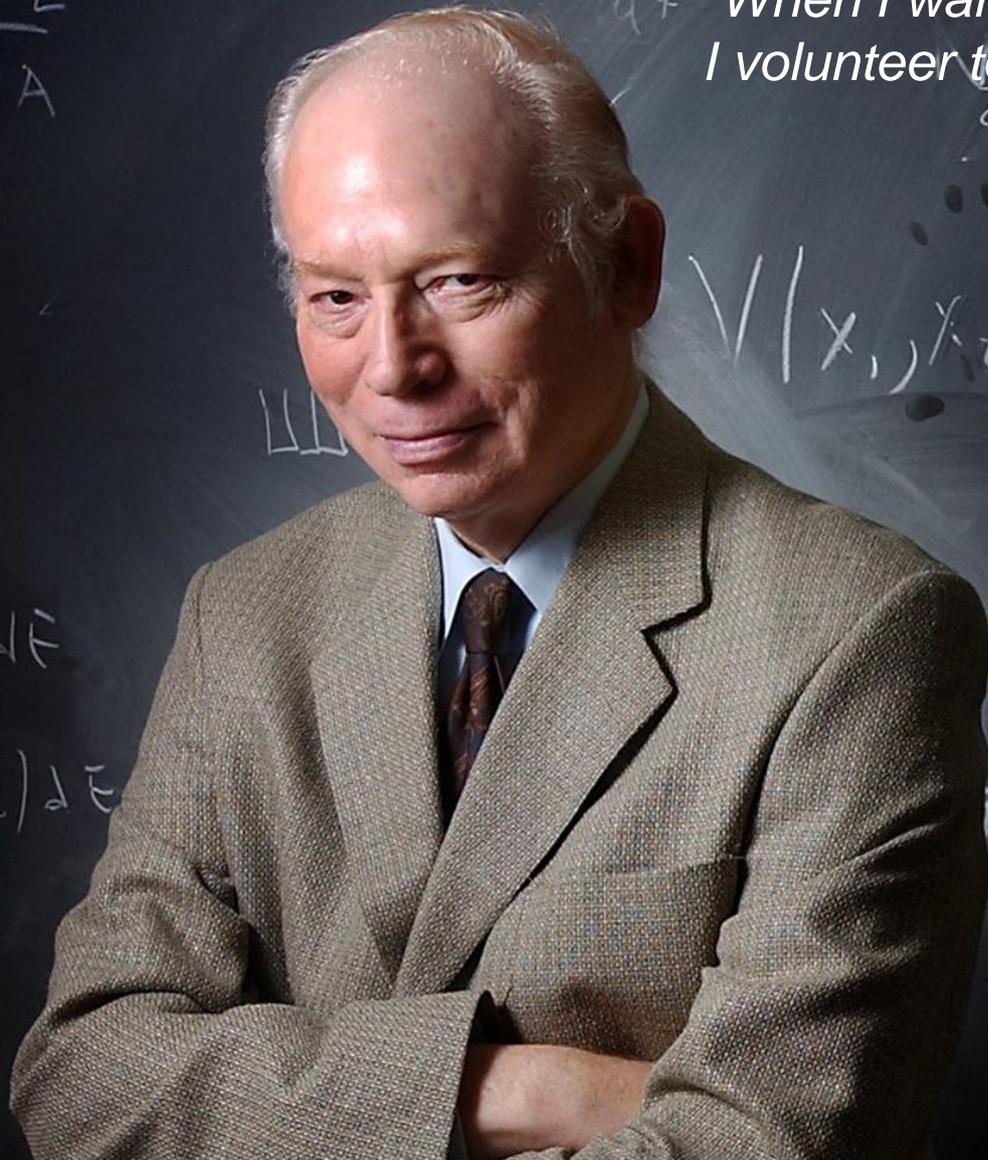
Faculty of Electrical Engineering,  
Mechanical Engineering and Naval  
Architecture in Split, Croatia

Thematic CERN School of Computing 2018

# Why do I talk about this?

*"When I want to learn about something,  
I volunteer to teach a course on the subject"*

*Steven Weinberg*



THE NUMBER ONE BESTSELLER

Yuval Noah Harari



# Homo Deus

A Brief History  
of Tomorrow

'A SPELLBINDING BOOK'  
GUARDIAN

VINTAGE

# Thank You for Being Late

AN OPTIMIST'S GUIDE TO THRIVING  
IN THE AGE OF ACCELERATIONS

THOMAS L.  
FRIEDMAN

AUTHOR OF *THE WORLD IS FLAT*

*On the Origins of LIFE, MEANING,  
and the UNIVERSE ITSELF*

THE  
BIG  
PICTURE

*Author of THE PARTICLE AT THE END OF THE UNIVERSE*  
SEAN CARROLL

*"Carroll is a surefooted guide through some of the  
most perplexing and fascinating insights of modern physics."*

—BRIAN GREENE, *author of THE ELEGANT UNIVERSE*

LIFE  
3.0

BEING HUMAN IN THE AGE OF  
ARTIFICIAL INTELLIGENCE

MAX TEGMARK



NEW YORK TIMES BEST SELLER

'One of the most important books I've ever read —  
an indispensable guide to thinking clearly about the world' Bill Gates

# FACT FUL NESS

TEN REASONS  
WE'RE WRONG ABOUT  
THE WORLD — AND WHY  
THINGS ARE BETTER  
THAN YOU THINK

**Hans Rosling** with Ola Rosling and  
Anna Rosling Rönnlund

"MY NEW FAVORITE BOOK OF ALL TIME." —BILL GATES

# STEVEN PINKER

# ENLIGHTENMENT NOW

THE CASE FOR  
REASON, SCIENCE,  
HUMANISM,  
AND PROGRESS



GAPMINDER TOOLS

DOLLAR STREET

VIDEOS

DOWNLOADS

TEACH

IGNORANCE

DATA

Custom

## WHY WE WROTE FACTFULNESS

Why we wrote Factfulness



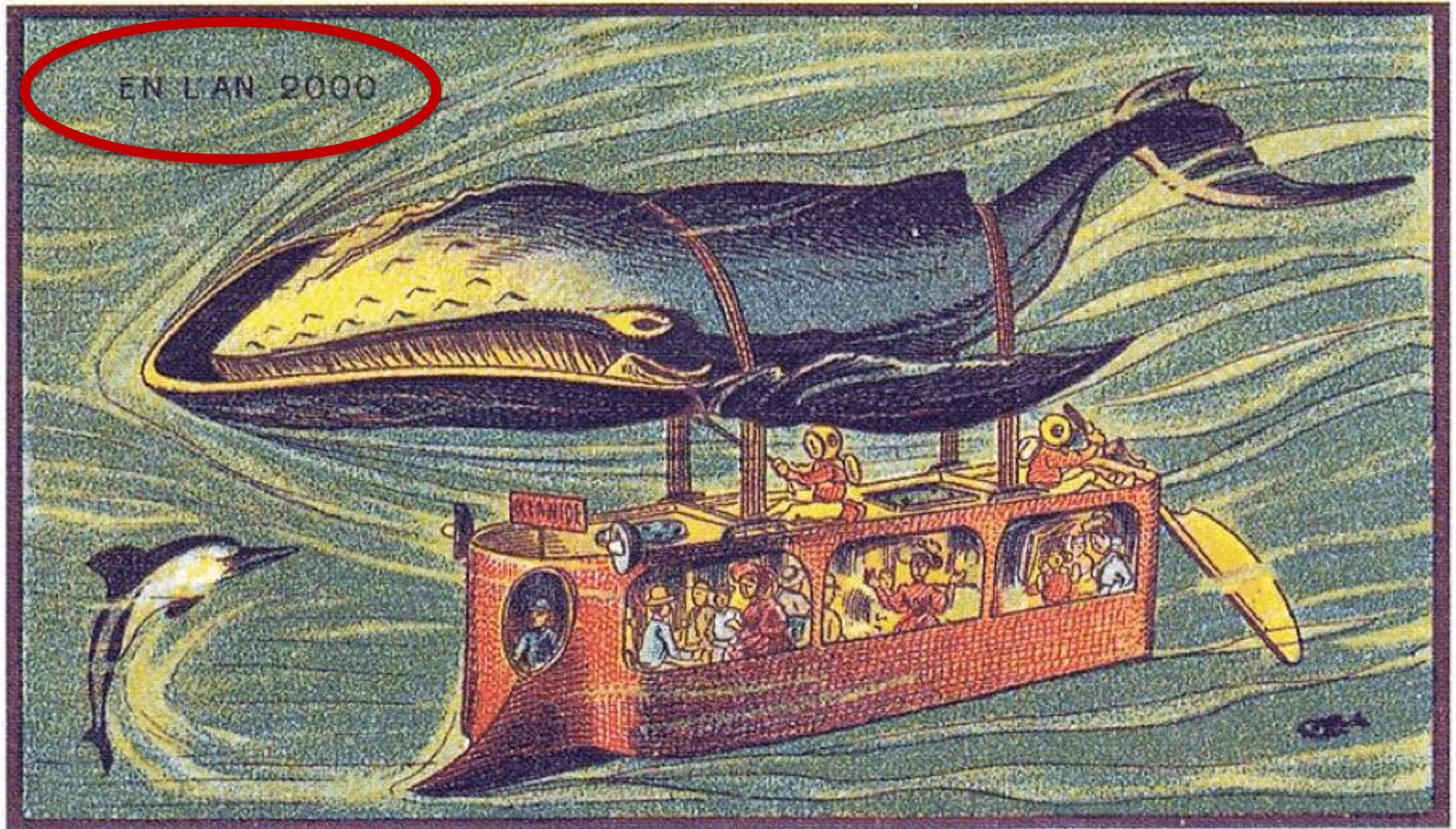
# Even more optimistic



# Two kind of optimists



# Predicting the future



A Whale-Bus



# Formula describing everyday life

By Sean Carroll

Quantum mechanics

Spacetime

Gravity

$$W = \int_{k < \Lambda} [Dg][DA][D\psi][D\Phi] \exp \left\{ i \int d^4x \sqrt{-g} \left[ \frac{m_p^2}{2} R \right. \right. \\ \left. \left. - \frac{1}{4} F_{\mu\nu}^a F^{a\mu\nu} + i \bar{\psi}^i \gamma^\mu D_\mu \psi^i + \left( \bar{\psi}_L^i V_{ij} \Phi \psi_R^j + \text{h.c.} \right) - |D_\mu \Phi|^2 - V(\Phi) \right] \right\}$$

Other forces                      Matter                      Higgs boson

► Here is written, for example, that:

- **Astrology doesn't work**
- **There is no afterlife**

# Standard Model of FUNDAMENTAL PARTICLES AND INTERACTIONS

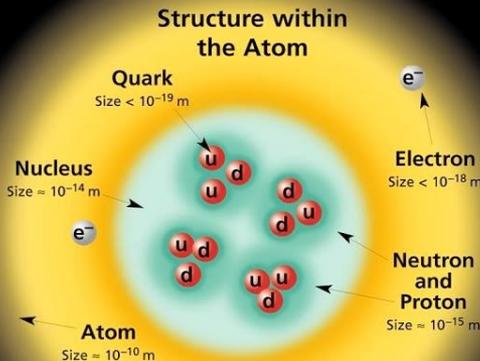
The Standard Model summarizes the current knowledge in Particle Physics. It is the quantum theory that includes the theory of strong interactions (quantum chromodynamics or QCD) and the unified theory of weak and electromagnetic interactions (electroweak). Gravity is included on this chart because it is one of the fundamental interactions even though not part of the "Standard Model."

## FERMIONS

**matter constituents**  
spin = 1/2, 3/2, 5/2, ...

Leptons spin = 1/2		
Flavor	Mass GeV/c <sup>2</sup>	Electric charge
$\nu_e$ electron neutrino	<1×10 <sup>-8</sup>	0
e electron	0.000511	-1
$\nu_\mu$ muon neutrino	<0.0002	0
$\mu$ muon	0.106	-1
$\nu_\tau$ tau neutrino	<0.02	0
$\tau$ tau	1.7771	-1

Quarks spin = 1/2		
Flavor	Approx. Mass GeV/c <sup>2</sup>	Electric charge
u up	0.003	2/3
d down	0.006	-1/3
c charm	1.3	2/3
s strange	0.1	-1/3
t top	175	2/3
b bottom	4.3	-1/3



If the protons and neutrons in this picture were 10 cm across, then the quarks and electrons would be less than 0.1 mm in size and the entire atom would be about 10 km across.

## BOSONS

**force carriers**  
spin = 0, 1, 2, ...

Unified Electroweak spin = 1		
Name	Mass GeV/c <sup>2</sup>	Electric charge
$\gamma$ photon	0	0
W <sup>-</sup>	80.4	-1
W <sup>+</sup>	80.4	+1
Z <sup>0</sup>	91.187	0

Strong (color) spin = 1		
Name	Mass GeV/c <sup>2</sup>	Electric charge
g gluon	0	0

### Color Charge

Each quark carries one of three types of "strong charge," also called "color charge." These charges have nothing to do with the colors of visible light. There are eight possible types of color charge for gluons. Just as electrically-charged particles interact by exchanging photons, in strong interactions color-charged particles interact by exchanging gluons. Leptons, photons, and W and Z bosons have no strong interactions and hence no color charge.

### Quarks Confined in Mesons and Baryons

One cannot isolate quarks and gluons; they are confined in color-neutral particles called **hadrons**. This confinement (binding) results from multiple exchanges of gluons among the color-charged constituents. As color-charged particles (quarks and gluons) move apart, the energy in the color-force field between them increases. This energy eventually is converted into additional quark-antiquark pairs (see figure below). The quarks and antiquarks then combine into hadrons; these are the particles seen to emerge. Two types of hadrons have been observed in nature: **mesons**  $q\bar{q}$  and **baryons**  $qqq$ .

### Residual Strong Interaction

The strong binding of color-neutral protons and neutrons to form nuclei is due to residual strong interactions between their color-charged constituents. It is similar to the residual electrical interaction that binds electrically neutral atoms to form molecules. It can also be viewed as the exchange of mesons between the hadrons.

**Spin** is the intrinsic angular momentum of particles. Spin is given in units of  $\hbar$ , which is the quantum unit of angular momentum, where  $\hbar = h/2\pi = 6.58 \times 10^{-25} \text{ GeV s} = 1.05 \times 10^{-34} \text{ J s}$ .

**Electric charges** are given in units of the proton's charge. In SI units the electric charge of the proton is  $1.60 \times 10^{-19}$  coulombs.

The **energy** unit of particle physics is the electronvolt (eV), the energy gained by one electron in crossing a potential difference of one volt. **Masses** are given in  $\text{GeV}/c^2$  (remember  $E = mc^2$ ), where  $1 \text{ GeV} = 10^9 \text{ eV} = 1.60 \times 10^{-10} \text{ joule}$ . The mass of the proton is  $0.938 \text{ GeV}/c^2 = 1.67 \times 10^{-27} \text{ kg}$ .

## PROPERTIES OF THE INTERACTIONS

Baryons $qqq$ and Antibaryons $\bar{q}\bar{q}\bar{q}$					
Baryons are fermionic hadrons. There are about 120 types of baryons.					
Symbol	Name	Quark content	Electric charge	Mass GeV/c <sup>2</sup>	Spin
p	proton	uud	1	0.938	1/2
$\bar{p}$	anti-proton	$\bar{u}\bar{u}\bar{d}$	-1	0.938	1/2
n	neutron	udd	0	0.940	1/2
$\Lambda$	lambda	uds	0	1.116	1/2
$\Omega^-$	omega	sss	-1	1.672	3/2

Interaction / Property	Gravitational	Weak (Electroweak)	Electromagnetic	Strong	
				Fundamental	Residual
<b>Acts on:</b>	Mass - Energy	Flavor	Electric Charge	Color Charge	See Residual Strong Interaction Note
<b>Particles experiencing:</b>	All	Quarks, Leptons	Electrically charged	Quarks, Gluons	Hadrons
<b>Particles mediating:</b>	Graviton (not yet observed)	W <sup>+</sup> W <sup>-</sup> Z <sup>0</sup>	$\gamma$	Gluons	Mesons
<b>Strength relative to electromag for two u quarks at:</b>					
for two u quarks at: $10^{-18} \text{ m}$	$10^{-41}$	0.8	1	25	Not applicable to quarks
$3 \times 10^{-17} \text{ m}$	$10^{-41}$	$10^{-4}$	1	60	
for two protons in nucleus $10^{-36}$	$10^{-36}$	$10^{-7}$	1	Not applicable to hadrons	

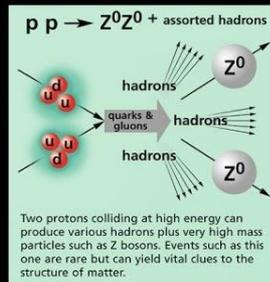
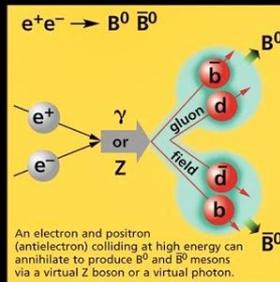
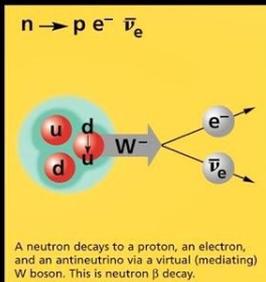
Mesons $q\bar{q}$					
Mesons are bosonic hadrons. There are about 140 types of mesons.					
Symbol	Name	Quark content	Electric charge	Mass GeV/c <sup>2</sup>	Spin
$\pi^+$	pion	$u\bar{d}$	+1	0.140	0
$K^-$	kaon	$s\bar{u}$	-1	0.494	0
$\rho^+$	rho	$u\bar{d}$	+1	0.770	1
$B^0$	B-zero	$d\bar{b}$	0	5.279	0
$\eta_c$	eta-c	$c\bar{c}$	0	2.980	0

### Matter and Antimatter

For every particle type there is a corresponding antiparticle type, denoted by a bar over the particle symbol (unless + or - charge is shown). Particle and antiparticle have identical mass and spin but opposite charges. Some electrically neutral bosons (e.g.,  $Z^0$ ,  $\gamma$ , and  $\eta_c = c\bar{c}$ , but not  $K^0 = d\bar{s}$ ) are their own antiparticles.

### Figures

These diagrams are an artist's conception of physical processes. They are *not* exact and have *no* meaningful scale. Green shaded areas represent the cloud of gluons or the gluon field, and red lines the quark paths.



### The Particle Adventure

Visit the award-winning web feature *The Particle Adventure* at <http://ParticleAdventure.org>

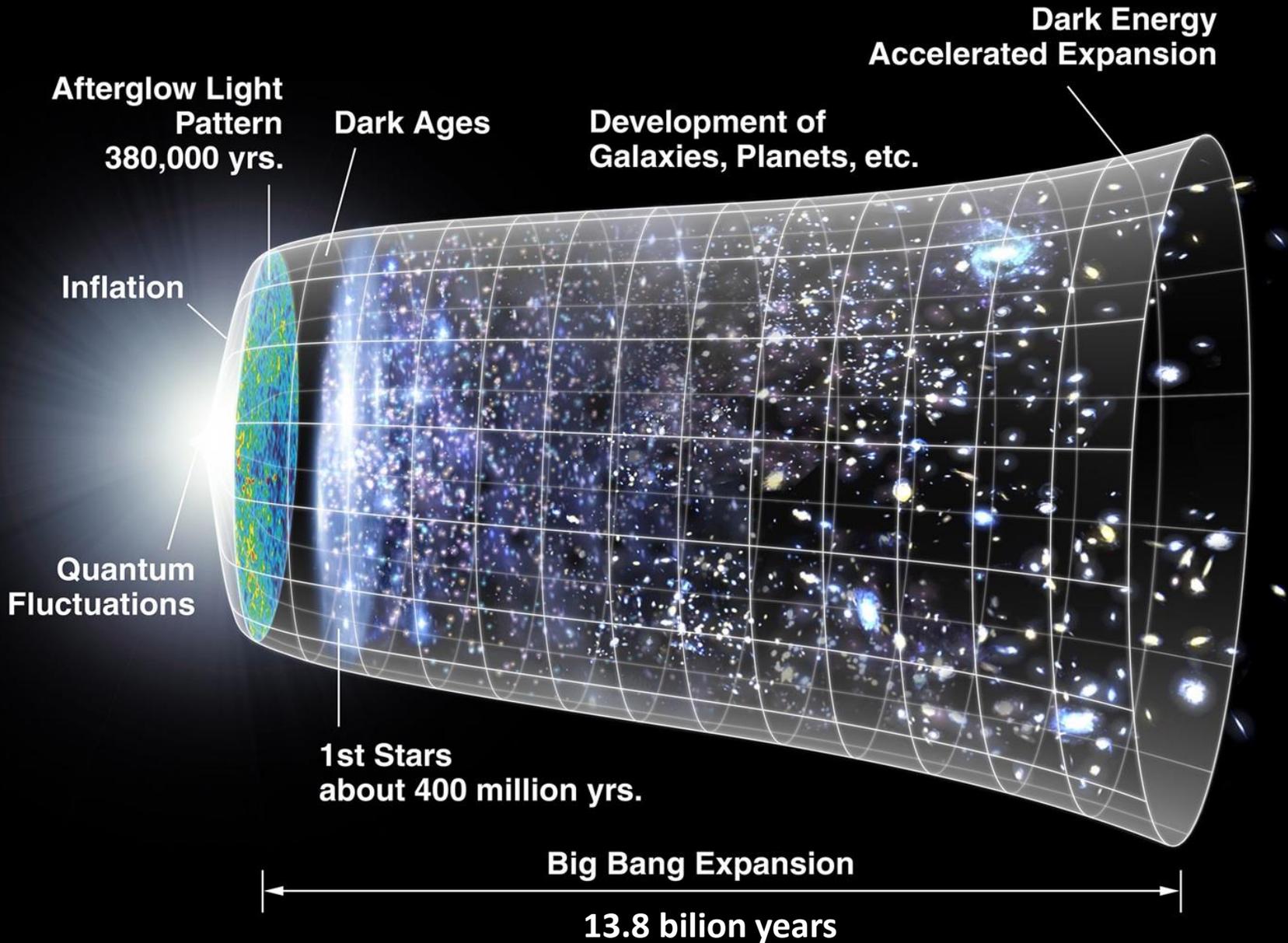
This chart has been made possible by the generous support of:

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U.S. National Science Foundation  
Lawrence Berkeley National Laboratory  
Stanford Linear Accelerator Center  
American Physical Society, Division of Particles and Fields  
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# What else do we know?





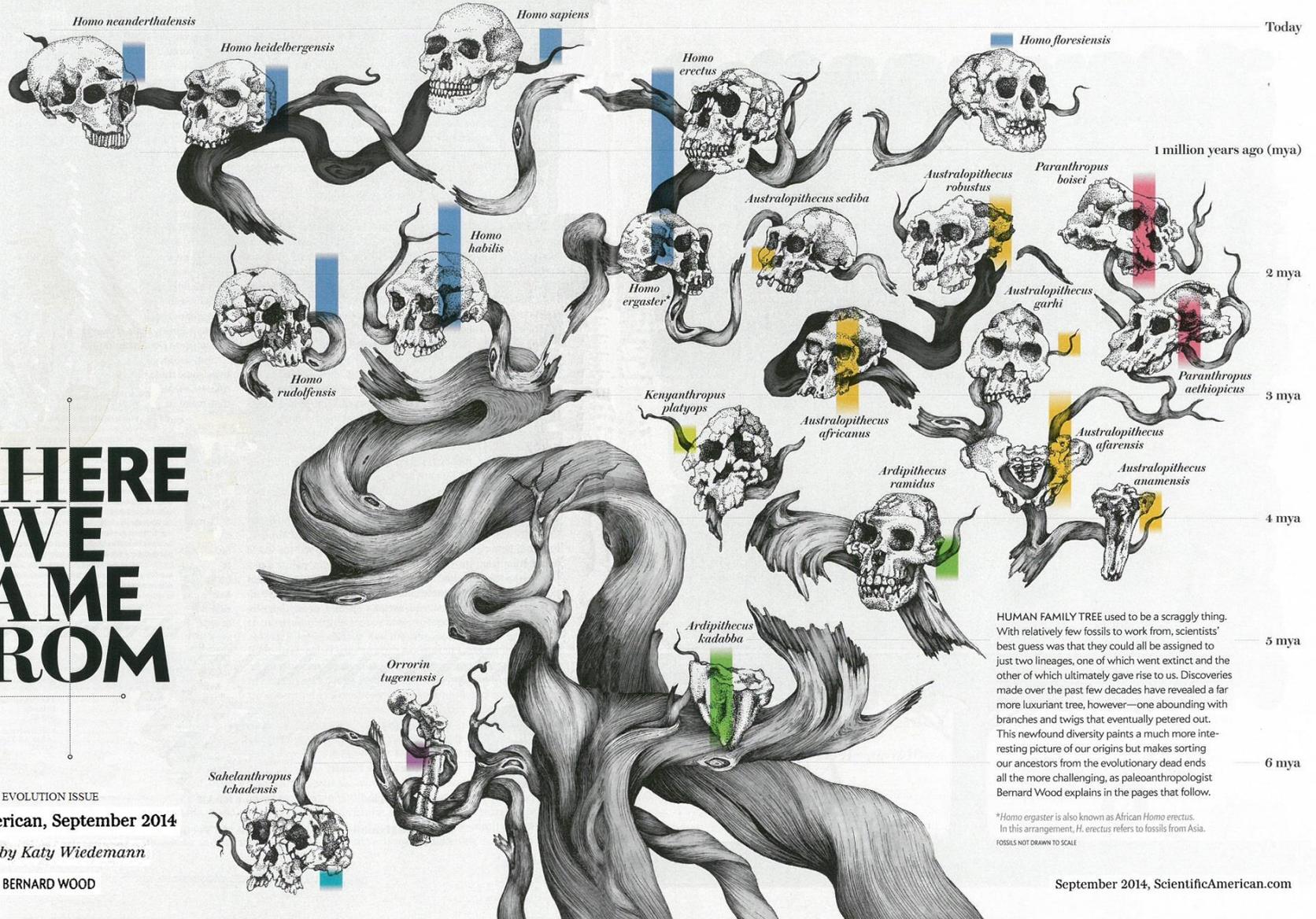
# WHERE WE CAME FROM

SPECIAL EVOLUTION ISSUE

Scientific American, September 2014

Illustration by Katy Wiedemann

SOURCE: BERNARD WOOD

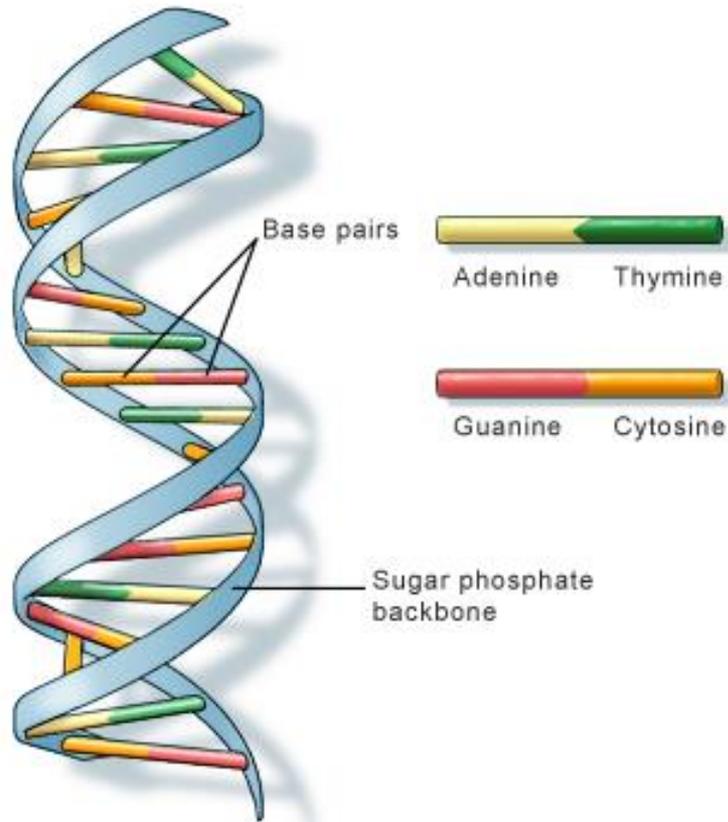


**HUMAN FAMILY TREE** used to be a scraggly thing. With relatively few fossils to work from, scientists' best guess was that they could all be assigned to just two lineages, one of which went extinct and the other of which ultimately gave rise to us. Discoveries made over the past few decades have revealed a far more luxuriant tree, however—one abounding with branches and twigs that eventually petered out. This newfound diversity paints a much more interesting picture of our origins but makes sorting our ancestors from the evolutionary dead ends all the more challenging, as paleoanthropologist Bernard Wood explains in the pages that follow.

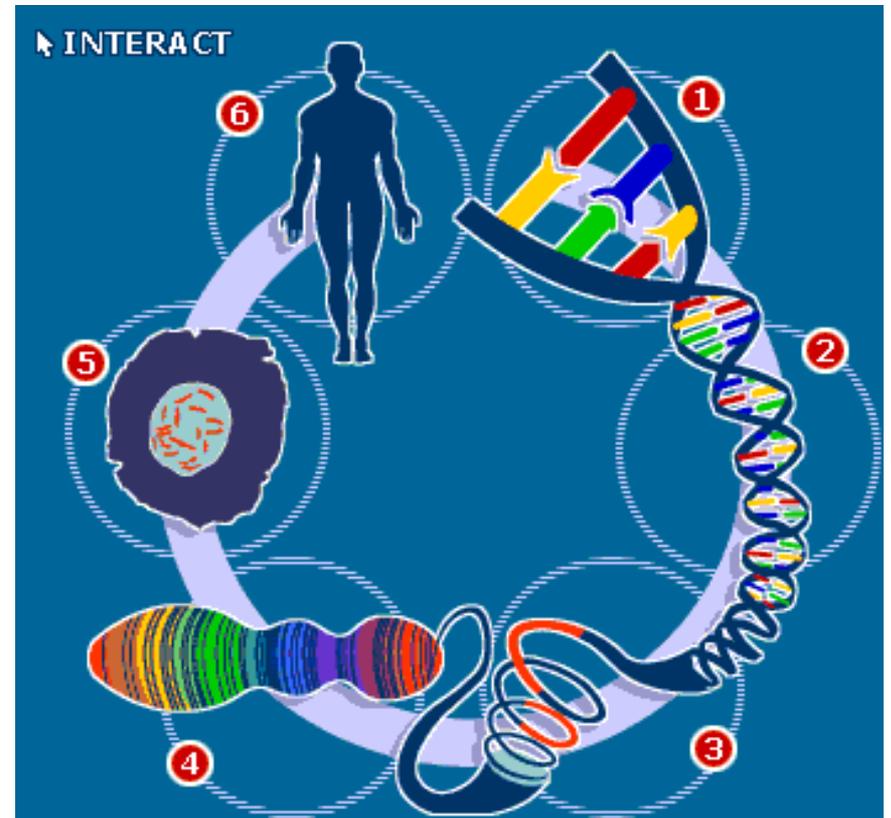
\*Homo ergaster is also known as African Homo erectus. In this arrangement, H. erectus refers to fossils from Asia. FOSSILS NOT DRAWN TO SCALE

# What else do we know?

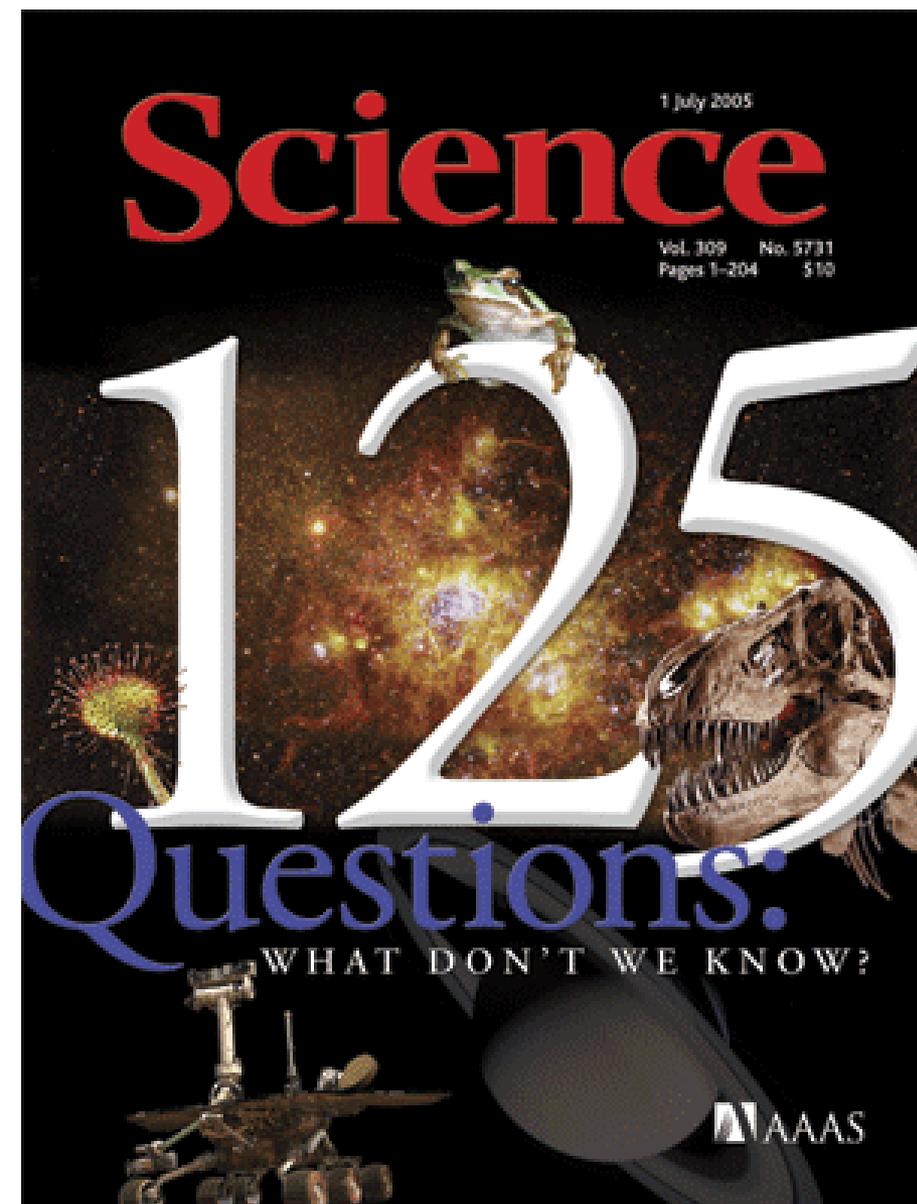
## ► DNA



U.S. National Library of Medicine



# What we don't know?



What is the universe made of?

What is the biological basis of consciousness?

Why do humans have so few genes?

To what extent are genetic variation and personal health linked?

Can the laws of physics be unified?

How much can human life span be extended?

What controls organ regeneration?

How can a skin cell become a nerve cell?

How does a single somatic cell become a whole plant?

How does earth's interior work?

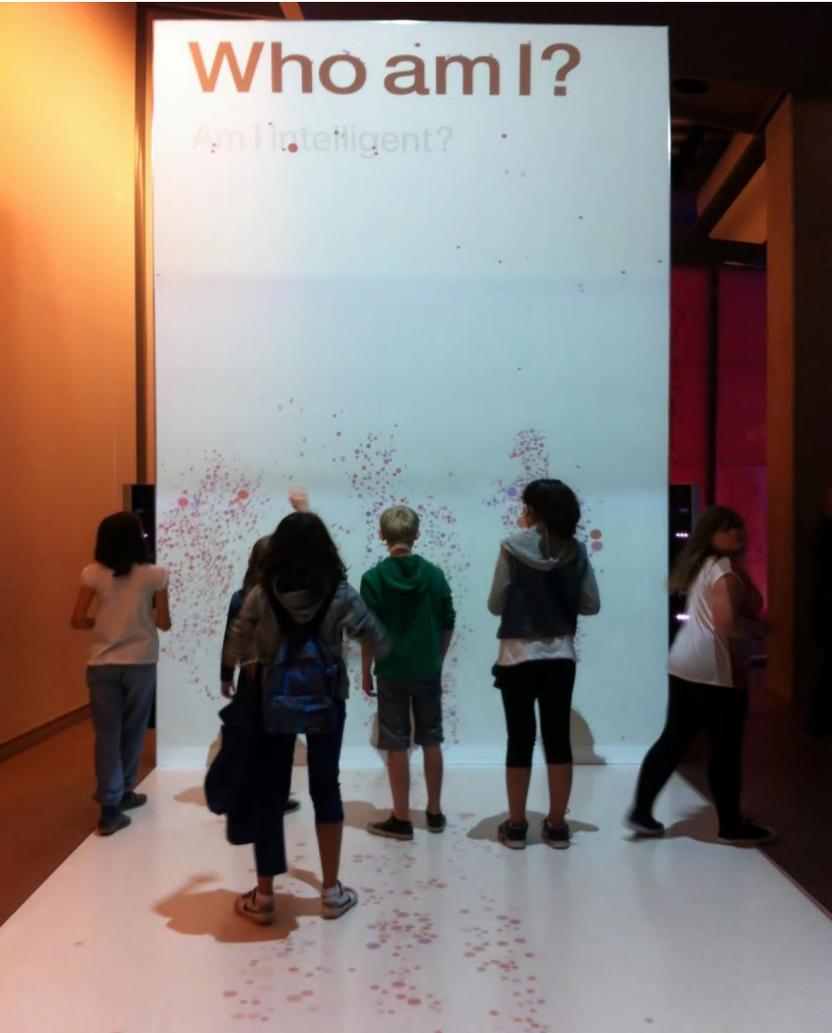
Are we alone in the universe?

How and where did life on earth arise?

What determines species diversity?

What genetic changes made us uniquely human?

# What we don't know?



- How are memories stored and retrieved?
- How did cooperative behavior evolve?
- How will big pictures emerge from a sea of biological data?
- How far can we push chemical self-assembly?
- What are the limits of conventional computing?
- Can we selectively shut off immune responses?
- Do deeper principles underlie quantum uncertainty and nonlocality?
- Is an effective hiv vaccine feasible?
- How hot will the greenhouse world be?
- What can replace cheap oil -- and when?
- Will malthus continue to be wrong?
- Is ours the only universe?
- What drove cosmic inflation?
- When and how did the first stars and galaxies form?

# What we don't know?



What's so weird about prime numbers?

How do we beat bacteria?

Can computers keep getting faster?

Will we ever cure cancer?

When can I have a robot butler?

What's at the bottom of the ocean?

What's at the bottom of a black hole?

How do we get more energy from the sun?

Is time travel possible?

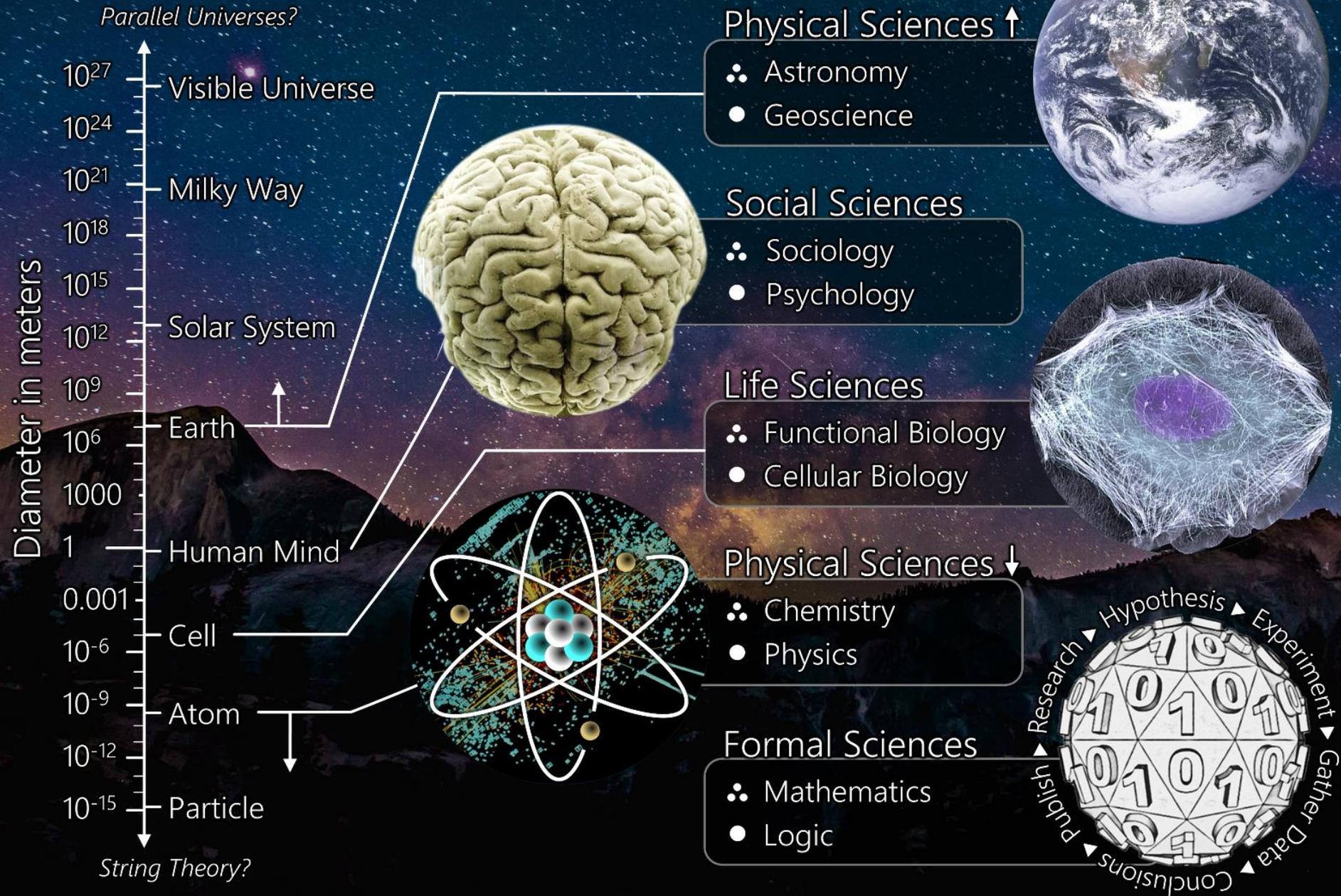
Why do we dream?

Why is there stuff?

Are there other universes?

Where do we put all the carbon?

# Scale of the Universe / Branches of Science





**SO YOU'RE TELLING ME**

**PEOPLE FROM YOUR COUNTRY THINK  
THAT FACEBOOK GIVES US FOOD FOR  
EVERY LIKE?**



# Eternal questions

---

What are we?

Where do we come from?

Where are we going?

---

# What are we?





**Human body consists of  
about**

**7 000 000 000 000 000  
000 000 000 000  
000**

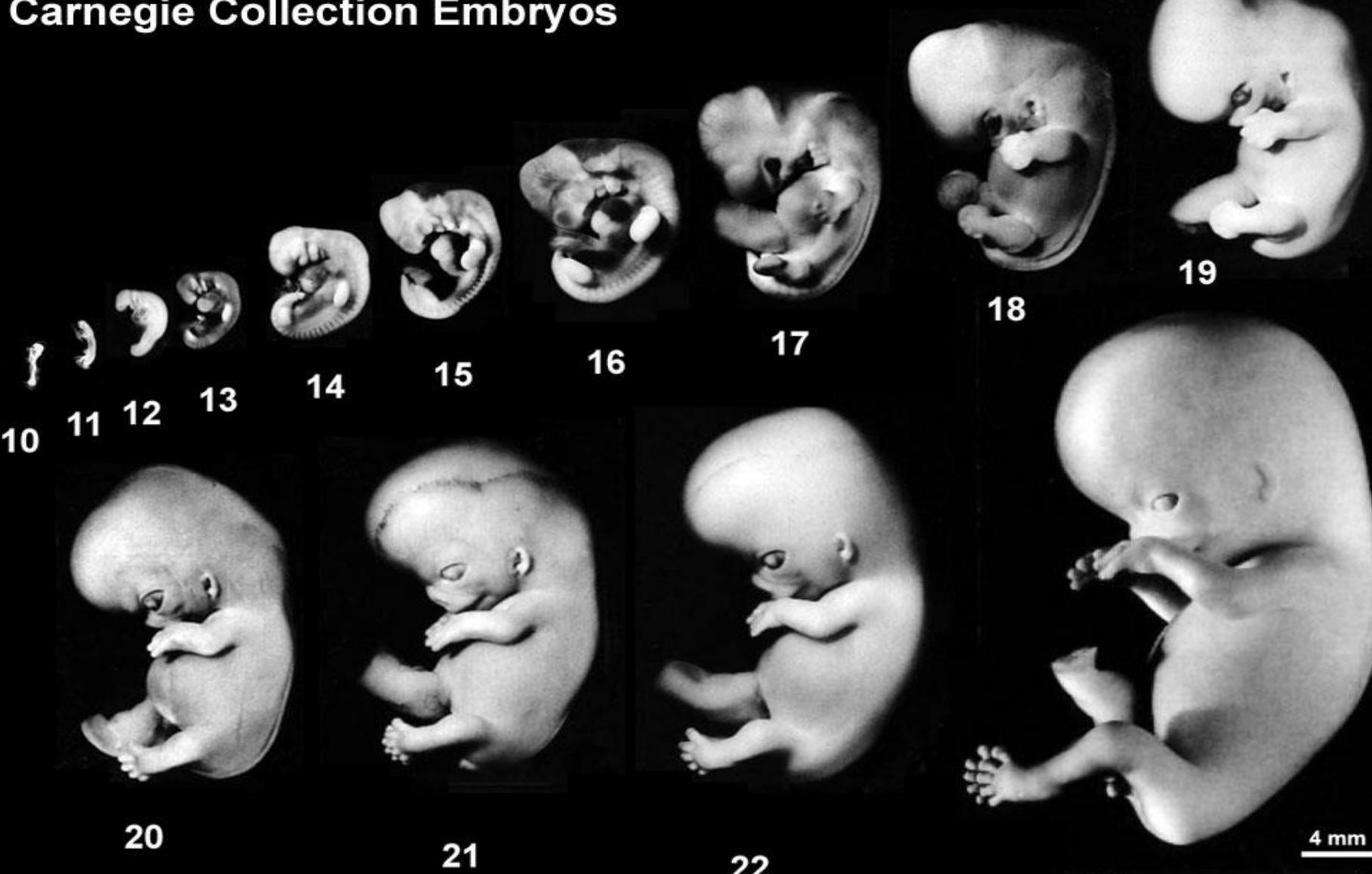
**Atoms**

**(7 x 10<sup>27</sup>)**





# Carnegie Collection Embryos



4 mm

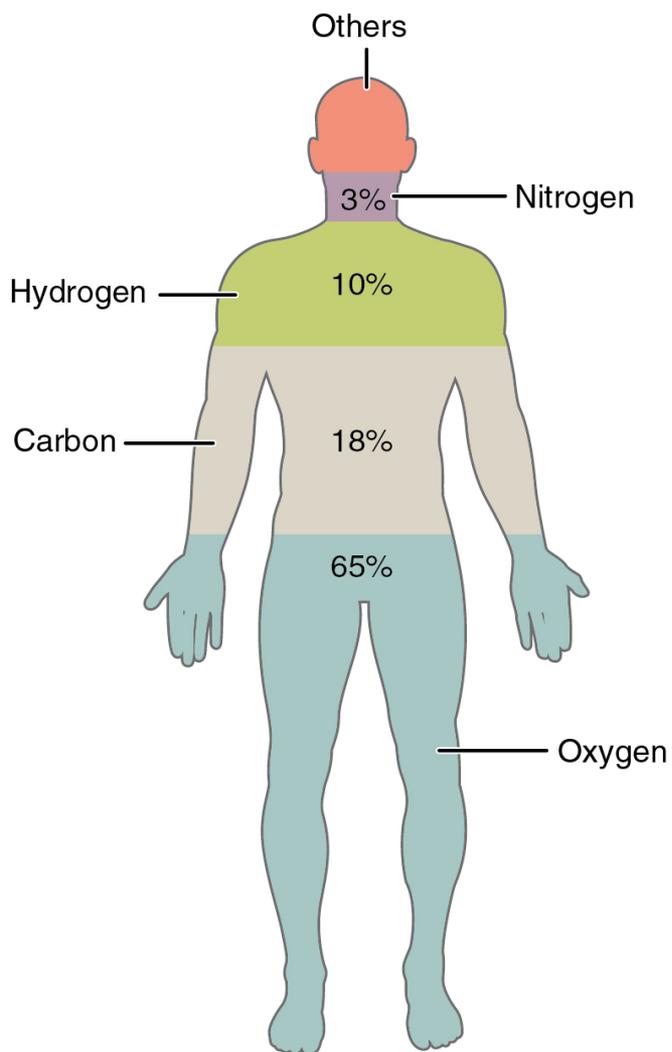


**$7 \times 10^{27}$   
Atoms**



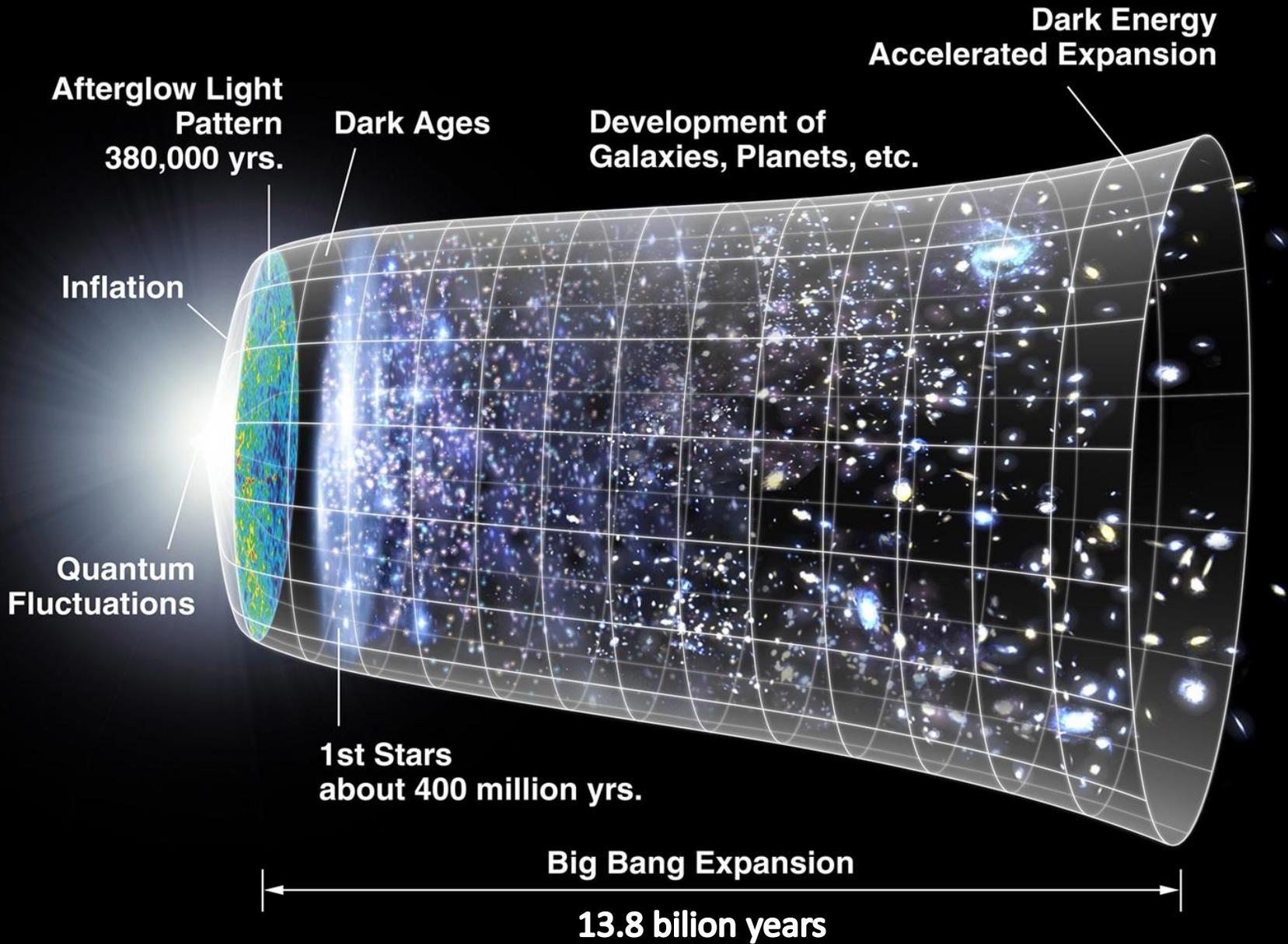
# Where do we come from?





Element	Symbol	Percentage in Body
Oxygen	O	65.0
Carbon	C	18.5
Hydrogen	H	9.5
Nitrogen	N	3.2
Calcium	Ca	1.5
Phosphorus	P	1.0
Potassium	K	0.4
Sulfur	S	0.3
Sodium	Na	0.2
Chlorine	Cl	0.2
Magnesium	Mg	0.1
Trace elements include boron (B), chromium (Cr), cobalt (Co), copper (Cu), fluorine (F), iodine (I), iron (Fe), manganese (Mn), molybdenum (Mo), selenium (Se), silicon (Si), tin (Sn), vanadium (V), and zinc (Zn).		less than 1.0





# Big Bang

15 thousand million years

1 thousand million years

300 thousand years

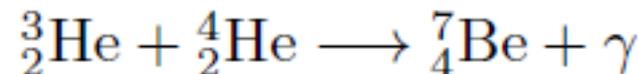
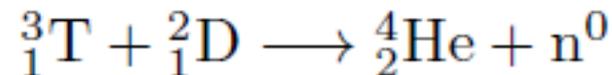
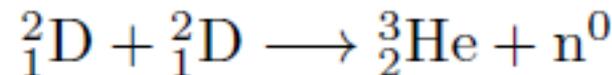
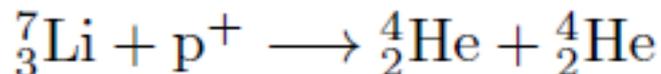
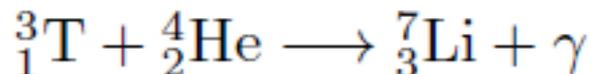
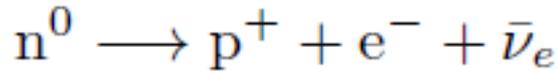
3 minutes

1 second

$10^{-10}$  seconds

$10^{-34}$  seconds

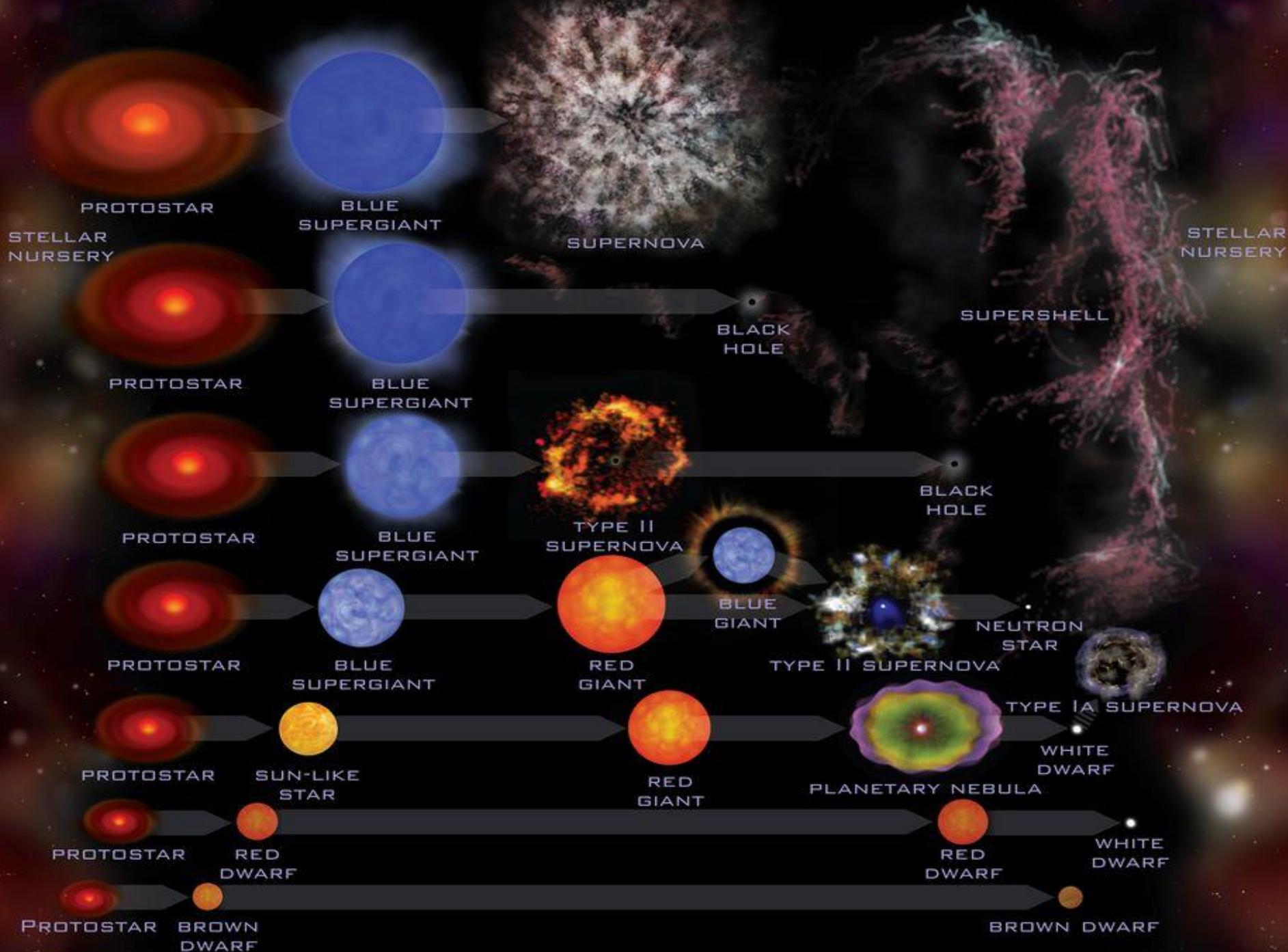
$10^{-43}$  seconds

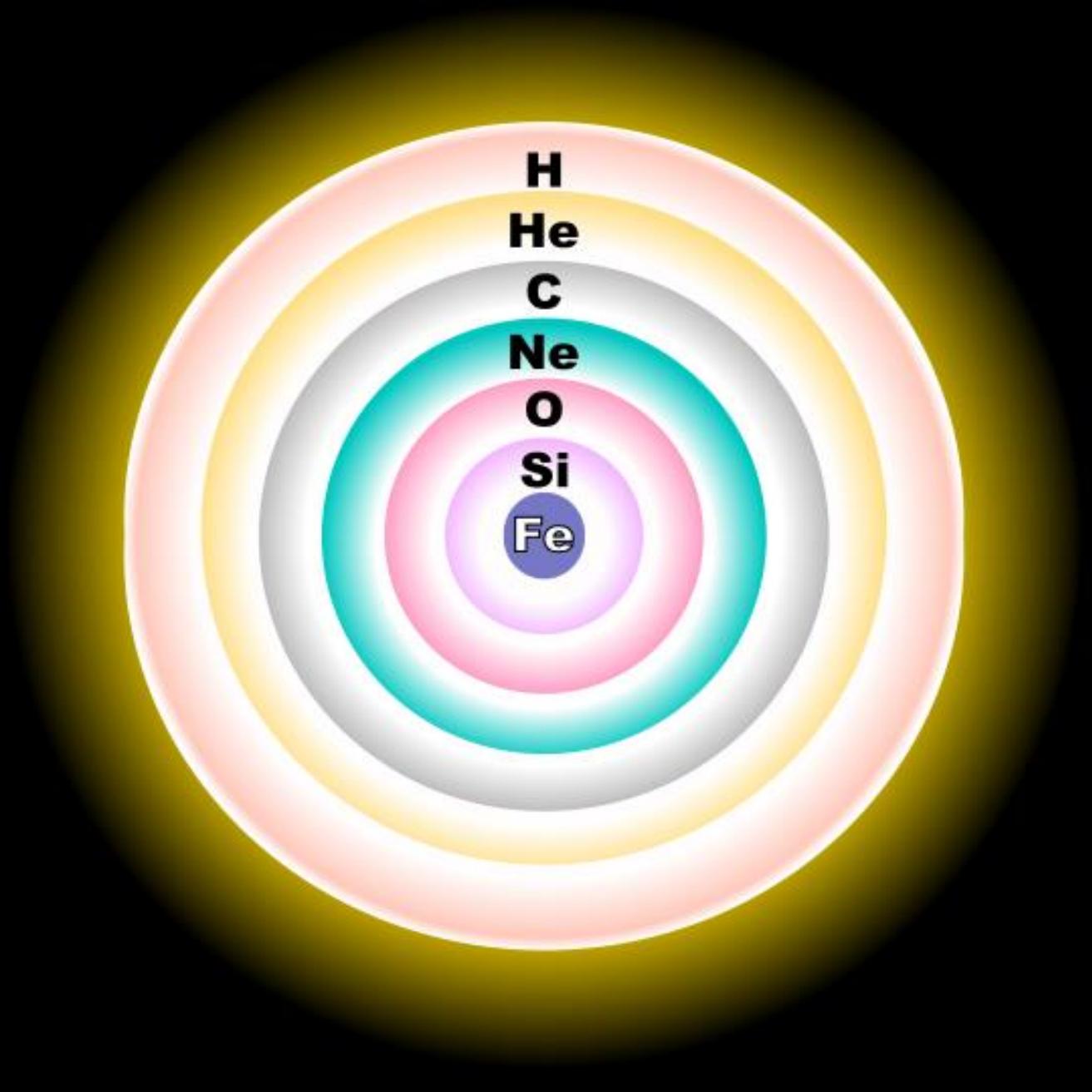


3 degrees K

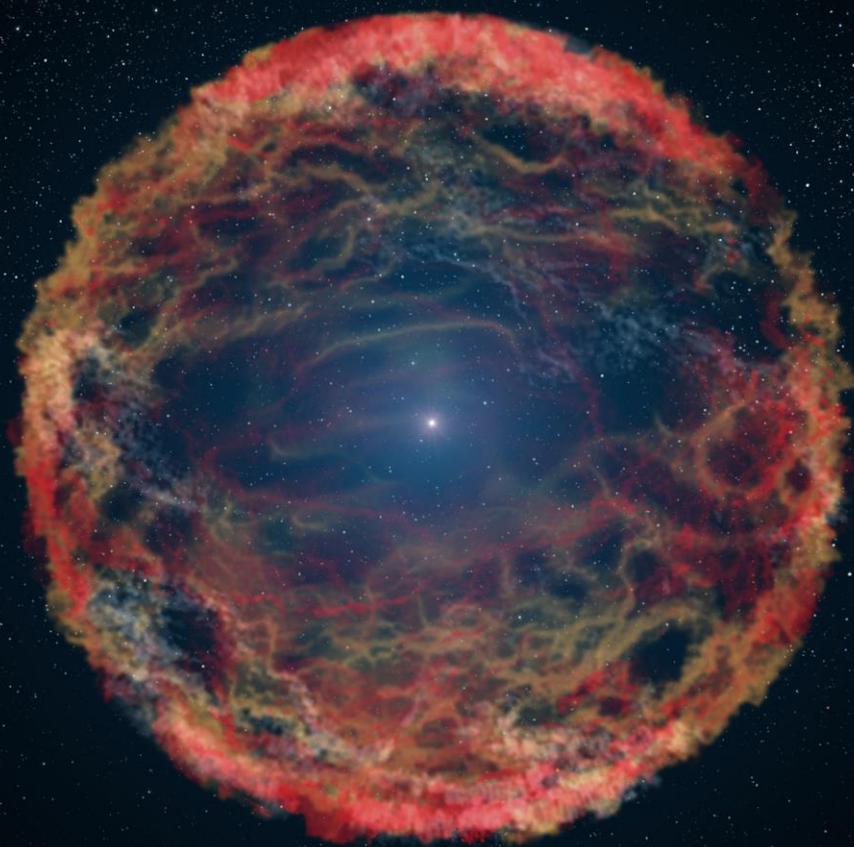








**H**  
**He**  
**C**  
**Ne**  
**O**  
**Si**  
**Fe**









HE IS THE STAR

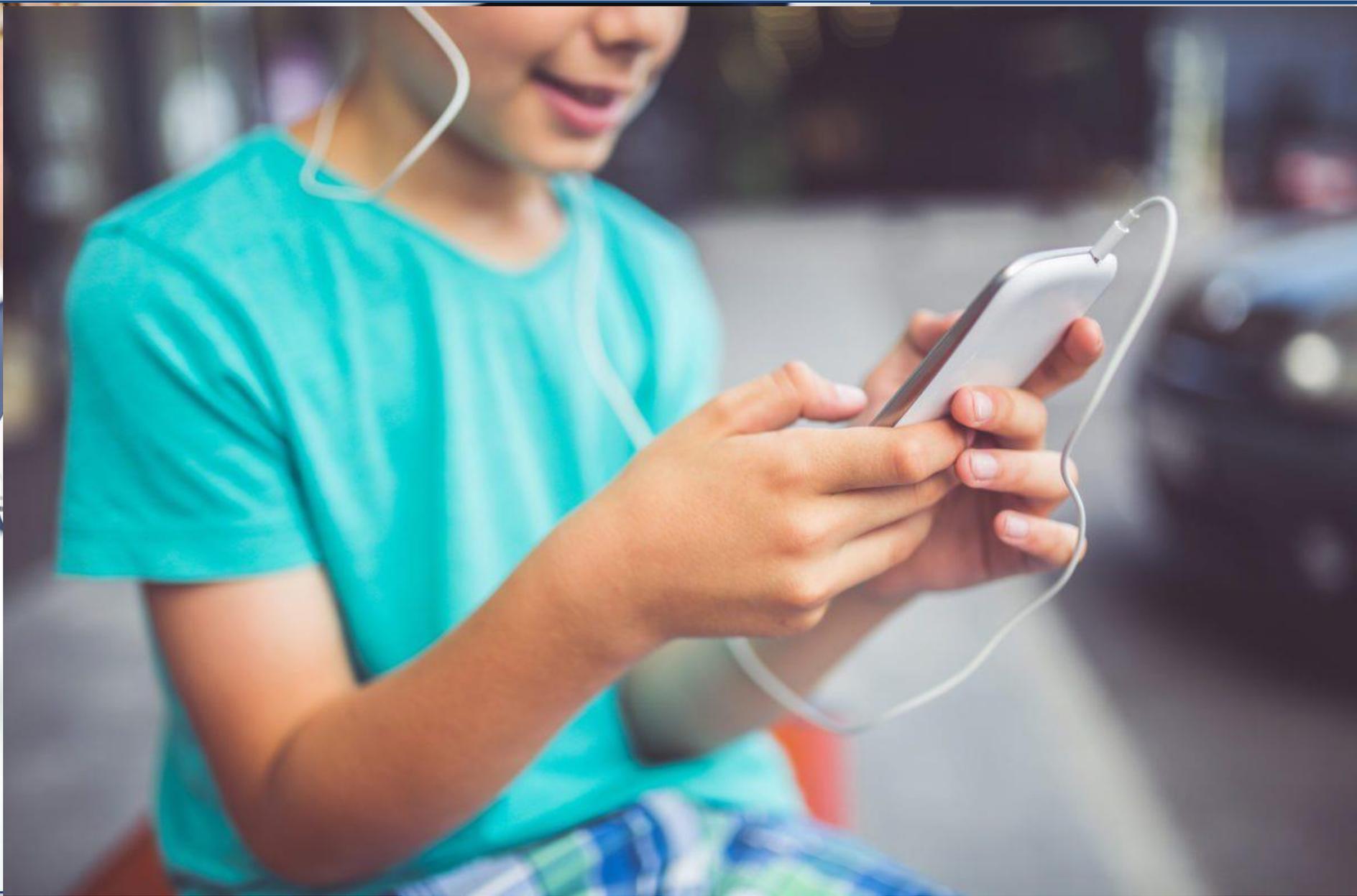
BUT NOT ONLY HIM ...

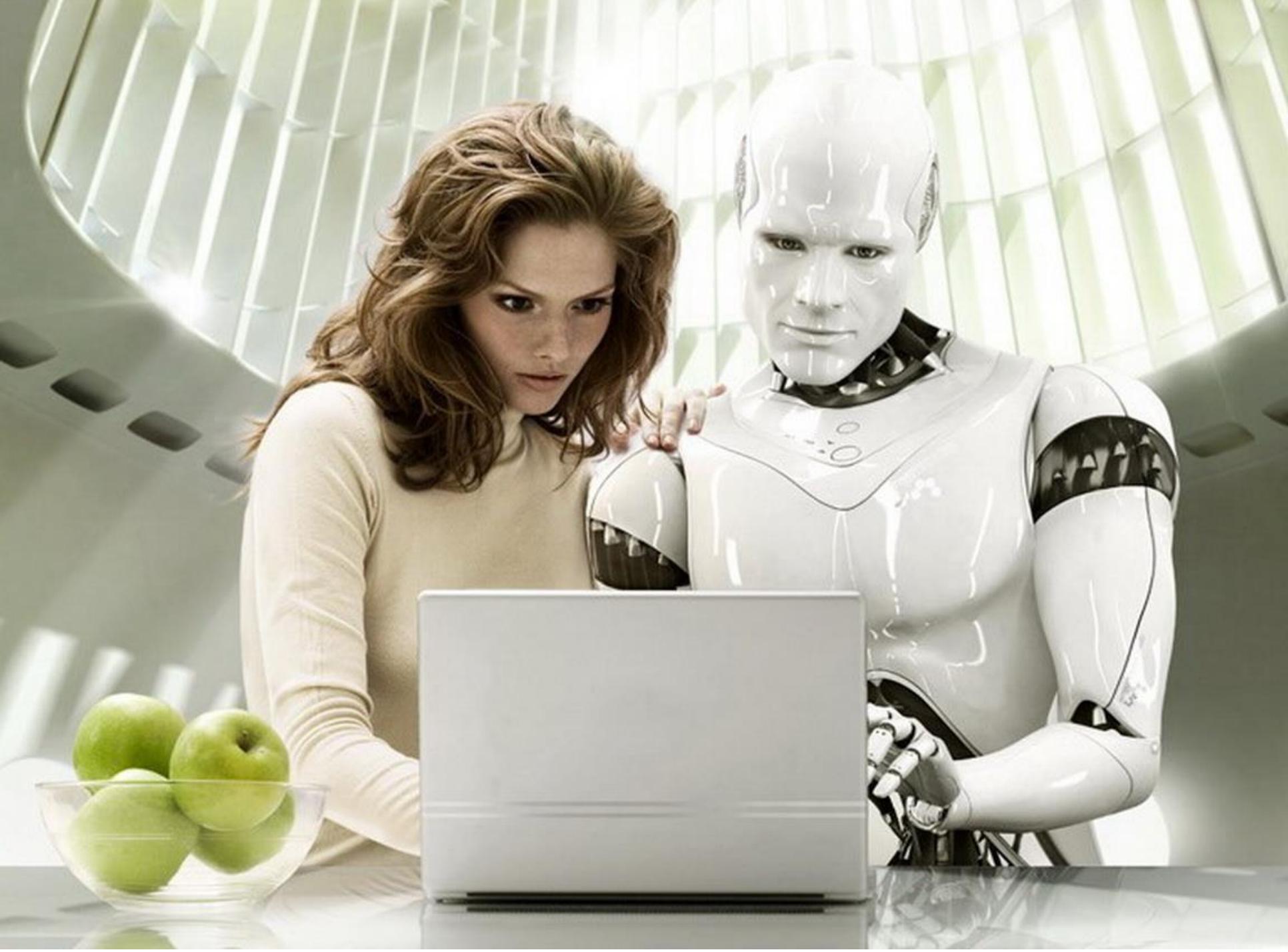
**I'M THE STAR!**



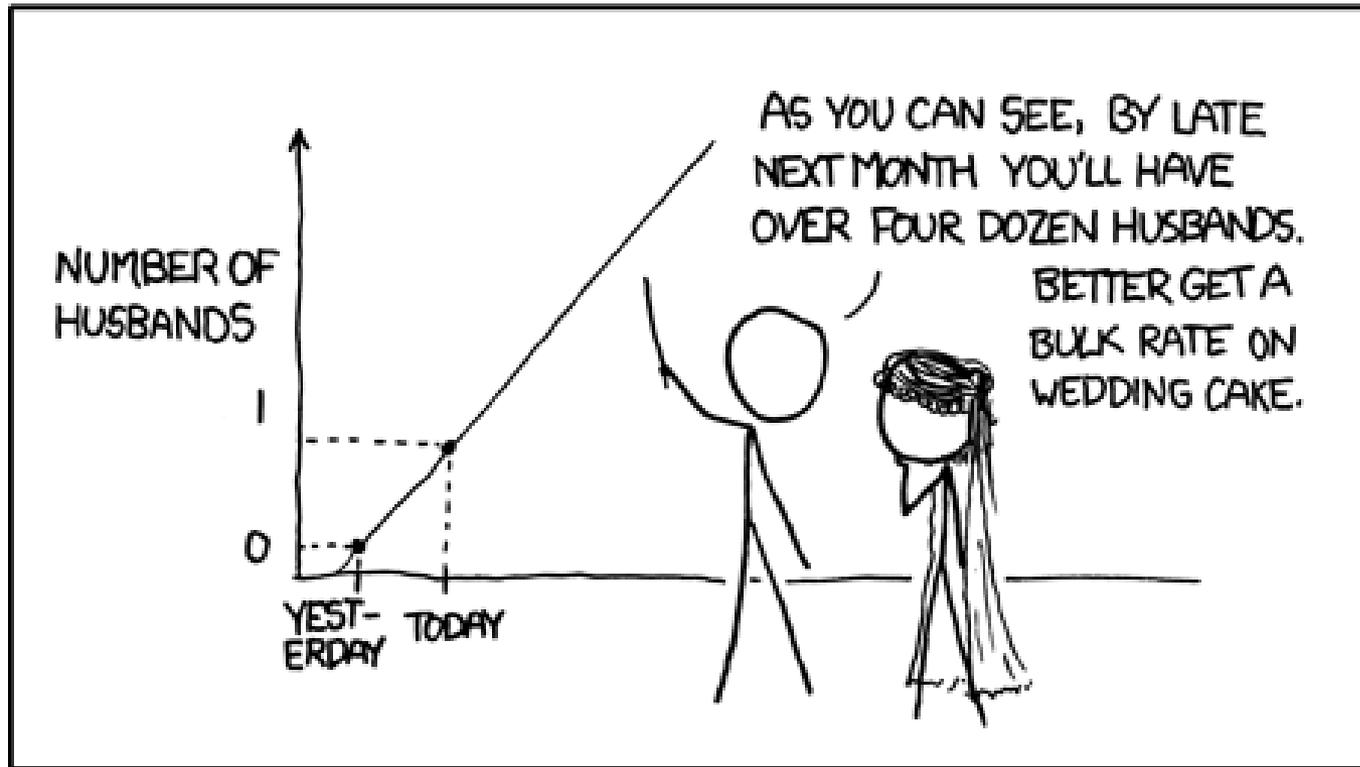
**AND I DESERVE SUCH A TREATMENT!**

**WE ARE CYBORGS!**

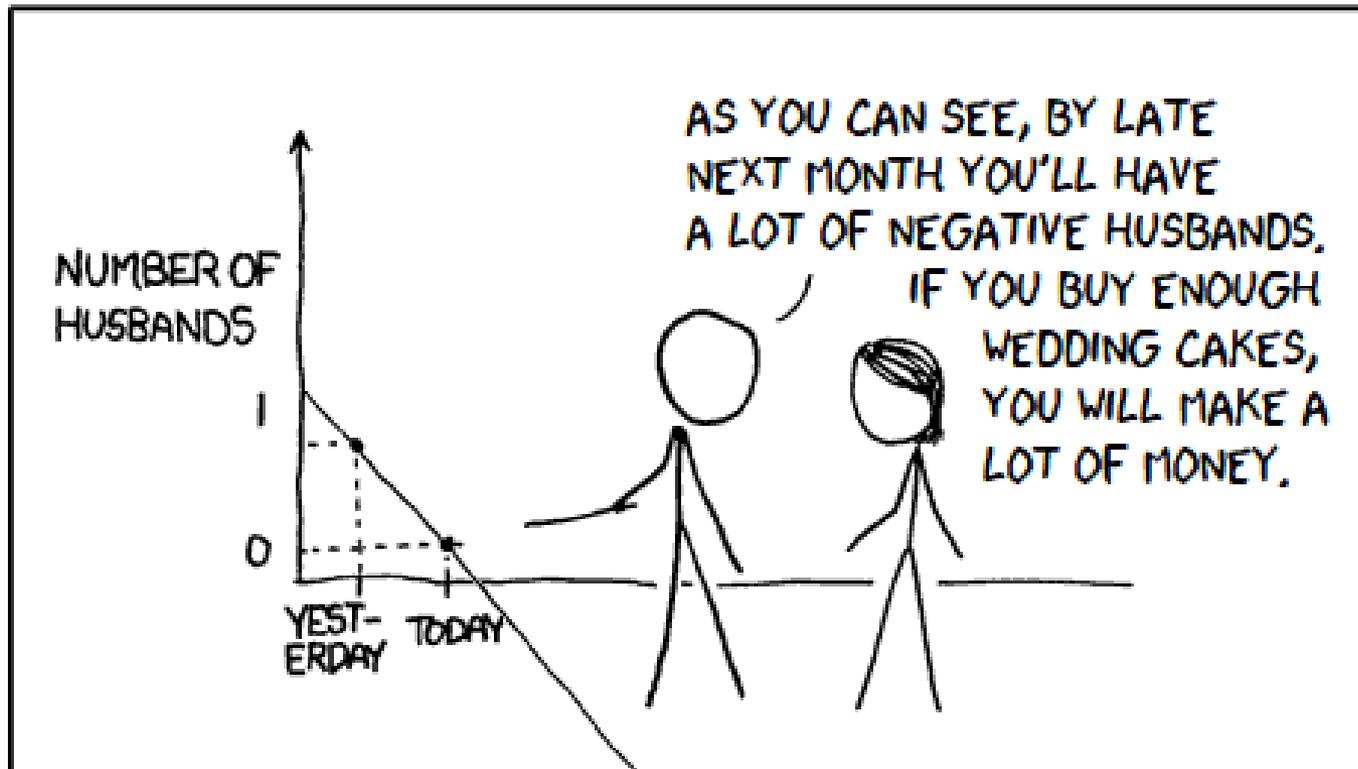


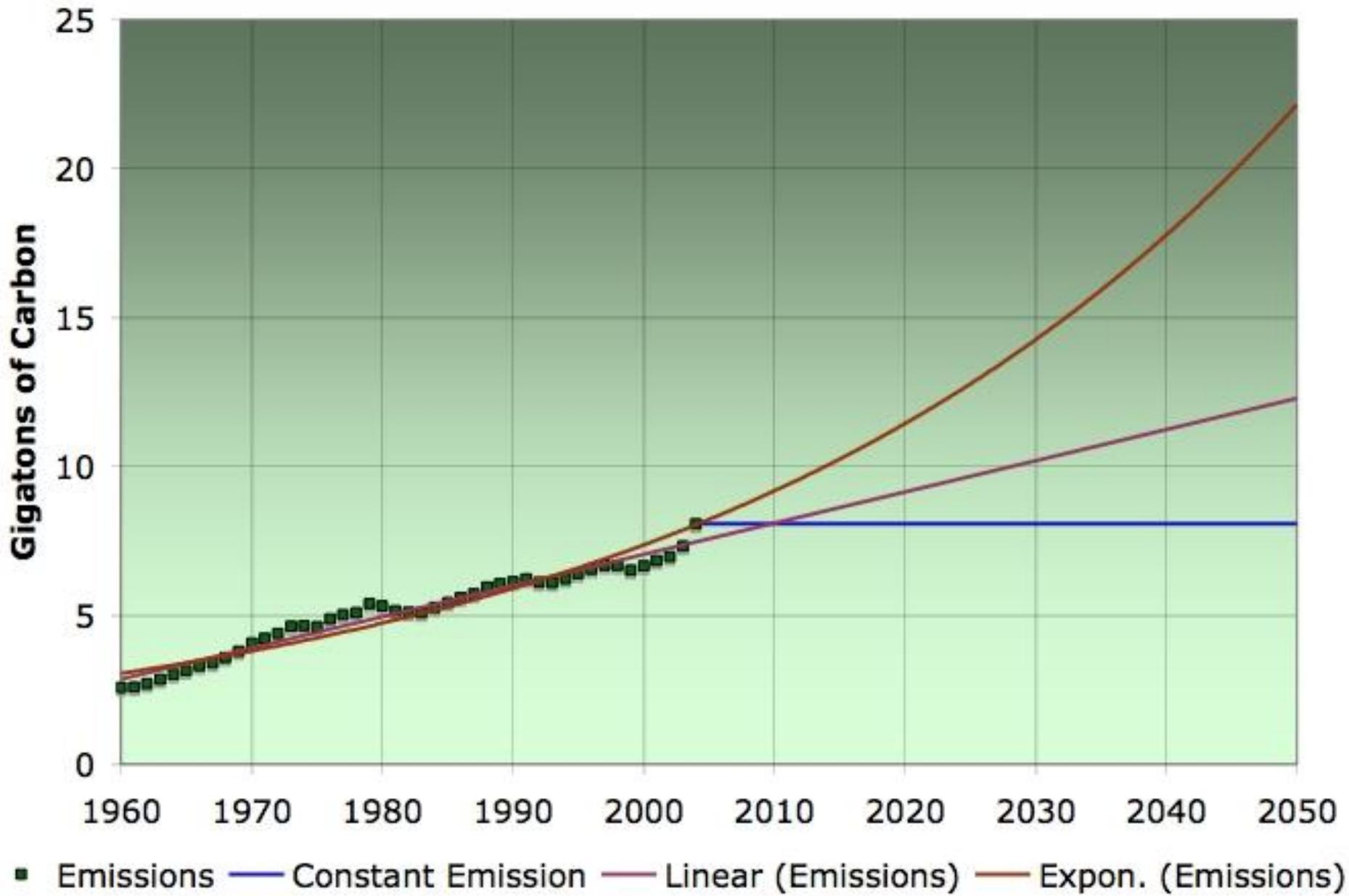


# MY HOBBY: EXTRAPOLATING

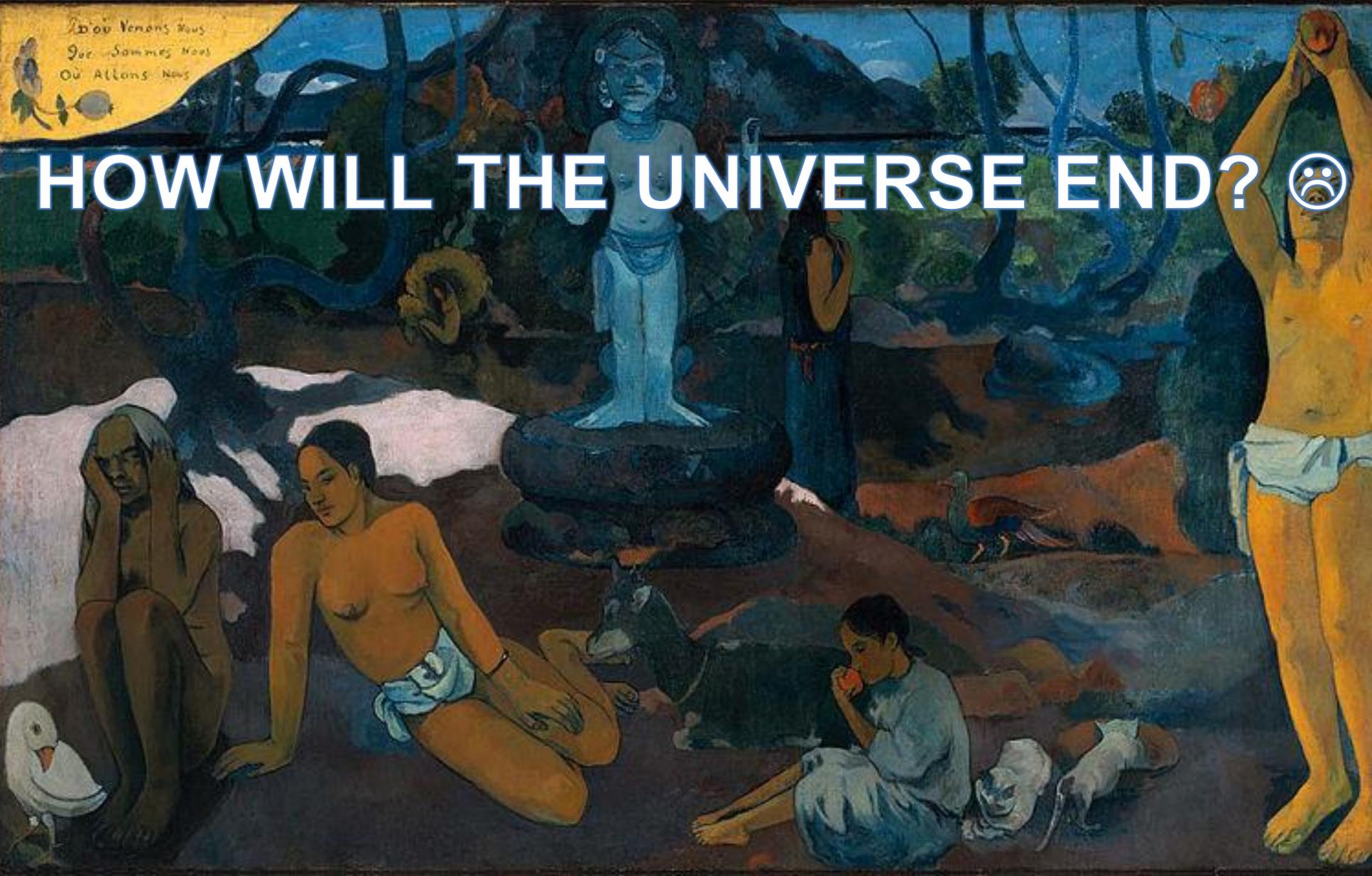


# MY HOBBY: EXTRAPOLATING





# Where are we going?

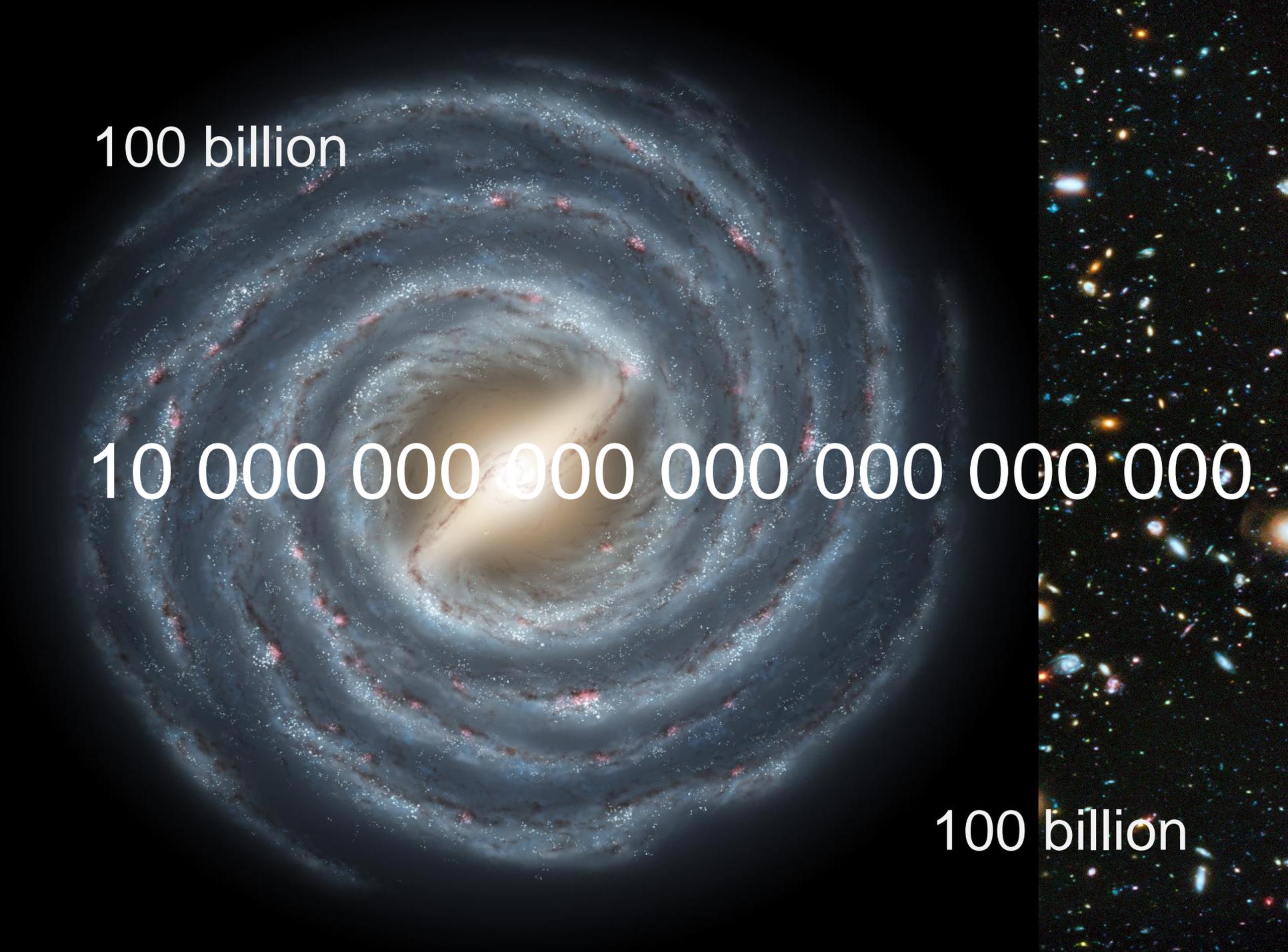


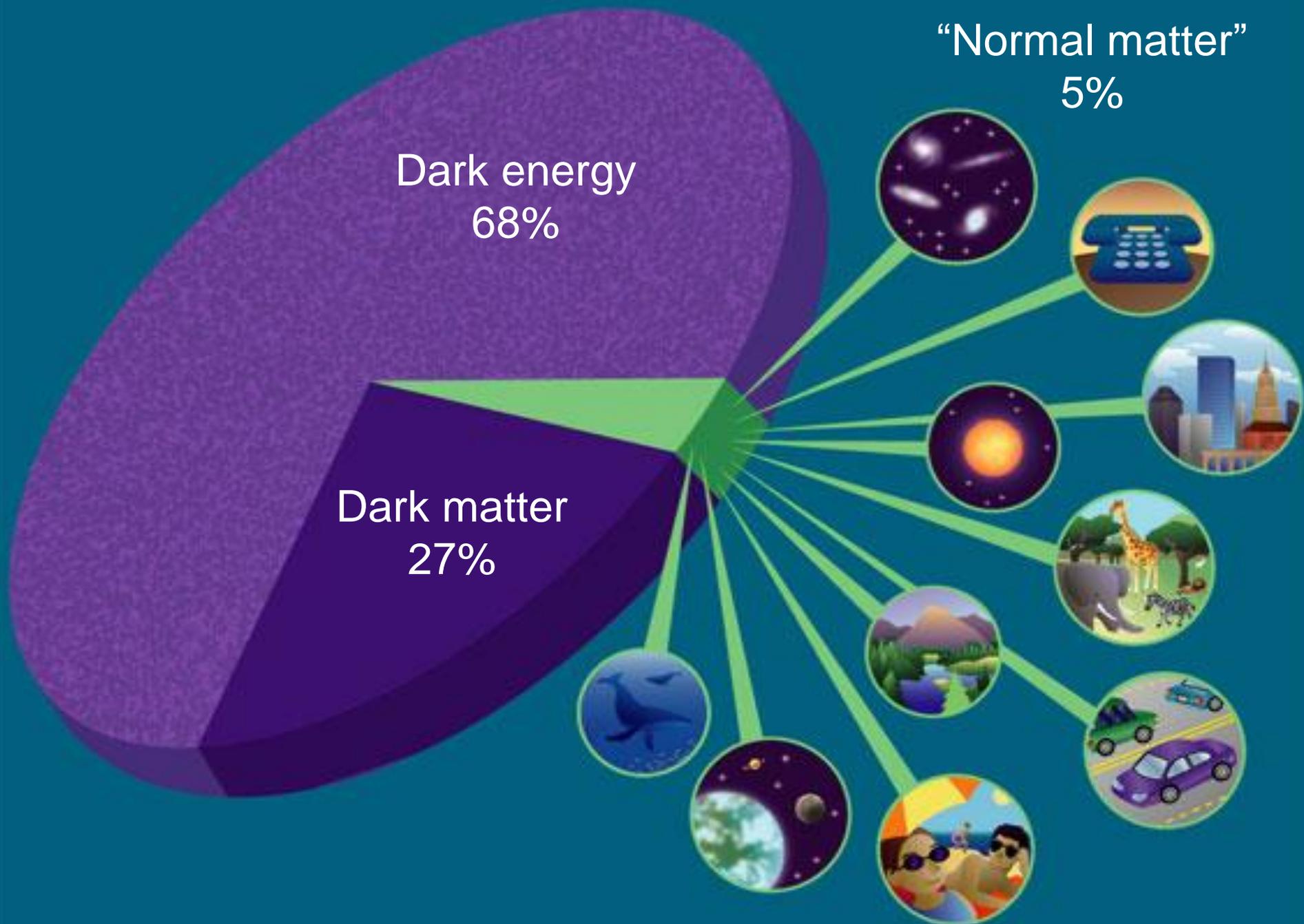
HOW WILL THE UNIVERSE END? ☹️

100 billion

10 000 000 000 000 000 000 000 000

100 billion





“Normal matter”  
5%

Dark energy  
68%

Dark matter  
27%

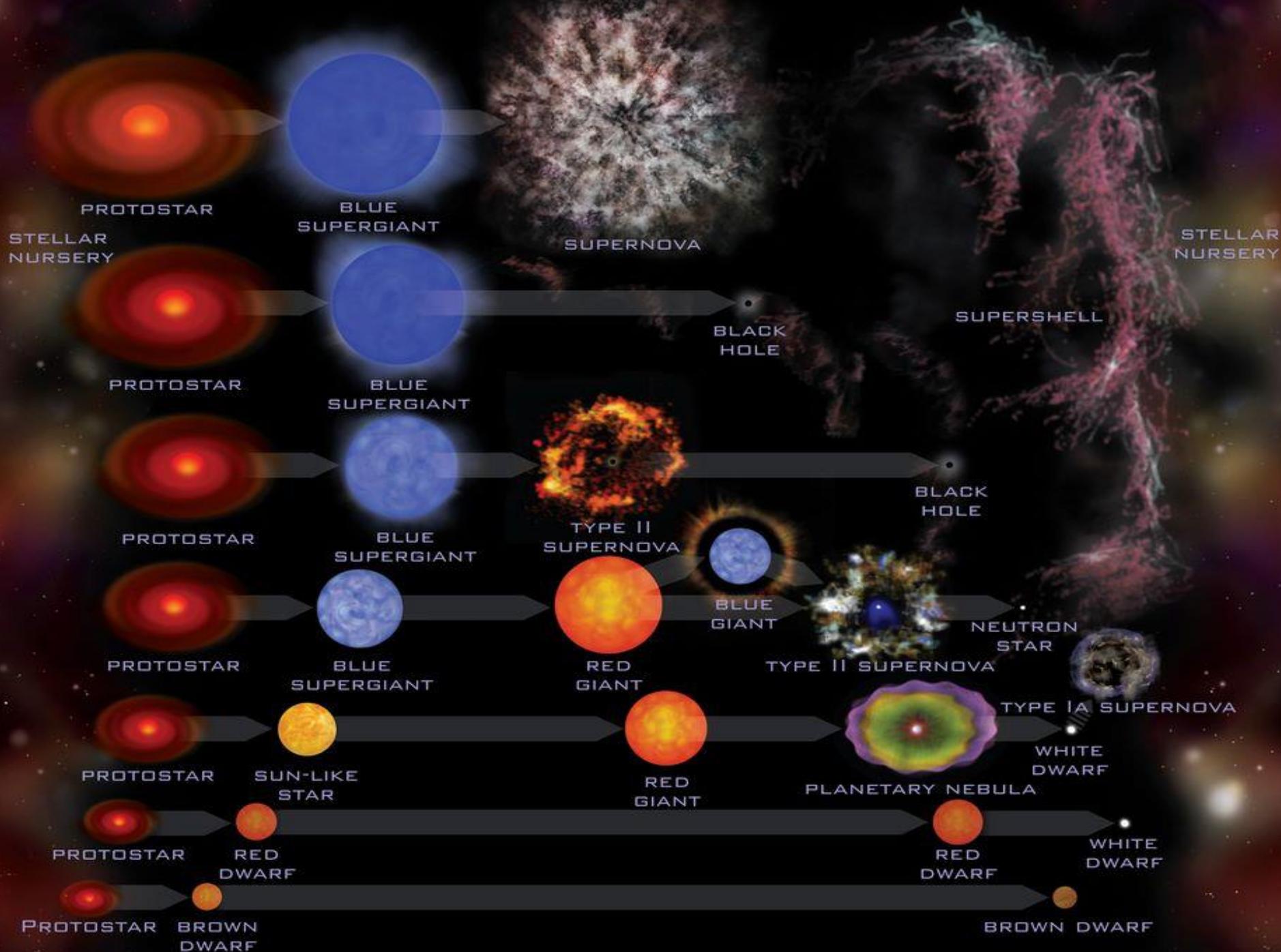
IT'S TIME TO MEET  
THE **TRUE** END



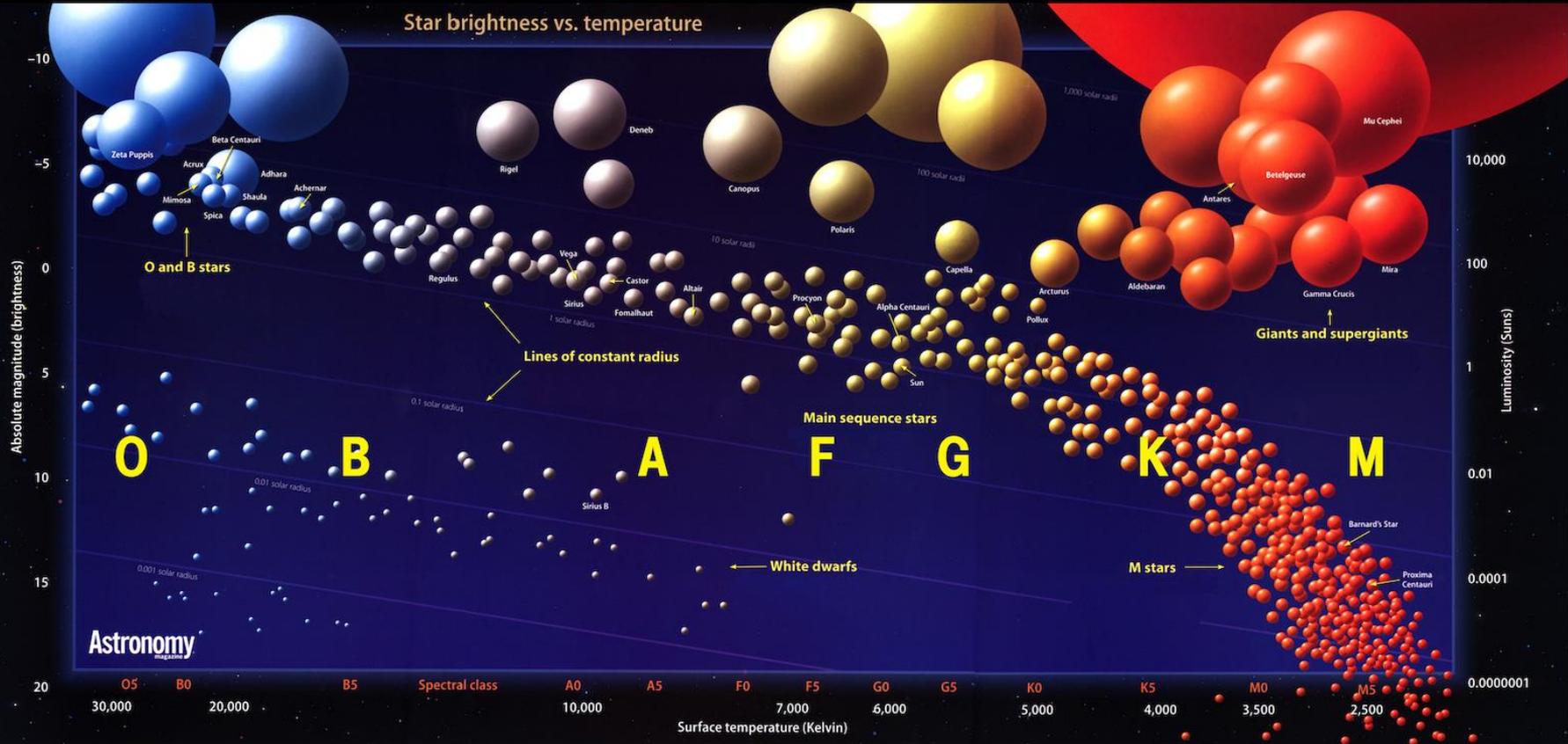
# Where are we going?



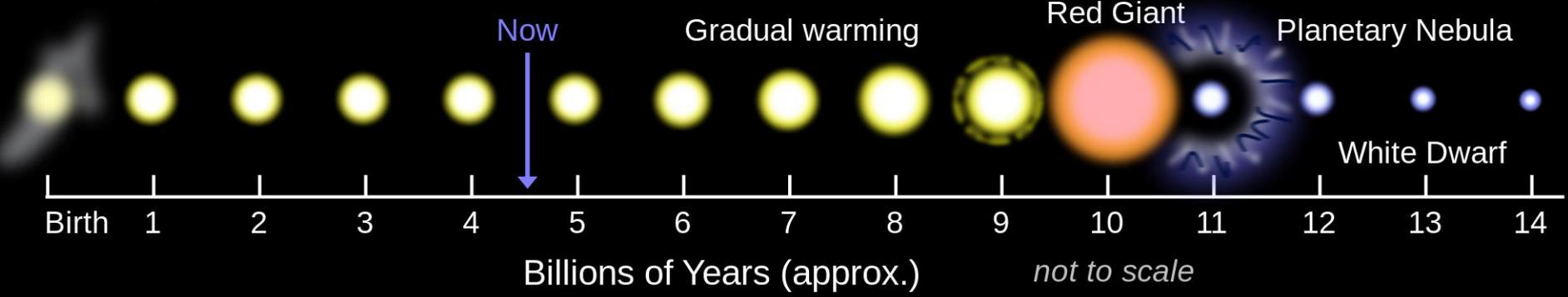
HOW WILL THE UNIVERSE END? ☹️  
HOW WILL THIS PART OF  
THE UNIVERSE END? ☹️\_



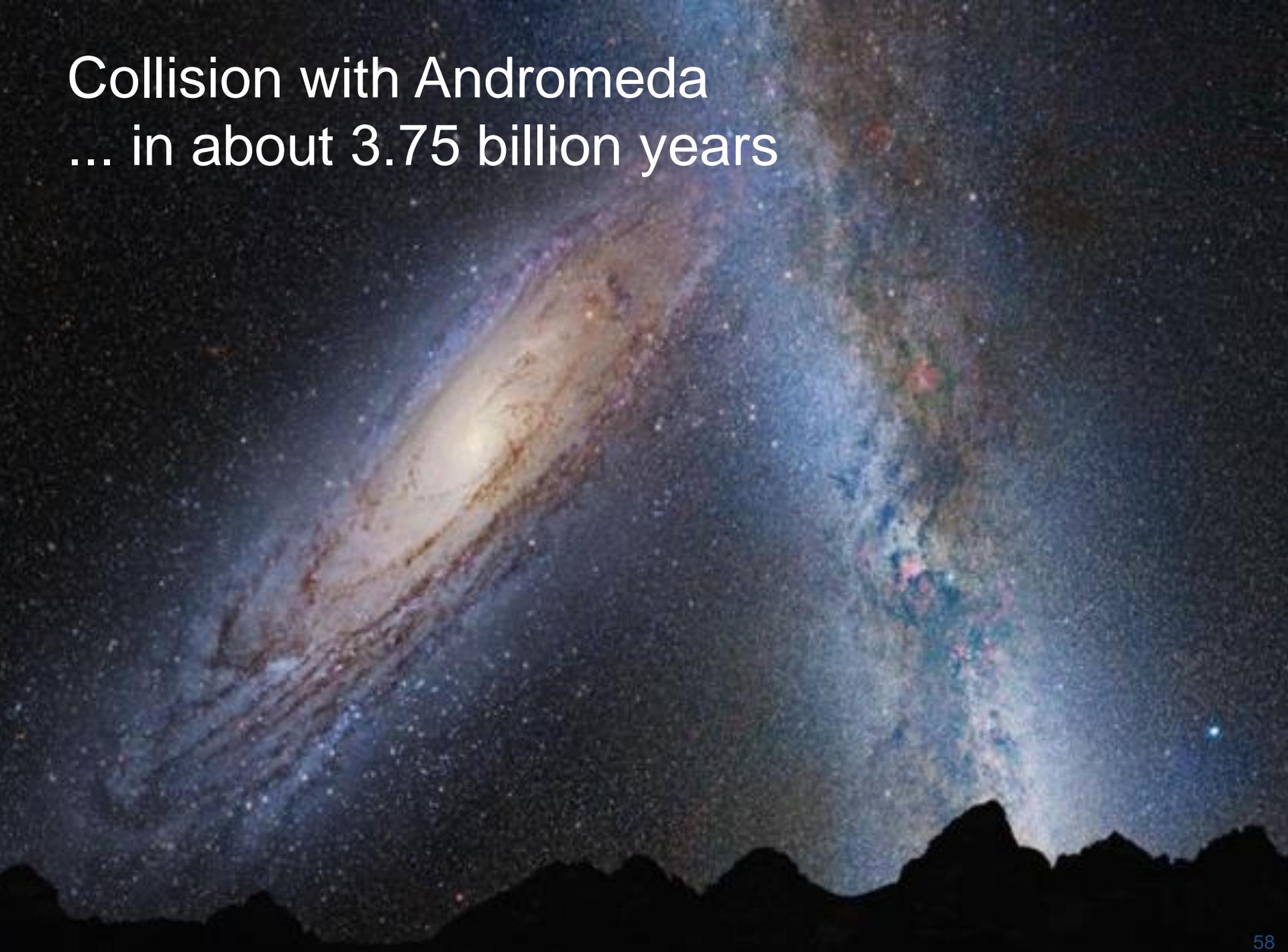
# Star brightness vs. temperature



# Life Cycle of the Sun



Collision with Andromeda  
... in about 3.75 billion years



A close-up photograph of a hand holding a white rectangular sign. The sign has the text "TIME FOR SOME GOOD NEWS!" written in bold, red, uppercase letters. The background is a blurred, light blue and white pattern, possibly a shirt or fabric.

**TIME FOR  
SOME GOOD  
NEWS!**

# The world in 1918



Bubbles

FACTS

TEACH

ABOUT

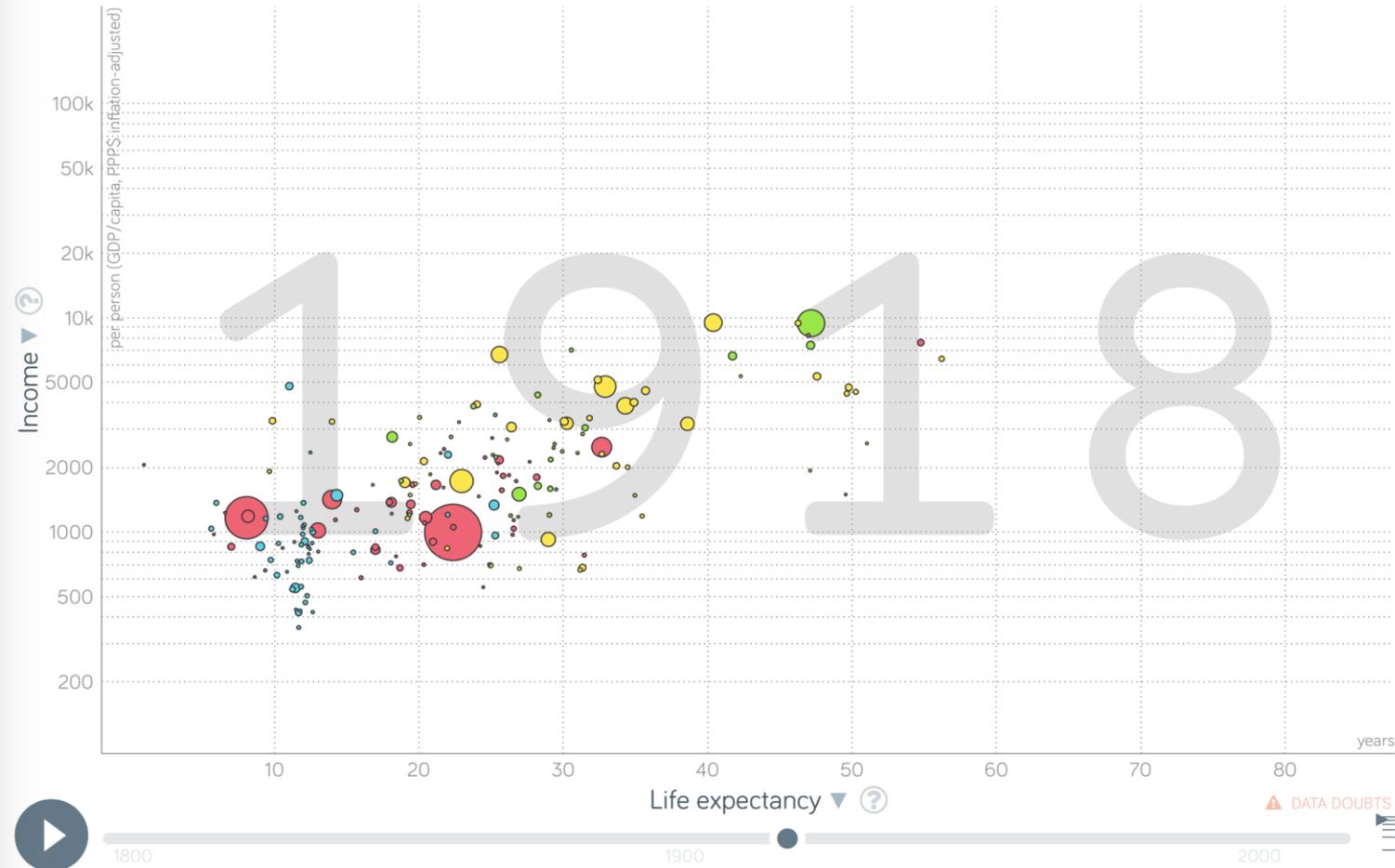


HOW TO USE

Share



English



Color World Regions



Select Search...

- Afghanistan
- Albania
- Algeria
- Andorra
- Angola
- Antigua and Barbuda
- Argentina
- Armenia
- Australia
- Austria

Size Population, total

Zoom 100%



# The world today



Color World Regions



Select

- Afghanistan
- Albania
- Algeria
- Andorra
- Angola
- Antigua and Barbuda
- Argentina
- Armenia
- Australia
- Austria

Size Population, total

Zoom 100%

OPTIONS    EXPAND    PRESENT

# Optimism and media

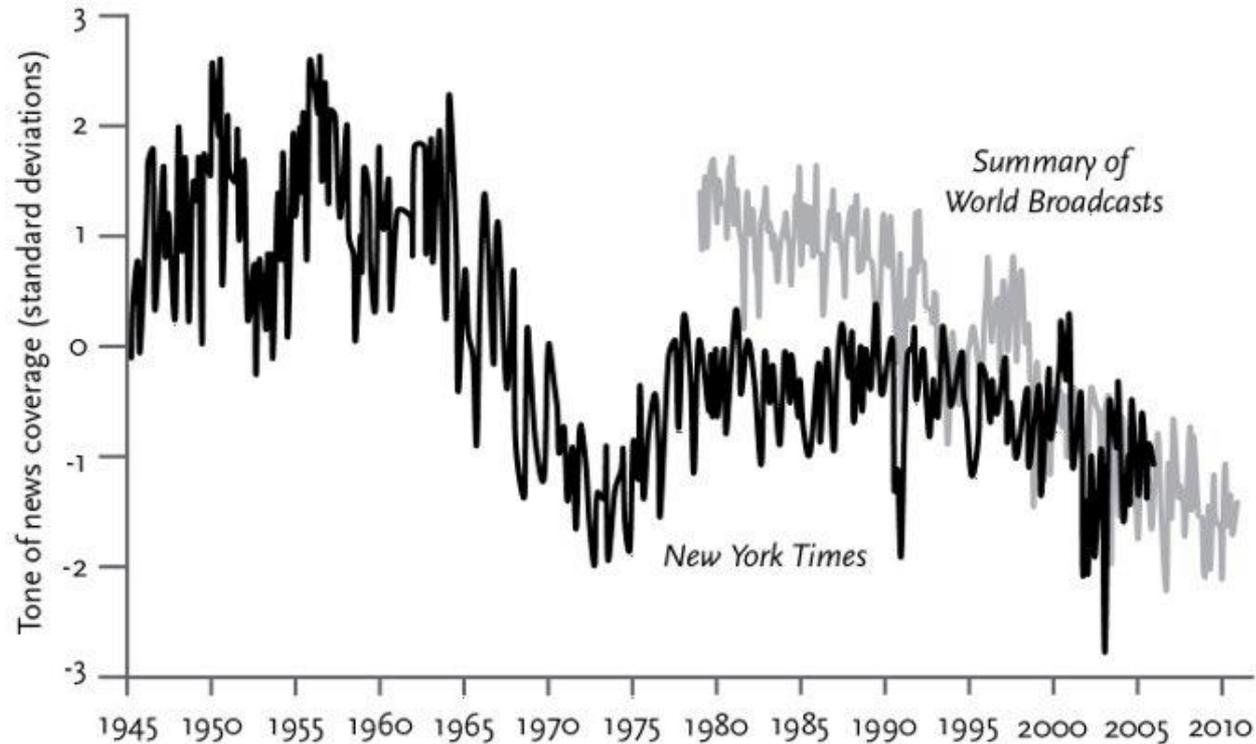


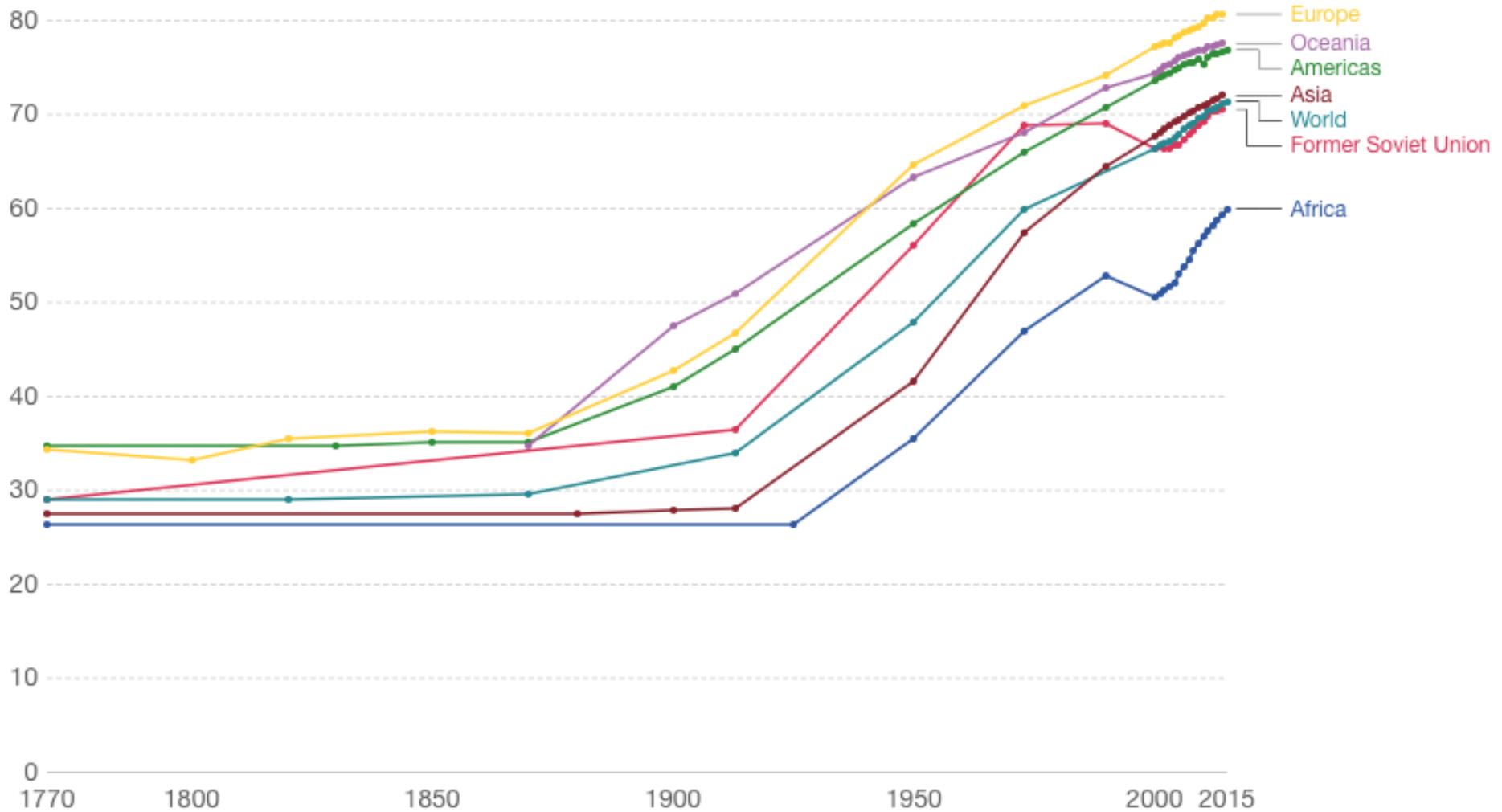
Figure 4-1: Tone of the news, 1945–2010

**Source:** Leetaru 2011. Plotted by month, beginning in January.





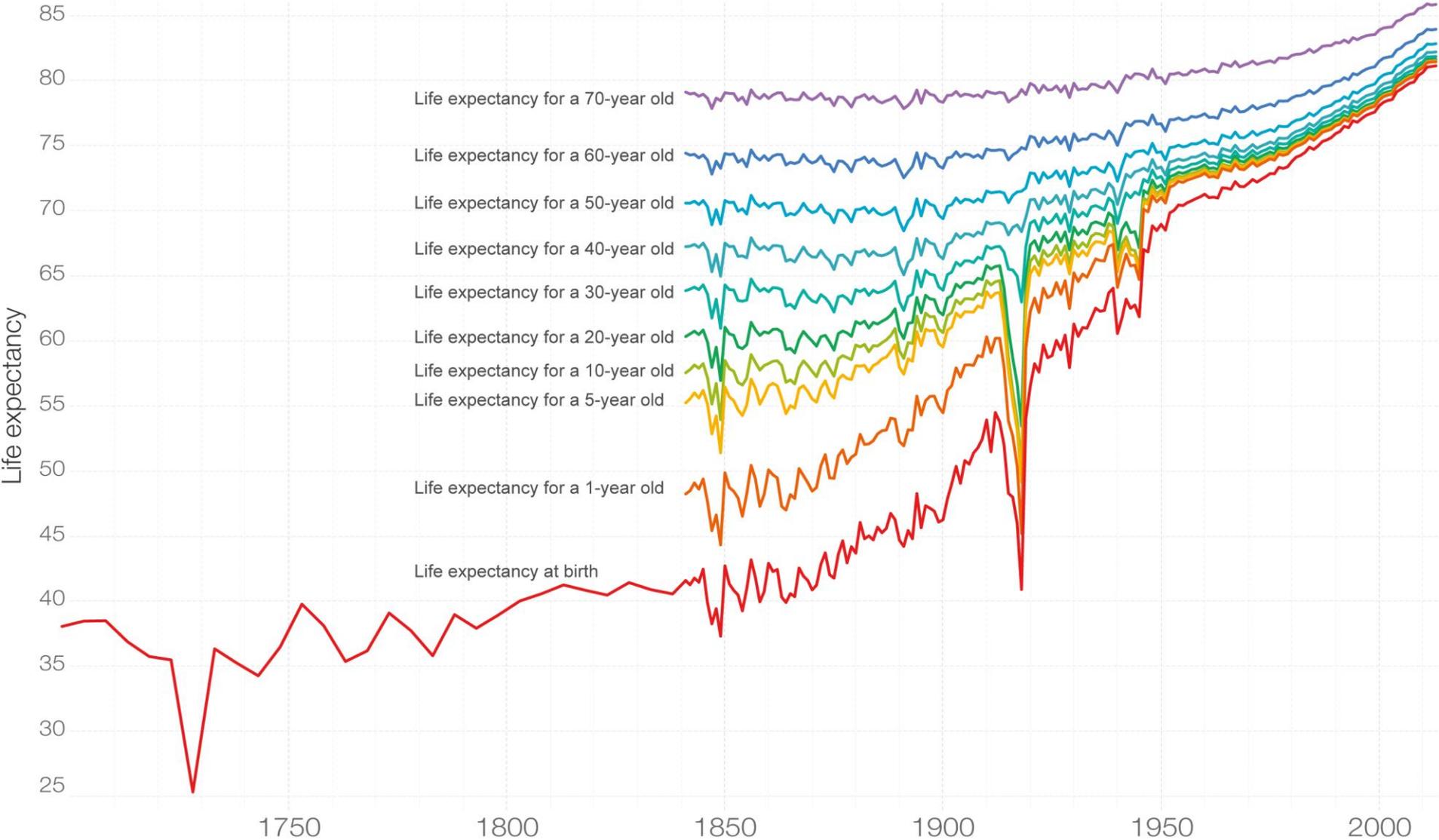
# Life expectancy globally and by world regions since 1770



Source: Life expectancy – James Riley for data 1990 and earlier; WHO and World Bank for later data (by Max Roser)

# Life Expectancy by Age in England and Wales, 1700-2013

Shown is the total life expectancy given that a person reached a certain age.

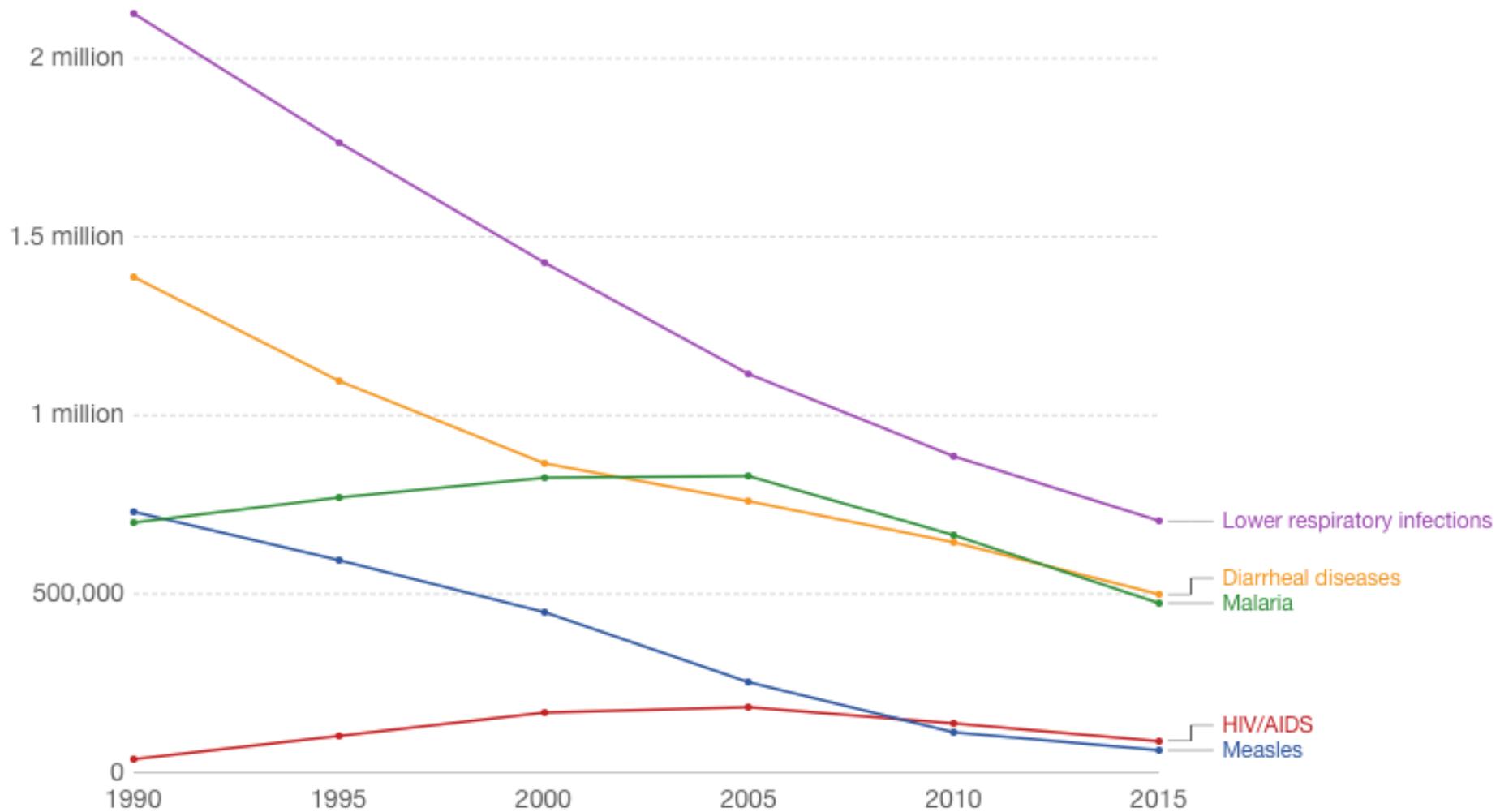


Data source: Life expectancy at birth Clio-Infra. Data on life expectancy at age 1 and older from the Human Mortality Database ([www.mortality.org](http://www.mortality.org)).

The interactive data visualization is available at [OurWorldinData.org](http://OurWorldinData.org). There you find the raw data and more visualizations on this topic.

Licensed under CC-BY-SA by the author Max Roser.

# Childhood deaths from the five most lethal infectious diseases worldwide

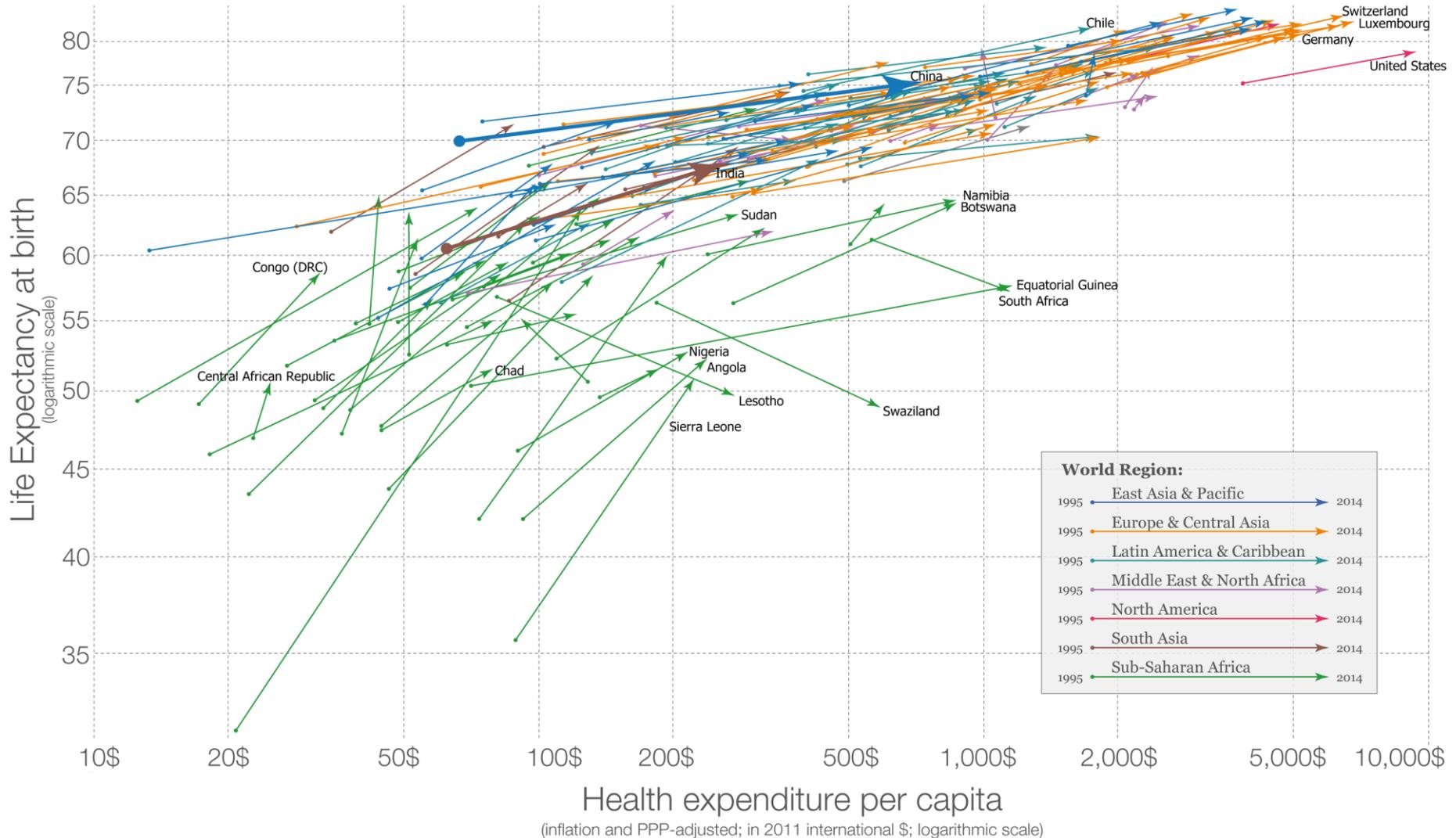


Source: IHME Global Burden of Disease (child deaths by disease) (2017)

# Life expectancy is increasing as more money is spent on health

The arrows show the change for all countries in the world, from 1995 (earliest available data) to 2014 (latest available data). [Not all countries are labelled]

Total health expenditure is the sum of public and private health expenditures. It covers the provision of health services (preventive and curative), family planning activities, nutrition activities, and emergency aid designated for health but does not include provision of water and sanitation.



# HEROES of SCIENCE

## MVP Top 10 Medical Lifesavers

- 1 [Karl Landsteiner](#) - 1.094 billion - blood groups led to transfusions
- 2 [Edward Jenner](#) - 530 million - smallpox vaccination
- 3 [Bill Foege](#) - 131 mil - 6% vaccination strategy eradicated smallpox
- 4 [John Enders](#) - 120 million - measles vaccine
- 5 [Howard Florey](#) - 82 million - penicillin, the drug
- 6 [Gaston Ramon](#) - 60 million - diphtheria and tetanus vaccines
- 7 [David Nalin](#) - 54 million - oral rehydration therapy
- 8 [Paul Ehrlich](#) - 42 million - diphtheria and tetanus antitoxin
- 9 [Frederick Banting](#) - 16.4 million - insulin for diabetes
- 10 [Andreas Gruentzig](#) - 15.4 million - angioplasty

## Honorable Mention: Pre-1900 Legends Lacking Numerical Data

[Louis Pasteur](#) - Germ Theory

[Joseph Lister](#) - Antiseptics

# HEROES



**NIELS  
BOHR**

1885-1962  
Theoretical Physicist

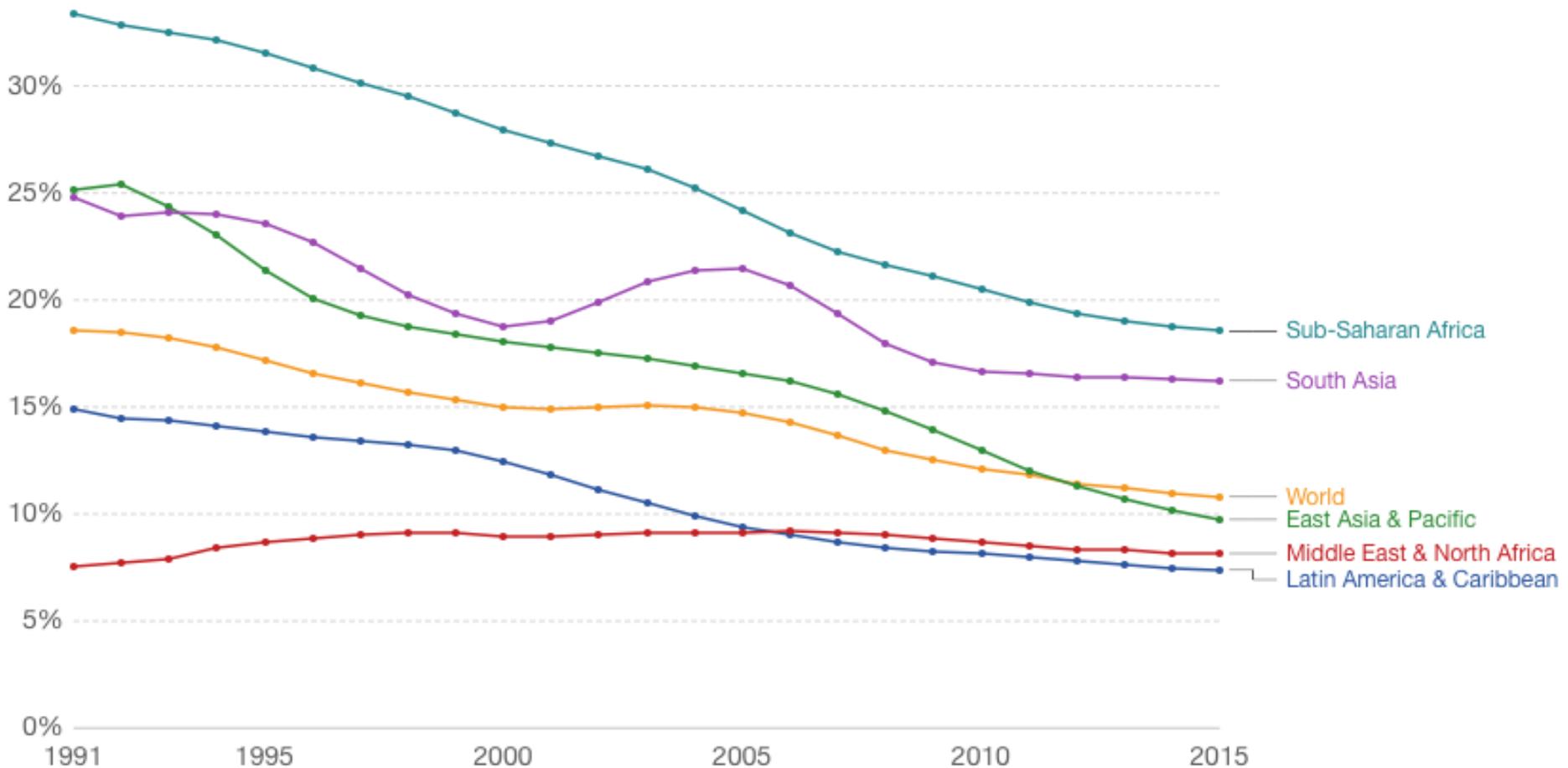


**ALBERT  
EINSTEIN**

1879-1955  
Theoretical Physicist

# Share of the population that is undernourished

This is the main FAO hunger indicator. It measures the share of the population that has a caloric intake which is insufficient to meet the minimum energy requirements necessary for a given individual. Data showing as 5 may signify a prevalence of undernourishment below 5%.



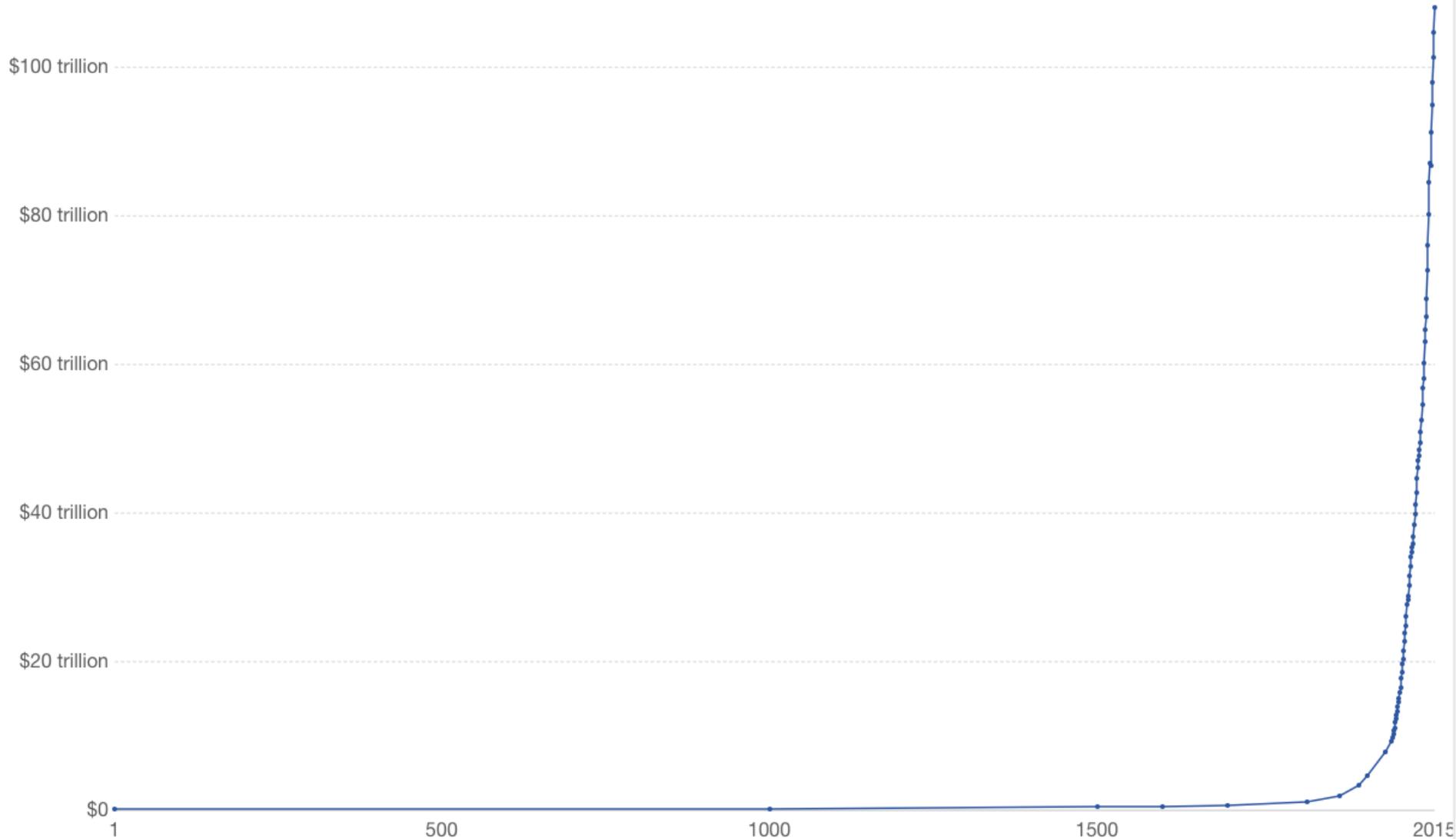
Source: UN Food and Agriculture Organization (FAO)

Note: Developed countries are not included in the regional estimates since the prevalence is below 5%.

# World GDP over the last two millennia

Total output of the world economy; adjusted for inflation and expressed in 2011 international dollars.

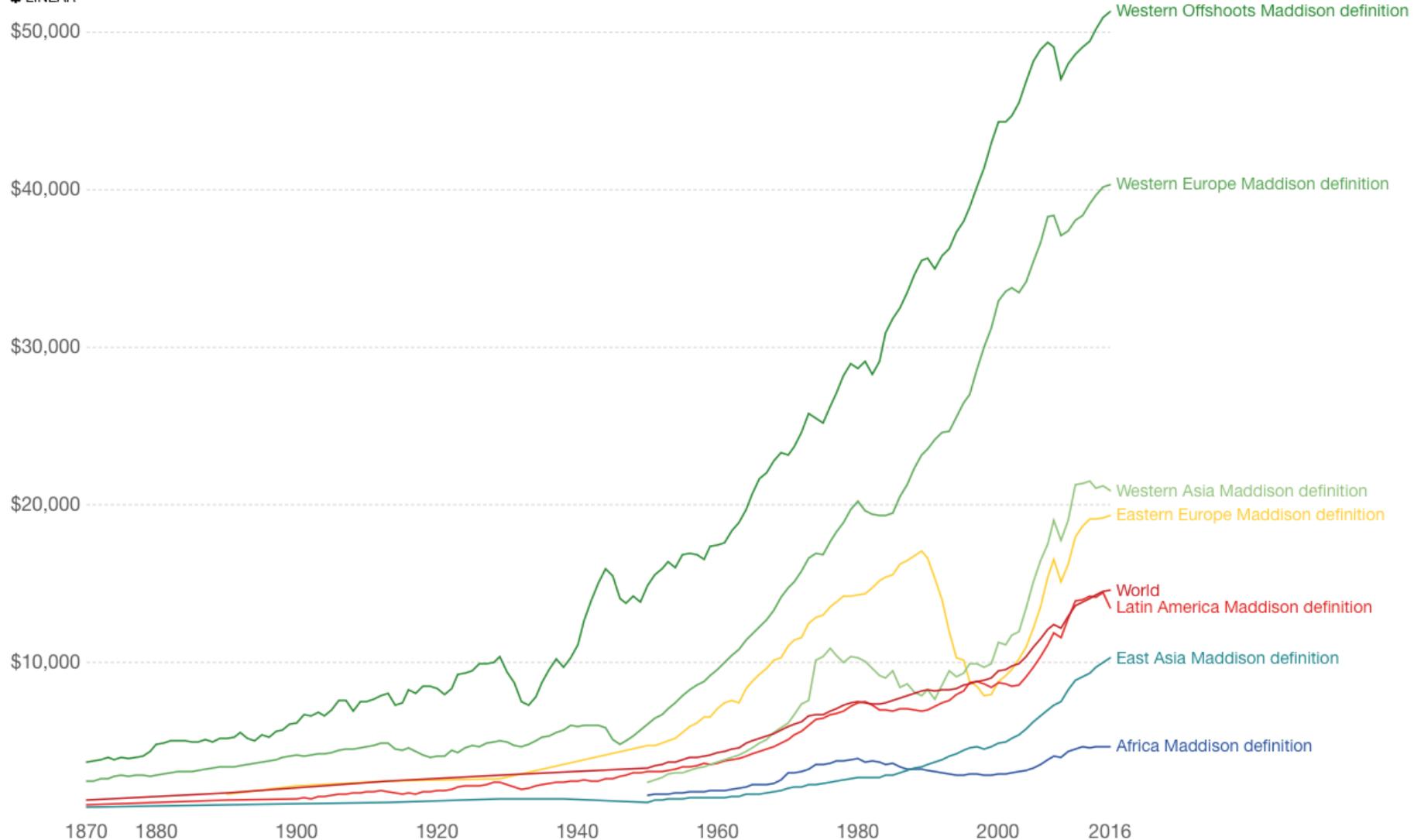
◆ LINEAR



# Average real GDP per capita across regions

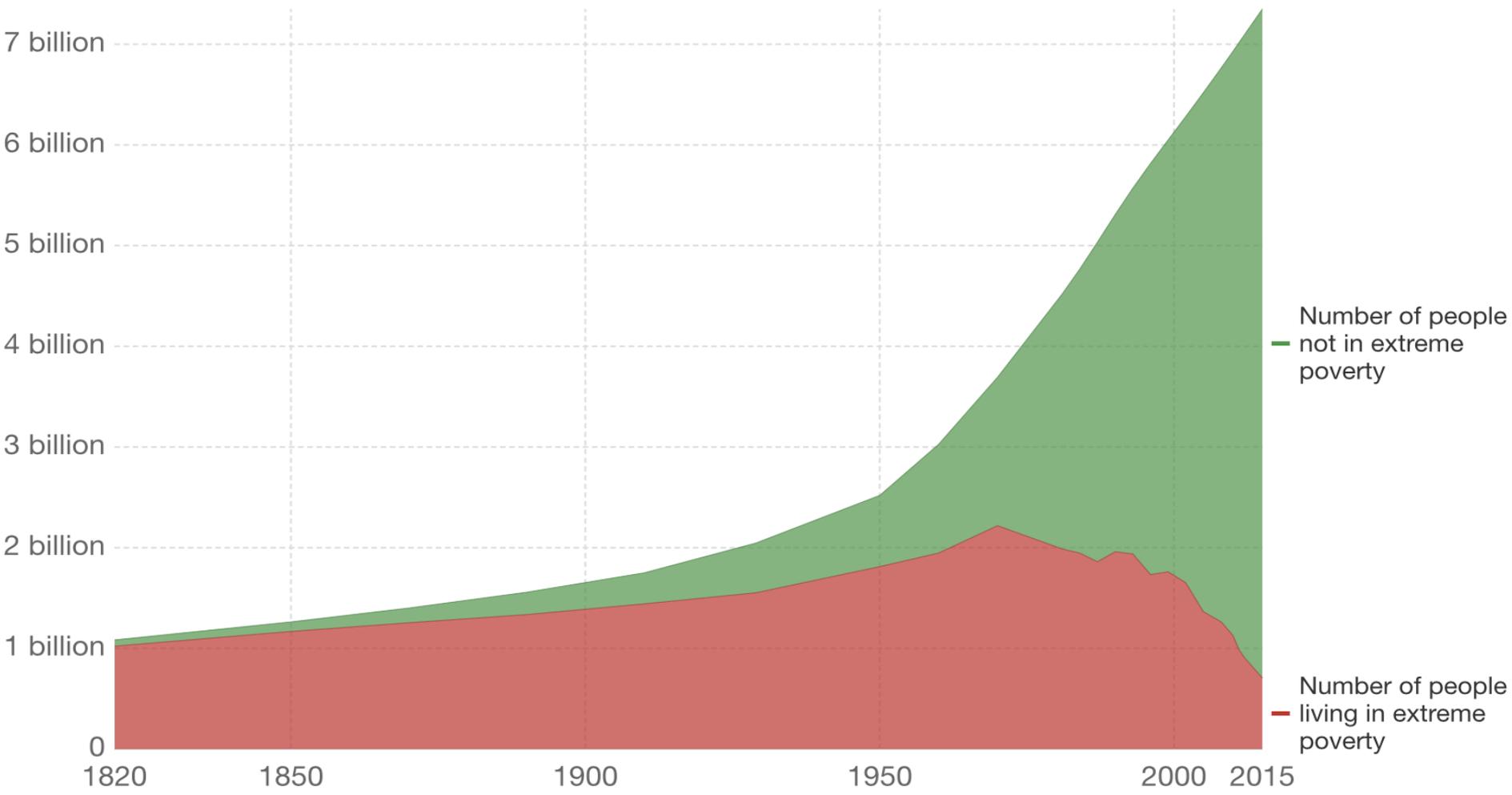
The measures are adjusted for inflation (at 2011 prices) and also for price differences between regions (multiple benchmarks allow for cross-regional income comparisons).

LINEAR



# World population living in extreme poverty, 1820-2015

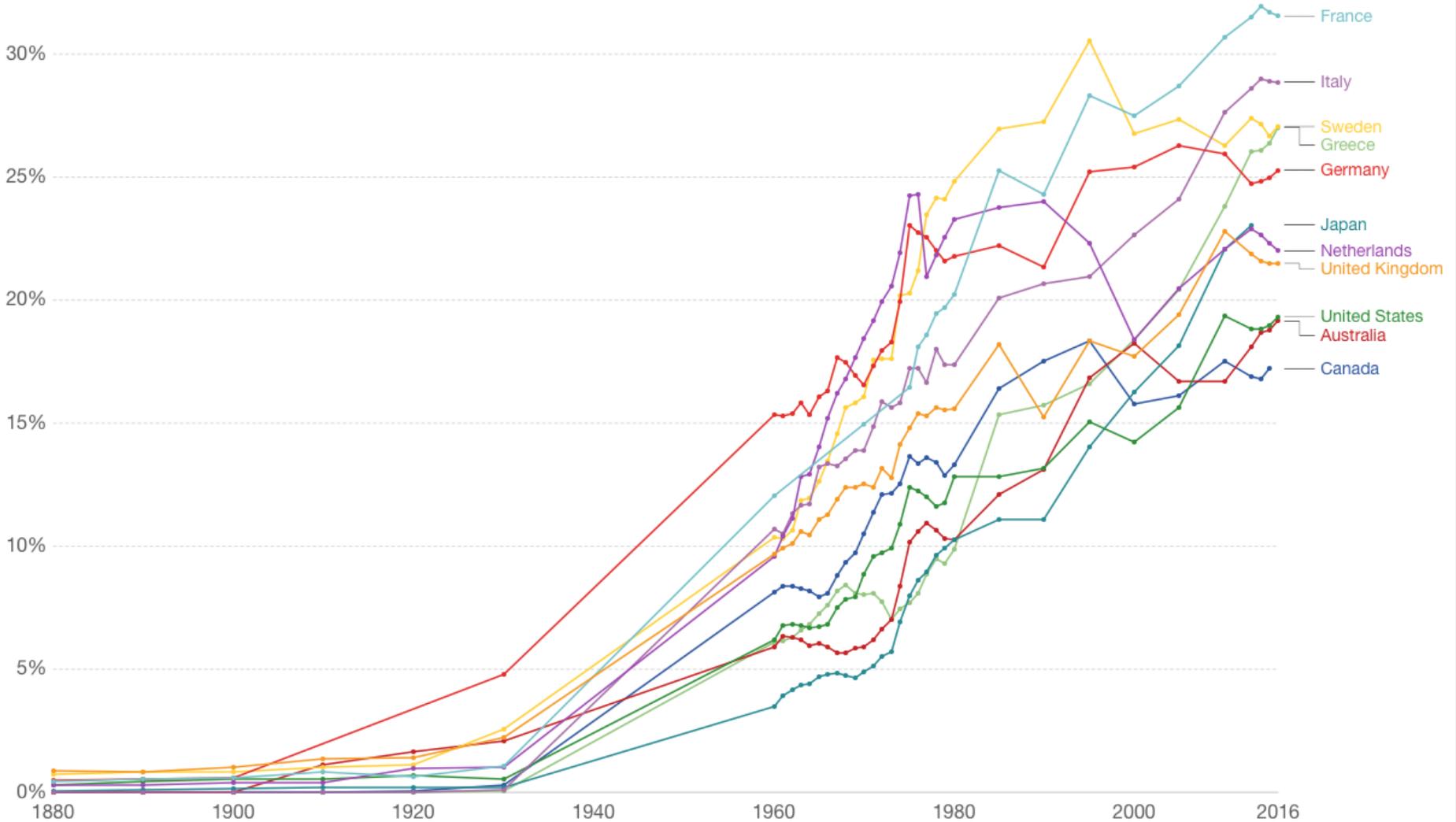
Extreme poverty is defined as living at a consumption (or income) level below 1.90 "international \$" per day. International \$ are adjusted for price differences between countries and for price changes over time (inflation).



Source: World Poverty in absolute numbers - OWID based on World Bank (2016) and Bourguignon and Morrisson (2002)  
OurWorldInData.org/extreme-poverty/ • CC BY-SA

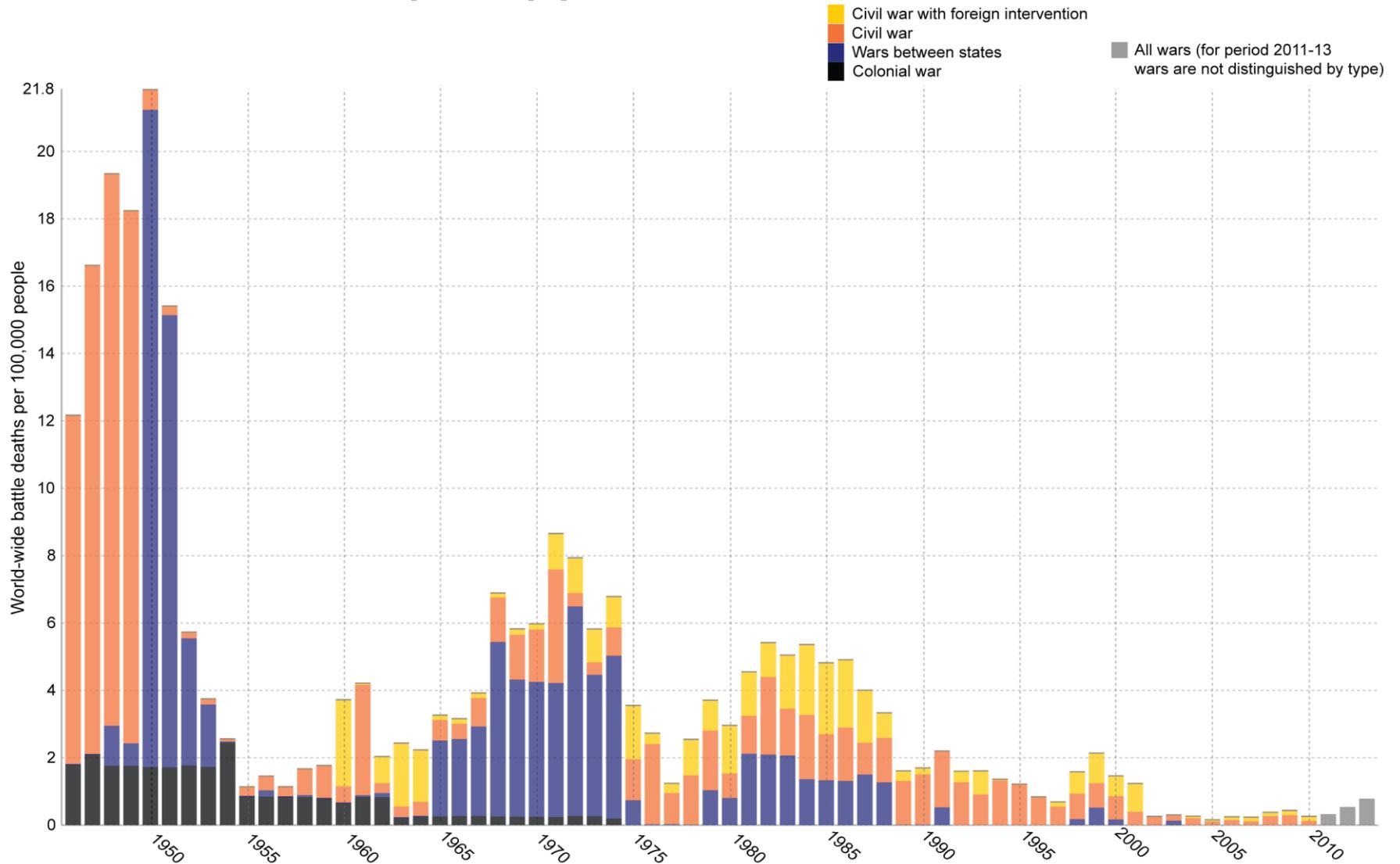
# Public social spending as a share of GDP

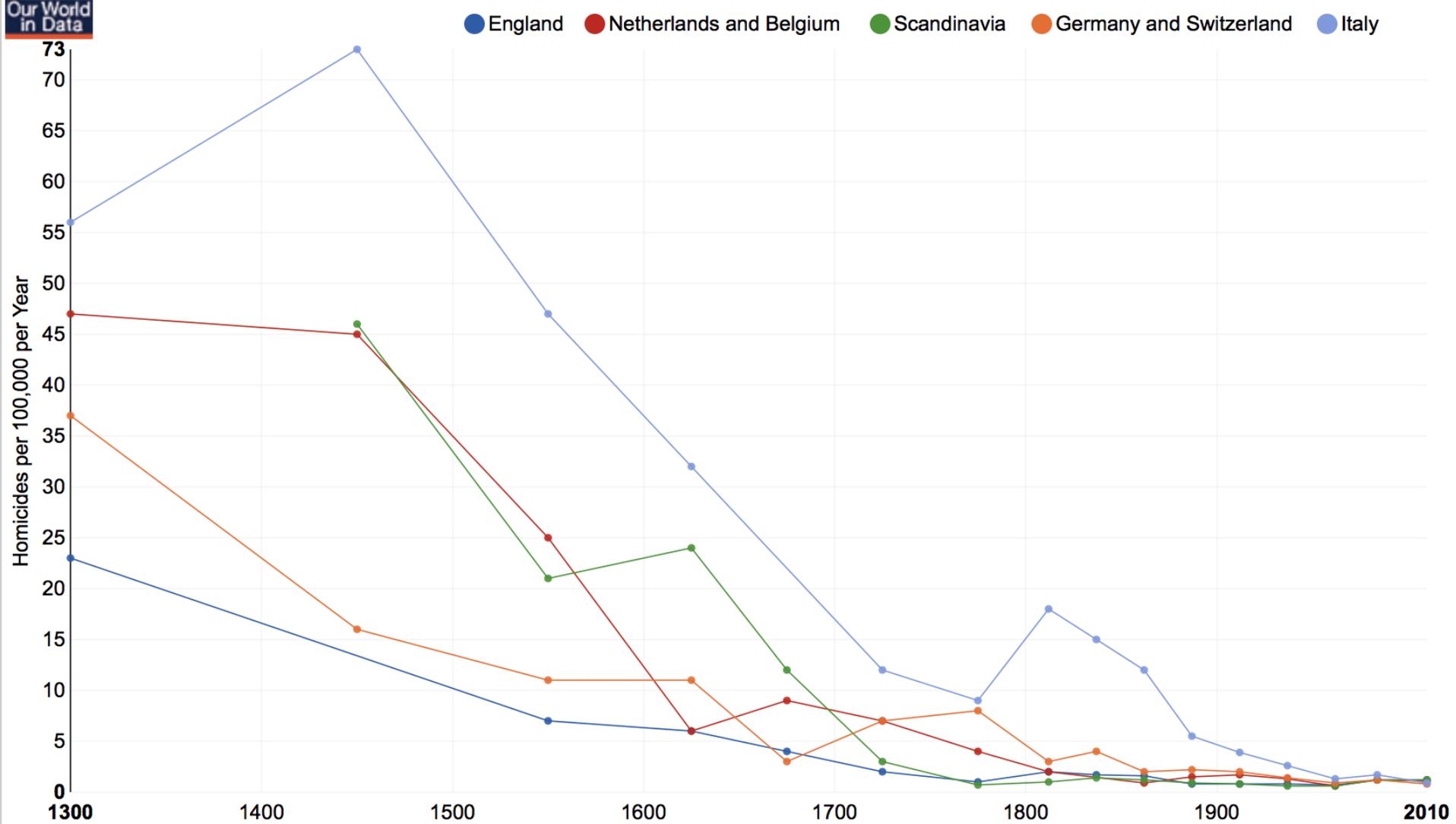
Social spending includes, among others, the following areas: health, old age, incapacity-related benefits, family, active labor market programmes, unemployment, and housing.



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

Annual world-wide battle deaths per 100,000 people





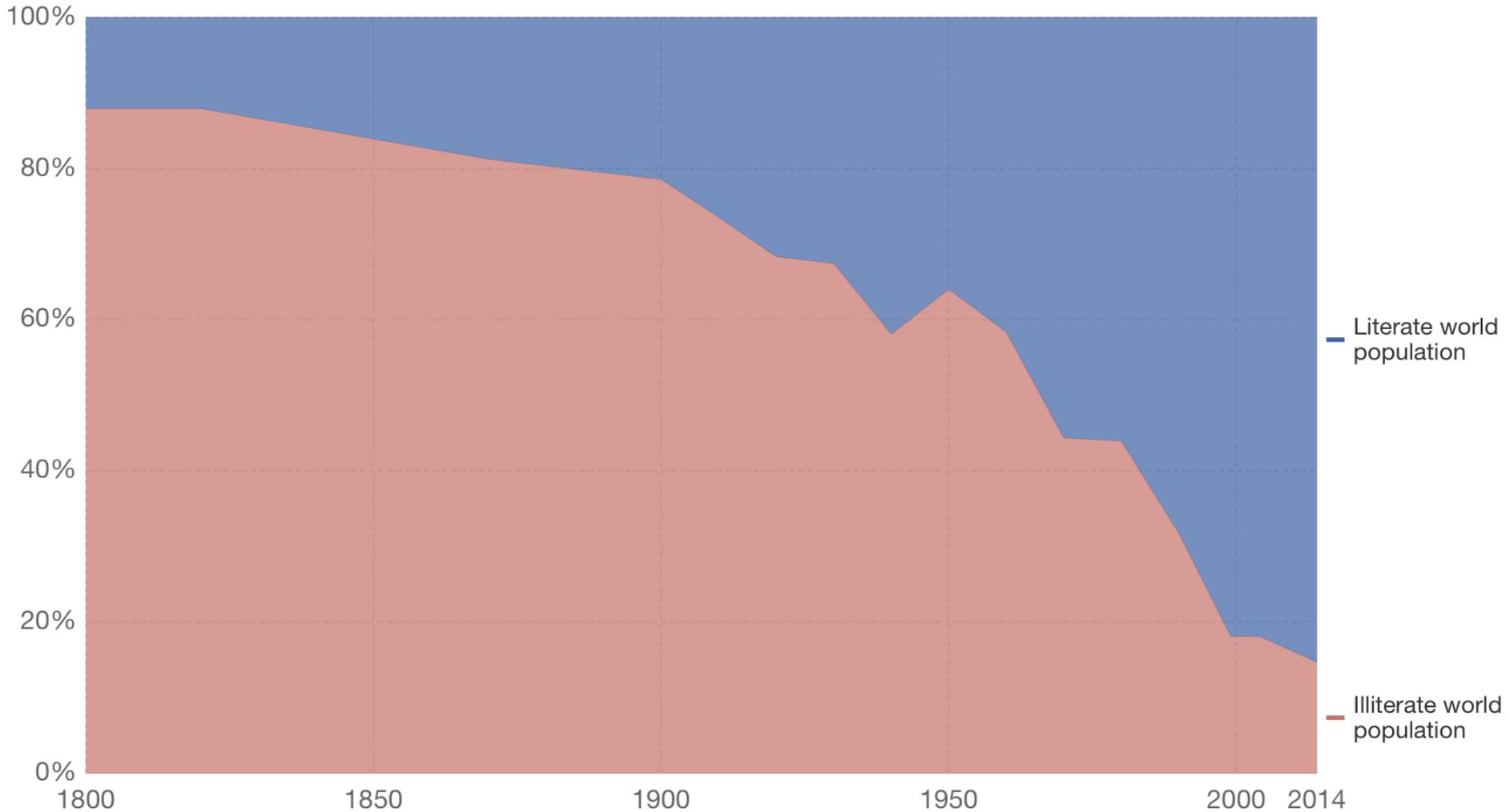
# Share of deaths by cause, World, 2016

Data refers to the specific cause of death, which is distinguished from risk factors for death, such as air pollution, diet and other lifestyle factors. This is shown by cause of death as the percentage of total deaths.



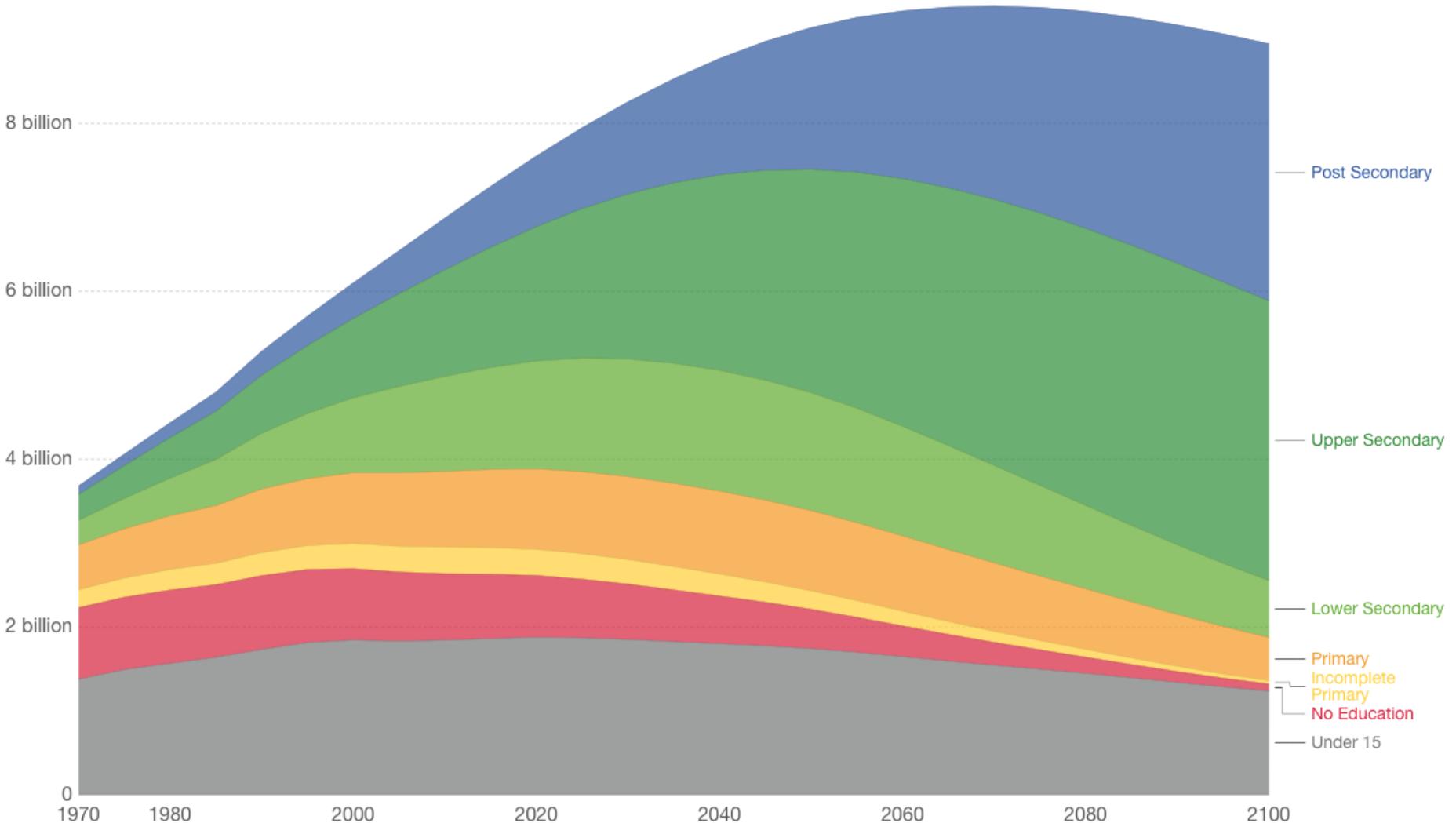
# Literate and illiterate world population

Population 15 years and older.



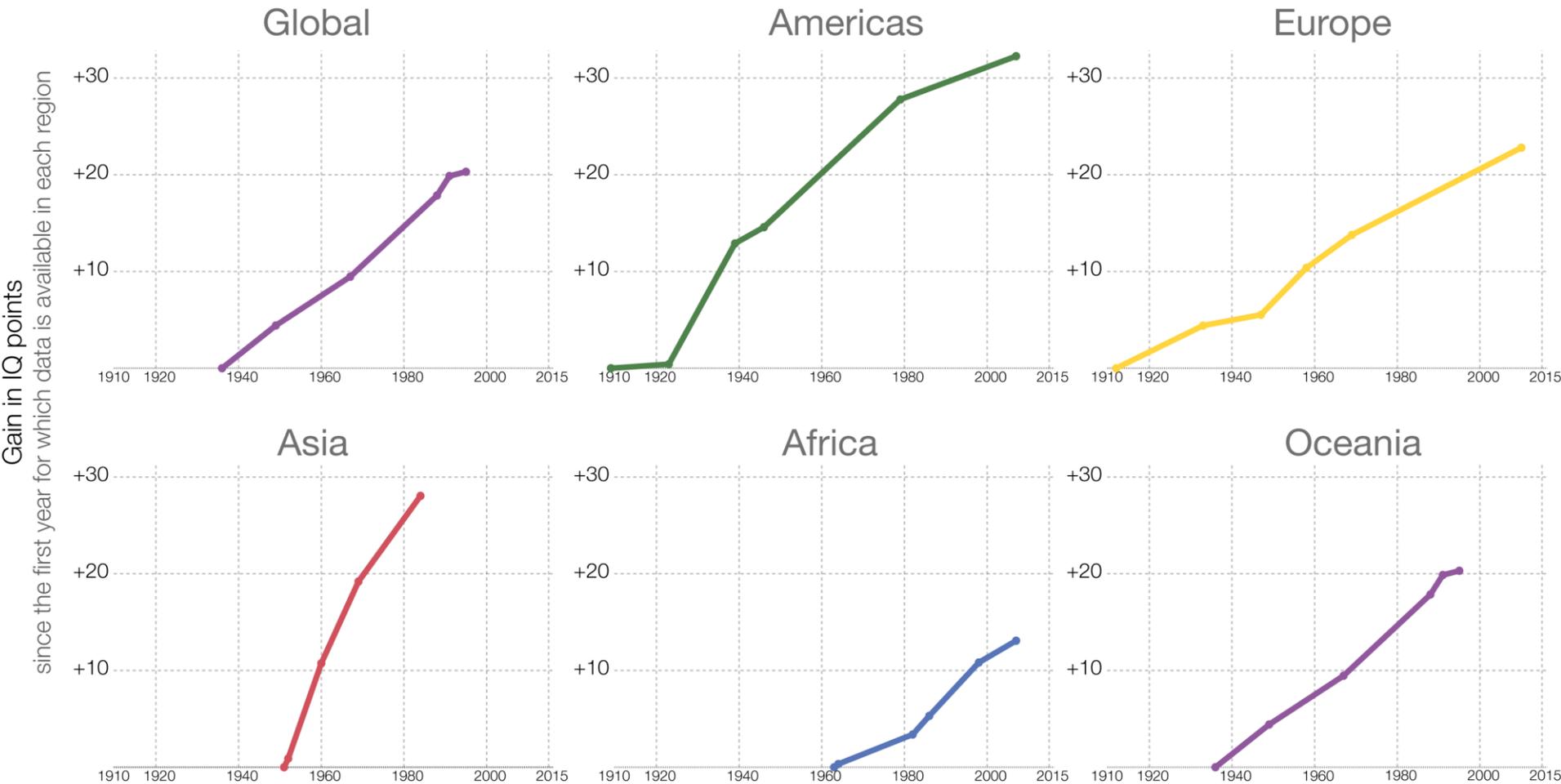
# Projected world population by level of education

This visualization shows the Medium projection by the International Institute for Applied Systems Analysis (IIASA). The researchers who created this projection describe it as their "middle of the road scenario that can also be seen as the most likely path".



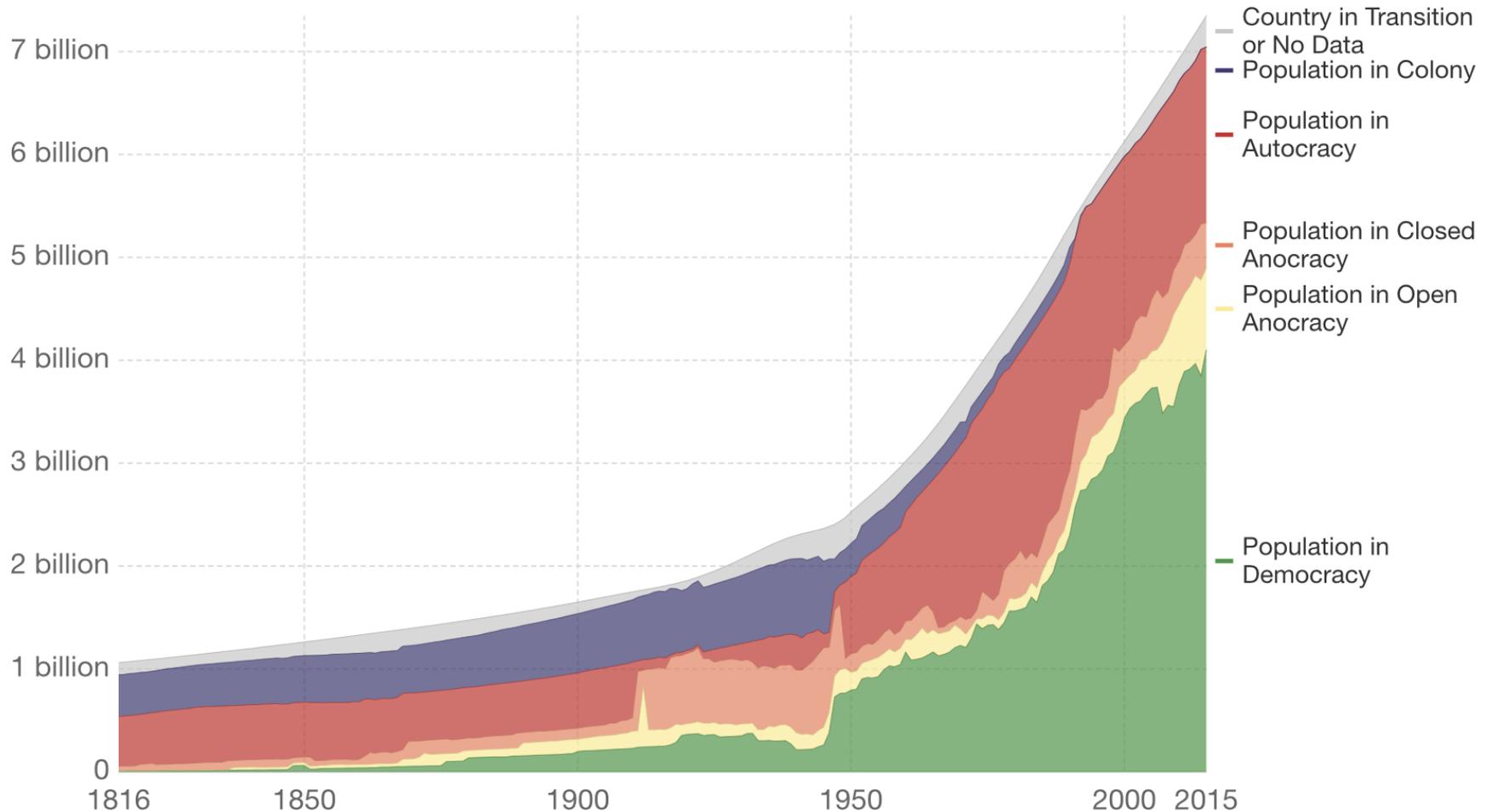
# The Flynn Effect: Gains in mean IQ (Intelligence quotient) for world regions, 1909-2013

Shown is the gain in mean fullscale IQ (Intelligence quotient) for world regions. Changes are relative to the first year for which data is available for a particular region.



# Number of world citizens living under different political regimes

The Polity IV score captures the type of political regime for each country on a range from -10 (full autocracy) to +10 (full democracy). Regimes that fall into the middle of this spectrum are called anocracies.



# Sve bolji svijet: liberalne vrijednosti

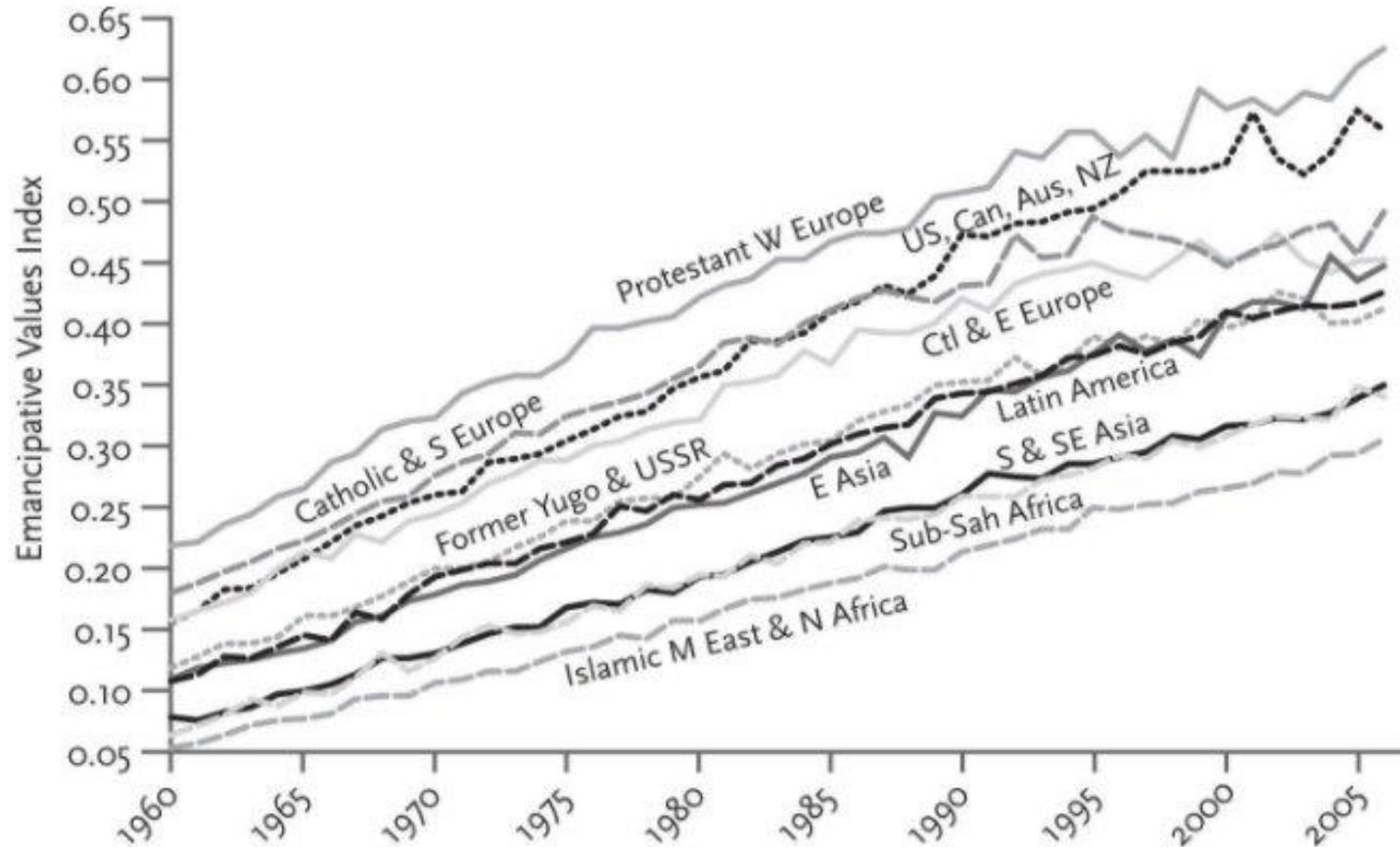
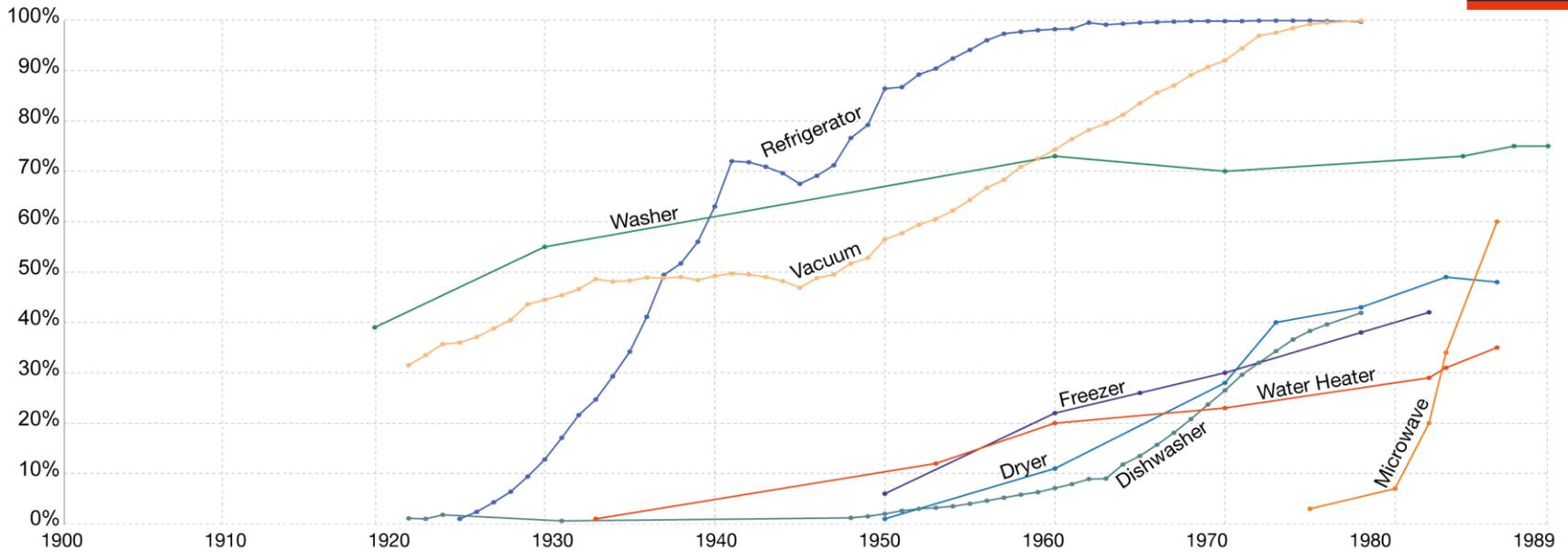


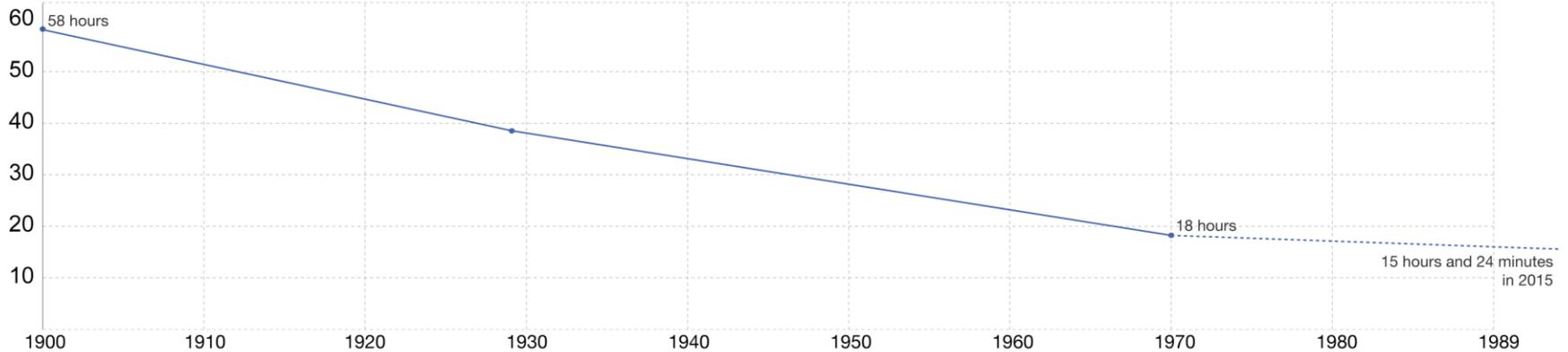
Figure 15-7: Liberal values across time (extrapolated), world's culture zones, 1960–2006

# Share of US households with basic electrical appliances



# Housework working hours per week, per household of two

Only counting the following three household chores: Preparing meals, laundry, and cleaning



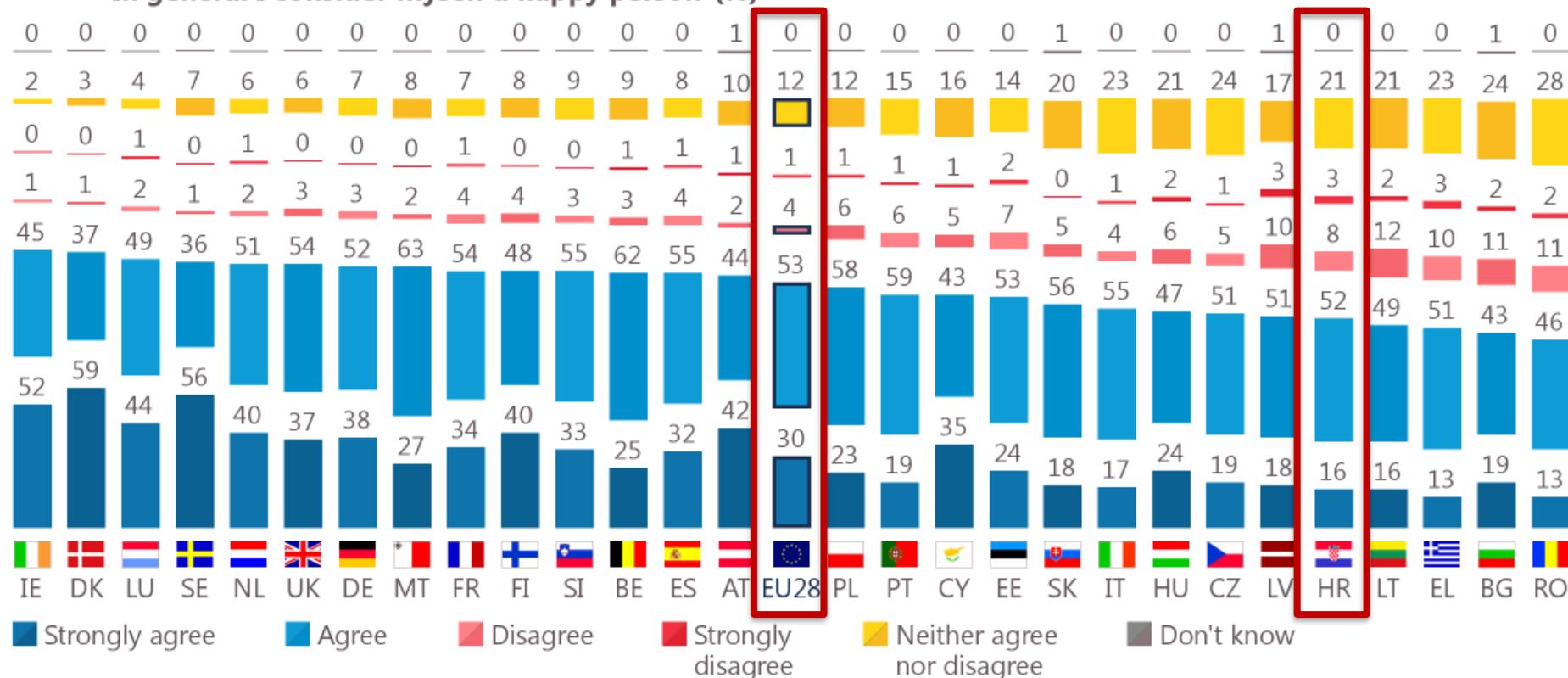
Data source: Greenwood, Seshadri and Yorukoglu (2005) – 'Engines of Liberation', Review of Economic Studies. Except working hours in 2015 from the American Time Use survey conducted by the BLS. The interactive data visualization is available at [OurWorldinData.org](http://OurWorldinData.org). There you find the raw data and more visualizations on this topic. Licensed under CC-BY-SA by the author Max Roser.

# Are people happier?

Izvor: Eurobarometer

QA1.2 Please tell me to what extent you personally agree or disagree with the following statements.

**In general I consider myself a happy person (%)**



Base: All respondents (N=28,031)

**83% in EU say they are happy!**

# Are people happier?

## Share of people who say they are happy

Share of people who say they are 'very happy' or 'rather happy'.

Our World  
in Data



Source: World Value Survey (2014)

Note: Full question asks: "Taking all things together, would you say you are (i) Very happy, (ii) Rather happy, (iii) Not very happy, (iv) Not at all happy, or (v) Don't Know".

OurWorldInData.org/bonheur-et-satisfaction/ • CC BY-SA

# In every country people think that others are less happy than they themselves say

People were asked the following question “When asked in a survey, what percentage of people do you think said that, taking all things together, they are very happy or rather happy?”. The average answer is plotted on the y-axis against the actual answer on the x-axis.



Je li ovo točno?

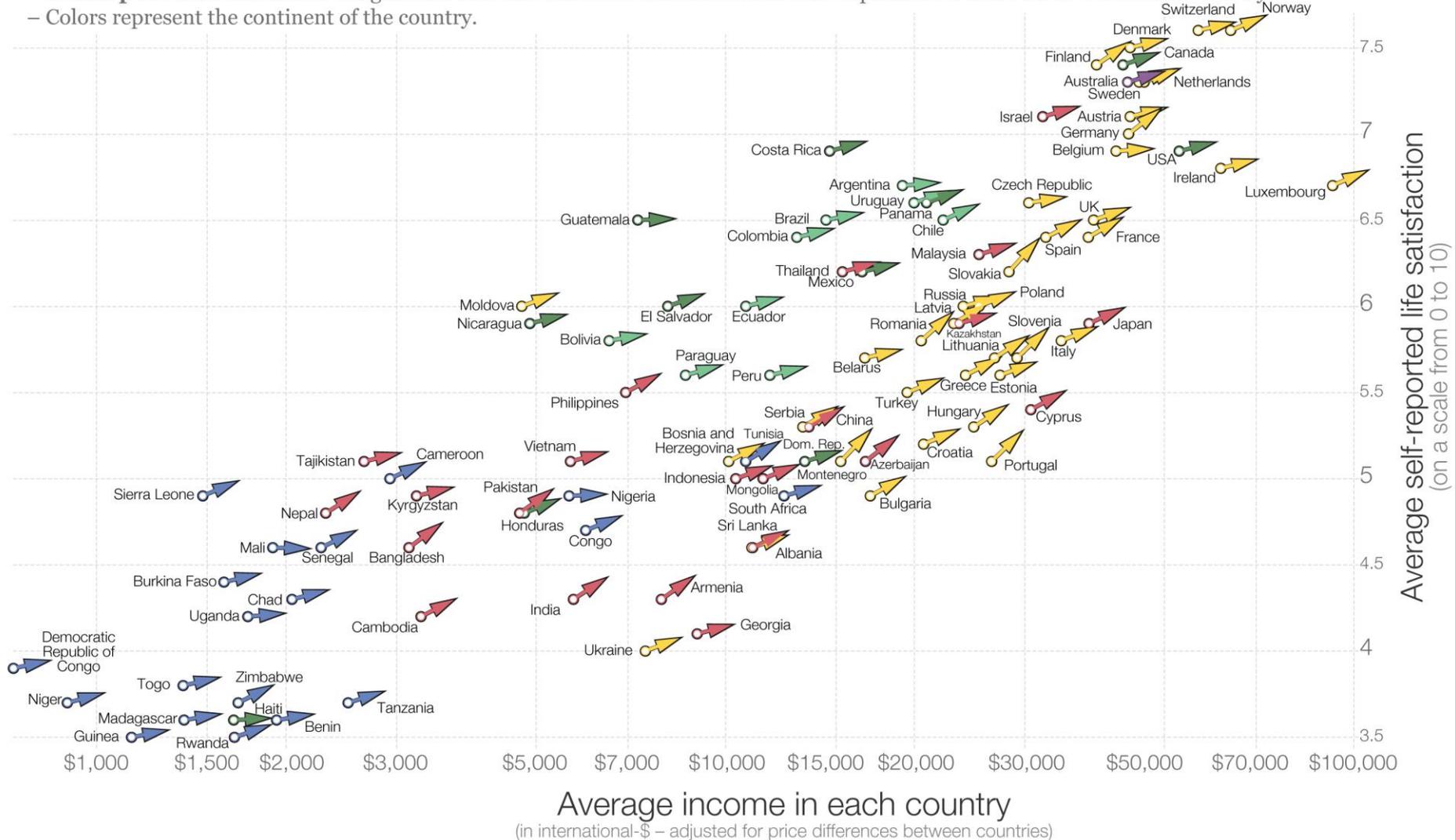
**Money can't buy  
happiness.**

Howard Hughes

quote fancy

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

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



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

# If we extrapolate ... in about 100 years

---

Hunger

Poverty

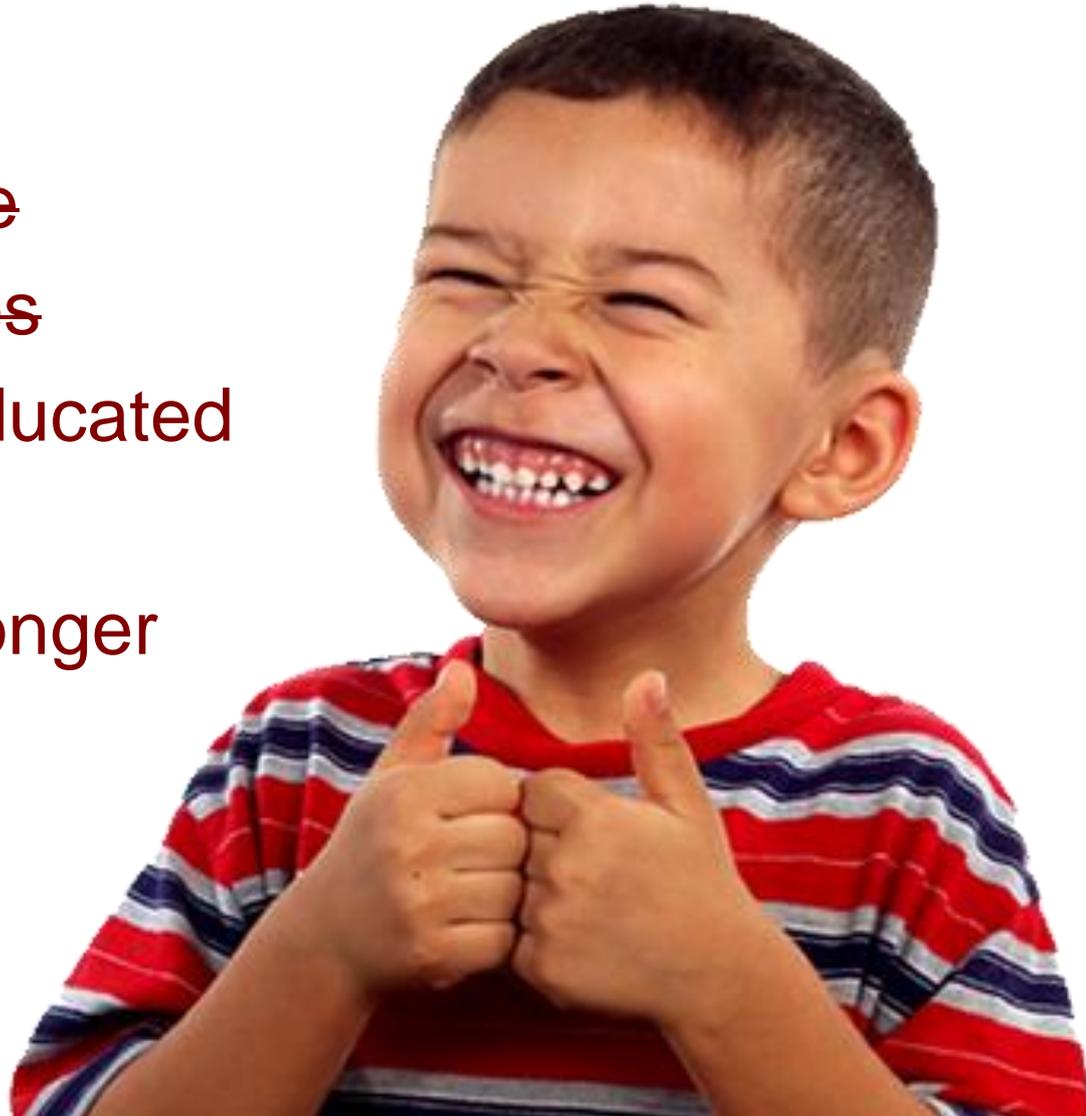
Violence

Diseases

More educated

Happier

Living longer



# Most of people agree



All these things can be measured.

And all have increased over time.

It is called **progress**.



THE WORLD HAS MADE  
SPECTACULAR PROGRESS IN  
EVERY SINGLE MEASURE OF  
HUMAN WELL-BEING



*-THE NEW YORK TIMES calls KORE-EDA's work...*  
"Brilliant, humorous, transcendent, breathtaking  
and exquisitely beautiful."

*-Kevin Thomas, THE LOS ANGELES TIMES*  
"Along with Antonioni, Ozu, and Hitchcock, Kore-eda understands  
how to create profoundly unique visual experiences."

a film by  
KORE-EDA HIROKAZU

# Nobody Knows

BASED ON A TRUE STORY

ON DVD +  
DIGITAL DOWNLOAD  
NOW AVAILABLE



**NOW  
YOU  
KNOW!**





UNIVERSE DOESN'T CARE ABOUT YOU!



... BUT WE DO CARE!

# The world we live in



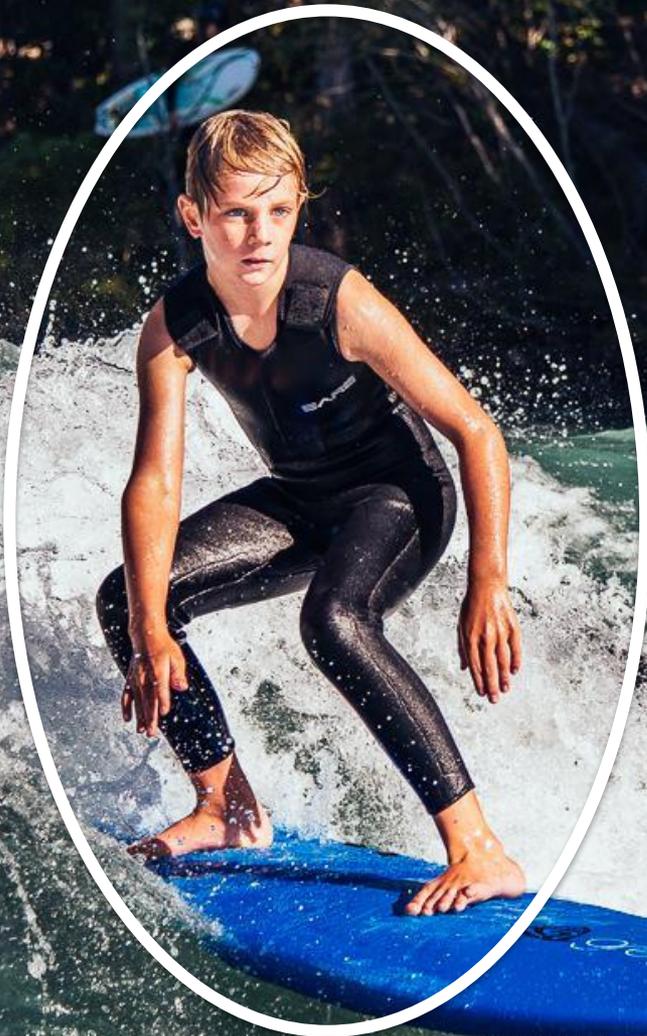


# Welcome to the **AGE OF ACCELERATION!**



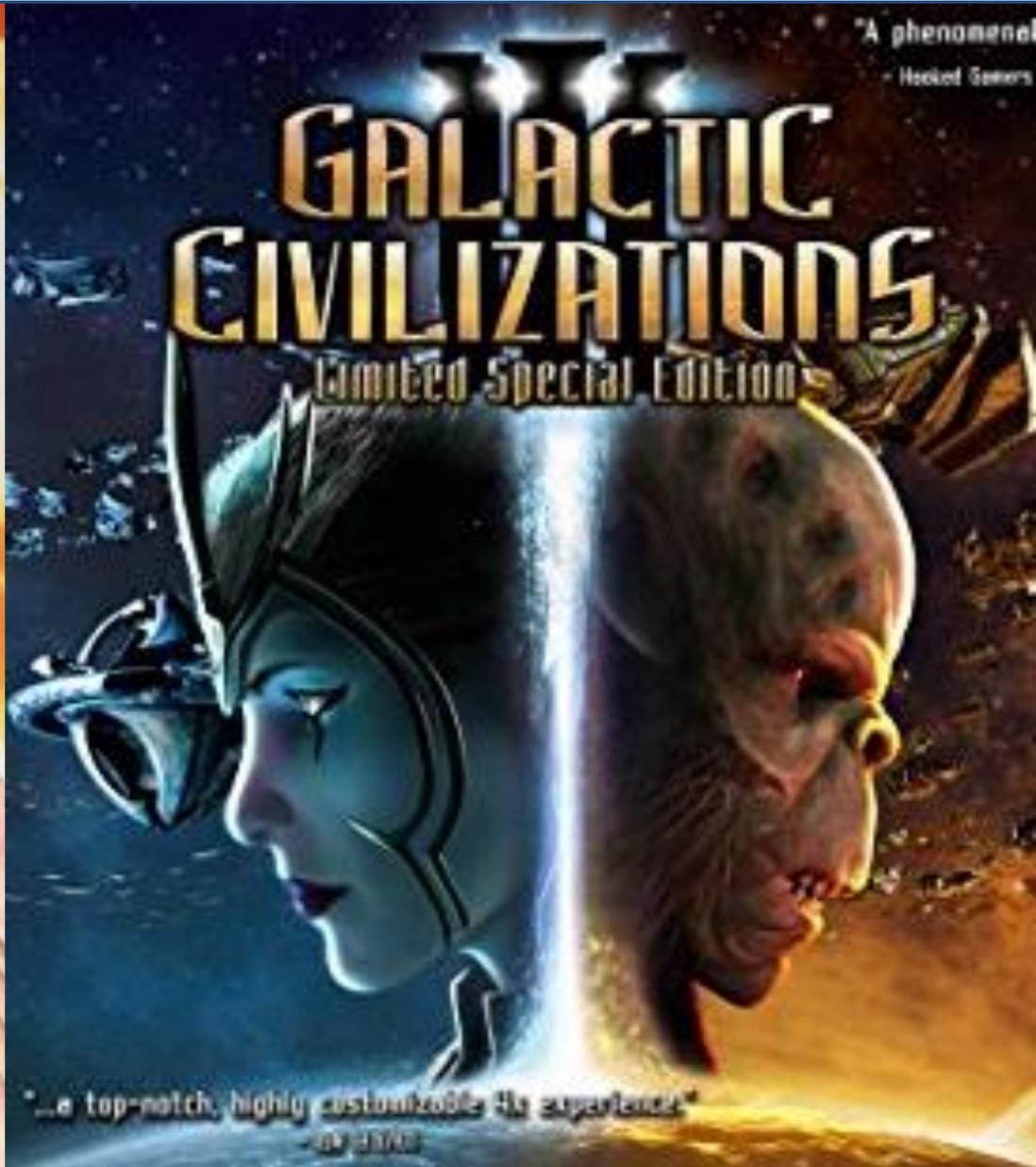
# How to live in the **AGE OF**



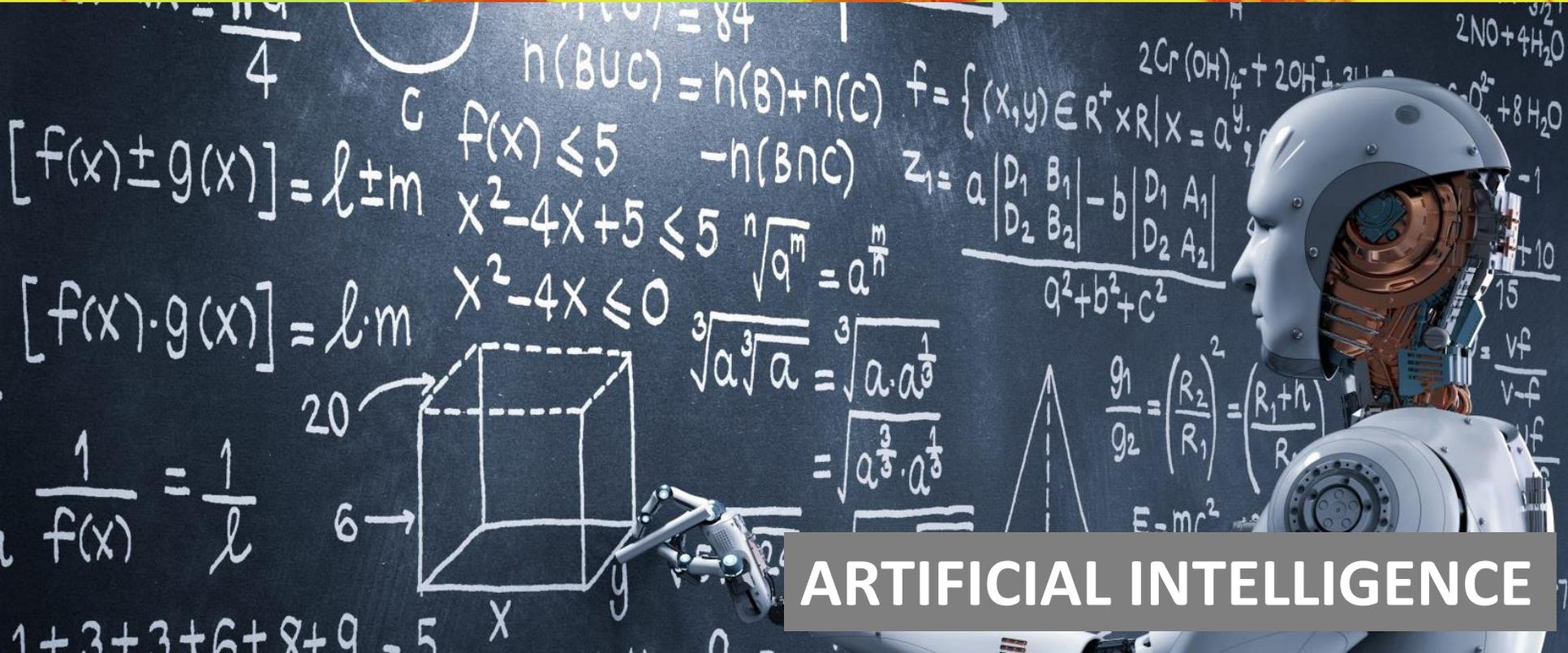
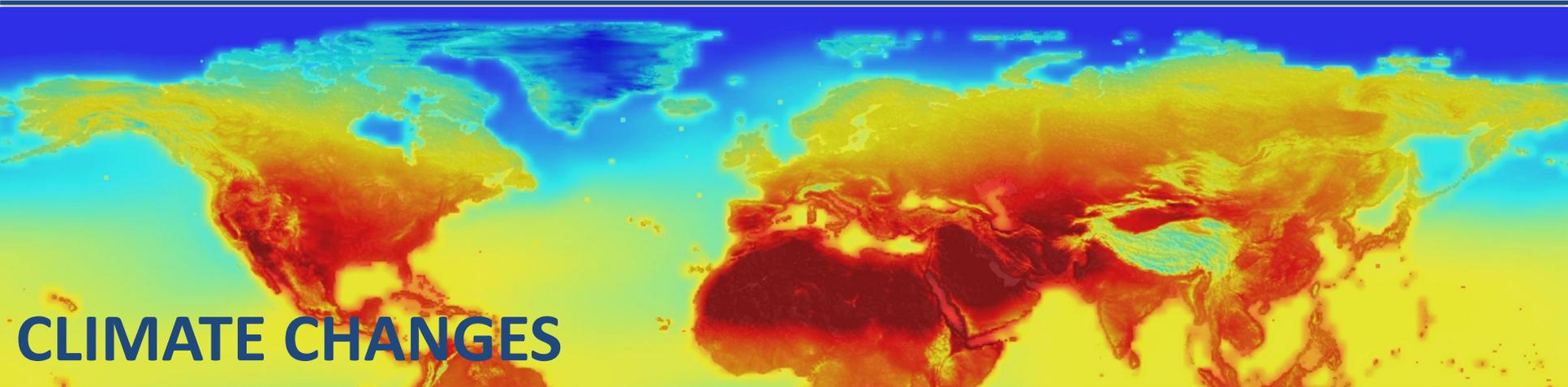


*RT Bishop*

# The most important question ever?

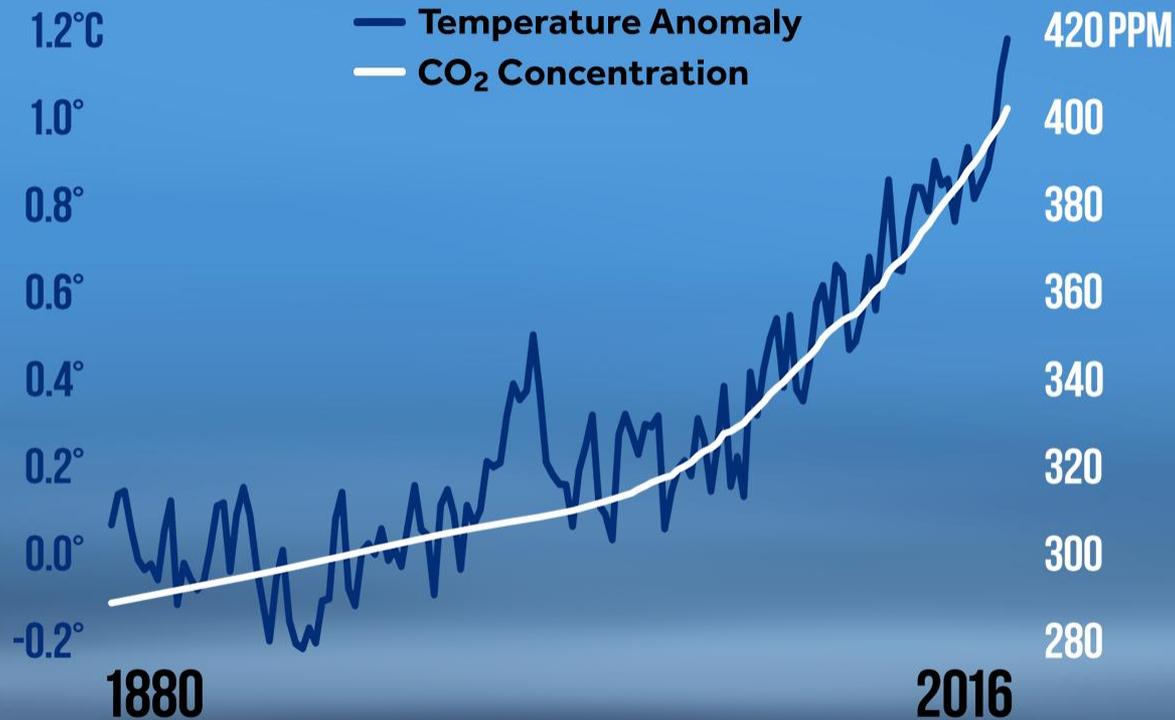


# Two biggest challenges



# CLIMATE CHANGES

## Global Temperature and Carbon Dioxide



Global temperature data averaged and adjusted to early industrial baseline (1881-1910).  
Source: NASA GISS, NOAA NCEI, ESRL

CLIMATE  CENTRAL

**PROBLEM IS REAL AND HUGE!**

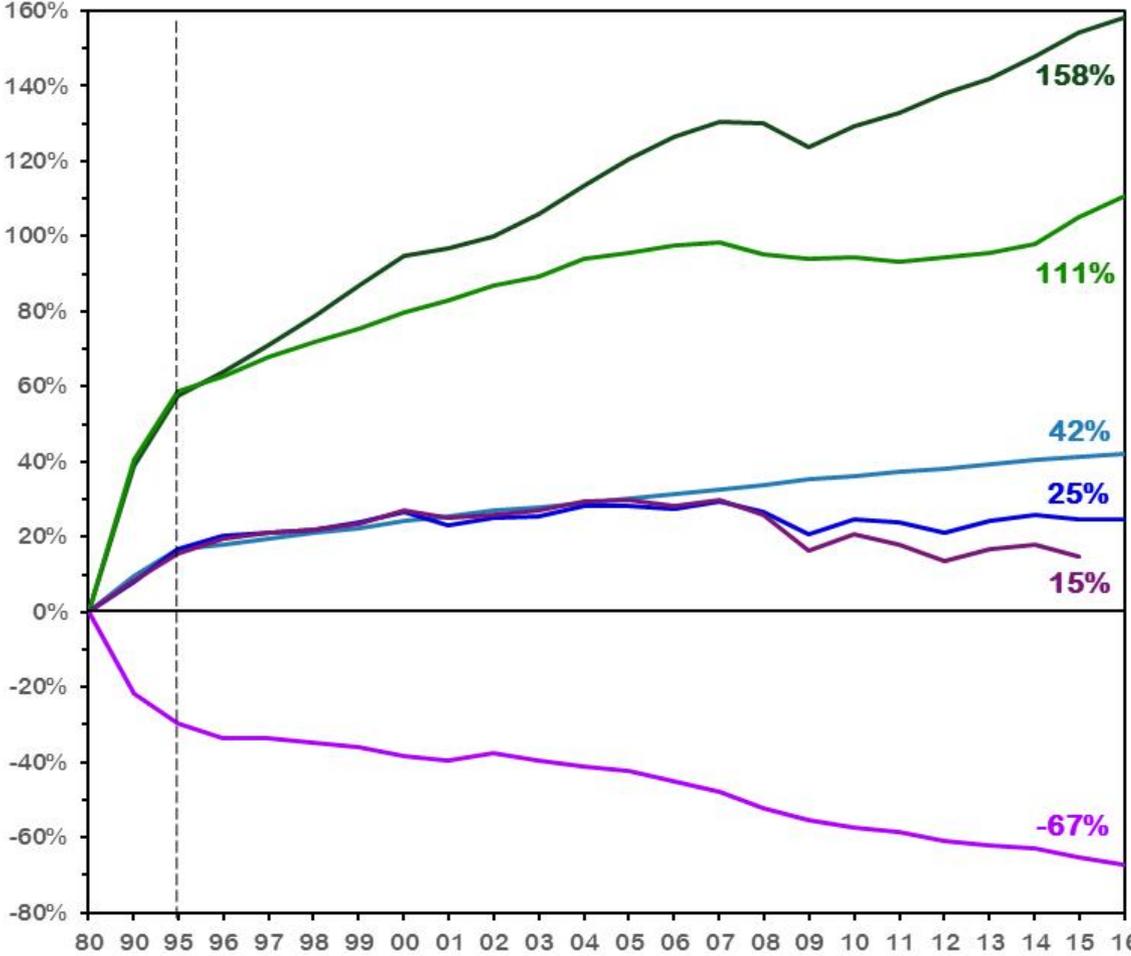
# ... but problems are solvable ...



# KNOWLEDGE!

# Nature protection is not in contradiction with progress

## Comparison of Growth Areas and Emissions, 1980-2016



**Gross Domestic Product**



**Vehicles Miles Traveled**



**Population**



**Energy Consumption**



**CO<sub>2</sub> Emissions**



**Aggregate Emissions (Six Common Pollutants)**

A black and white photograph of a woman, likely a leader, smiling warmly. She is wearing a light-colored headscarf with a dark border. The image has a grainy, high-contrast quality. In the upper right corner, there is a quote in yellow text.

***"Poverty is the biggest polluter."***

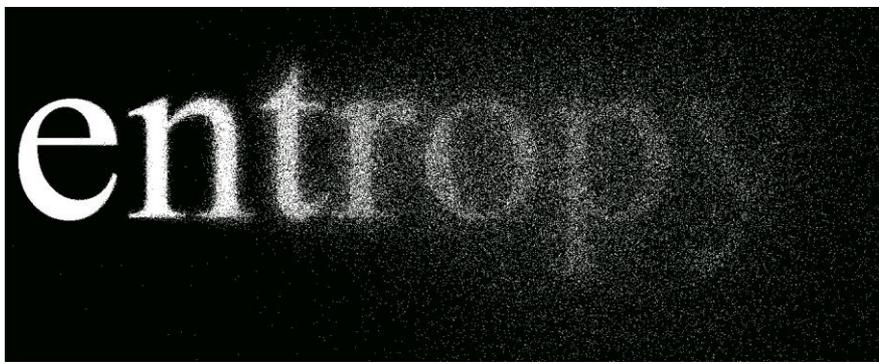
Indira Gandhi

### Global income distribution in 1800, 1975, and 2010

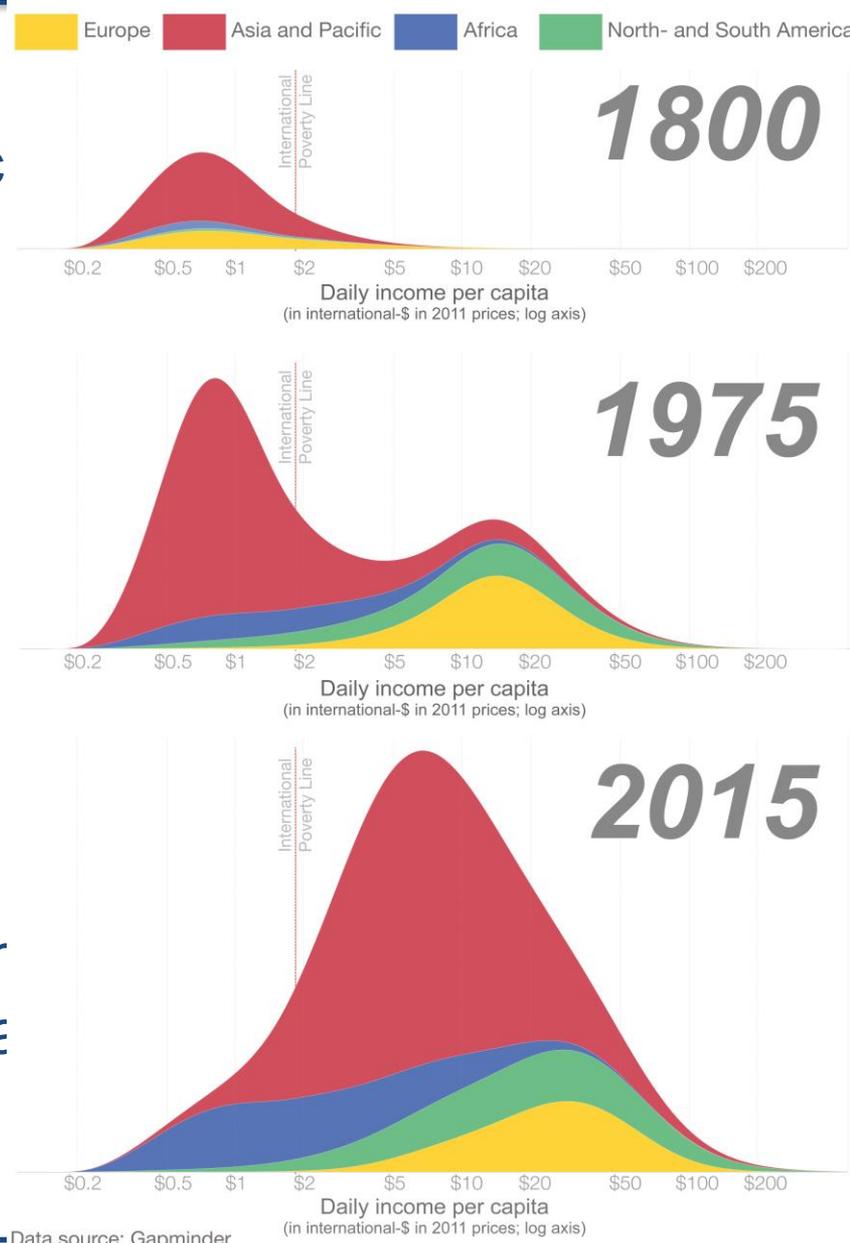
Income is measured by adjusting for price changes over time and for price differences between countries (purchasing power parity (PPP) adjustment). These estimates are based on reconstructed National Accounts and within-country inequality measures. Non-market income (e.g. through home production such as subsistence farming) is taken into account.

# New movement: Econ

- 1. Some degree of pollution is an inescapable consequence of **Sec Law of Thermodynamics**



- 2. **Industrialization** has been good humanity.
- 3. Tradeoff that pits human well-beir against environmental damage ca be renegotiated by **technology**.



# Two interesting processes in the world

**POPULATION  
DENSITY  
INCREASES**

**DIGITAL  
REVOLUTION**



## Dematerialization

>\$900,000 worth of applications in a smart phone today

Application	\$ (2011)	Original Device Name	Year*	MSRP	2011's \$
1. Video conferencing	<i>free</i>	Compression Labs VC	1982	\$250,000	\$586,904
2. GPS	<i>free</i>	TI NAVASTAR	1982	\$119,900	\$279,366
3. Digital voice recorder	<i>free</i>	SONY PCM	1978	\$2,500	\$8,687
4. Digital watch	<i>free</i>	Seiko 35SQ Astron	1969	\$1,250	\$7,716
5. 5 Mpixel camera	<i>free</i>	Canon RC-701	1986	\$3,000	\$6,201
6. Medical library	<i>free</i>	e.g. CONSULTANT	1987	Up to \$2,000	\$3,988
7. Video player	<i>free</i>	Toshiba V-8000	1981	\$1,245	\$3,103
8. Video camera	<i>free</i>	RCA CC010	1981	\$1,050	\$2,617
9. Music player	<i>free</i>	Sony CDP-101 CD player	1982	\$900	\$2,113
10. Encyclopedia	<i>free</i>	Compton's CD Encyclopedia	1989	\$750	\$1,370
11. Videogame console	<i>free</i>	Atari 2600	1977	\$199	\$744
<b>Total</b>	<b>free</b>				<b>\$902,065</b>

\*Year of Launch

# Nema odmora

Steven Pinker

- ▶ The fact that many measures of environmental quality are improving **does not mean that everything is OK**, that the environment got better by itself, or that we can just sit back and relax.
- ▶ For the cleaner environment we enjoy today **we must thanks the arguments, activism, legislation, regulations, treaties, and technological ingenuity** of the people who sought to improve it in the past.
- ▶ We'll need more of each to sustain the progress we've made, prevent reversals (particularly under the Trump presidency), and extend it to the wicked problems that still face us, such as the **health of the oceans and atmospheric greenhouse gases**.





# Artificial intelligence



# Artificial intelligence

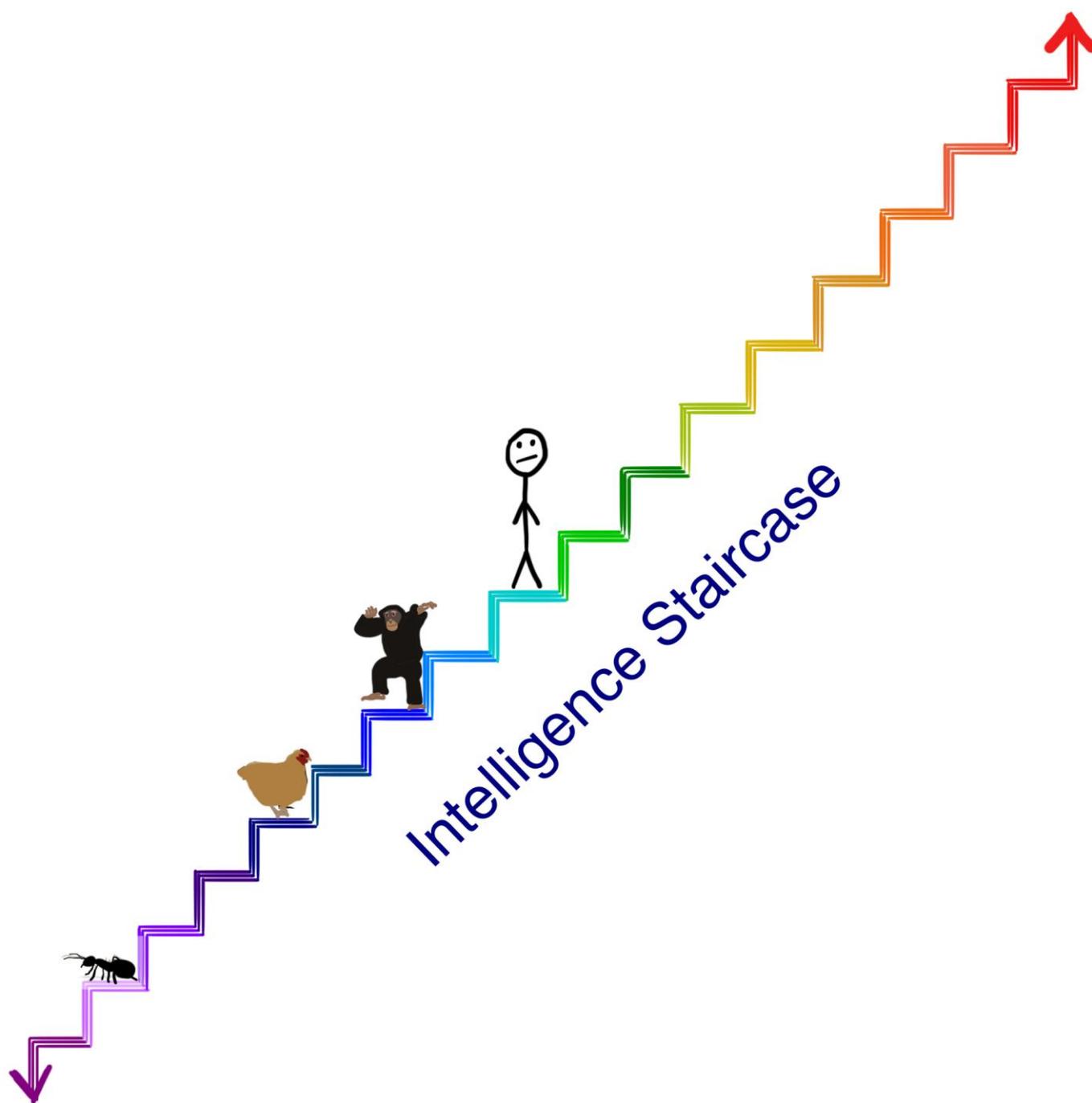


# General artificial intelligence (GAI)

---

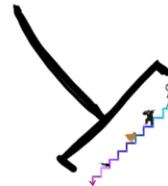


**CREATIVE  
INTELLIGENCE**



**Biological  
Range**

**GAI**



## LIFE 1.0

- Can survive and replicate
- Cannot design software nor hardware

## LIFE 2.0

- Can survive and replicate
- Can design software, but not hardware

## LIFE 3.0

- Can survive and replicate
- Can design software and hardware

A composite image featuring five vertical strips of human faces. From left to right: an older man with glasses, a woman with blue eyes, a woman with striking green eyes, a man with curly hair and a beard, and a man with a red beard. The text 'LIFE 2.1' is centered over the top half of the image.

LIFE 2.1

H U M A N S

# GAI: good or bad?

When will AI surpass human level?

Never

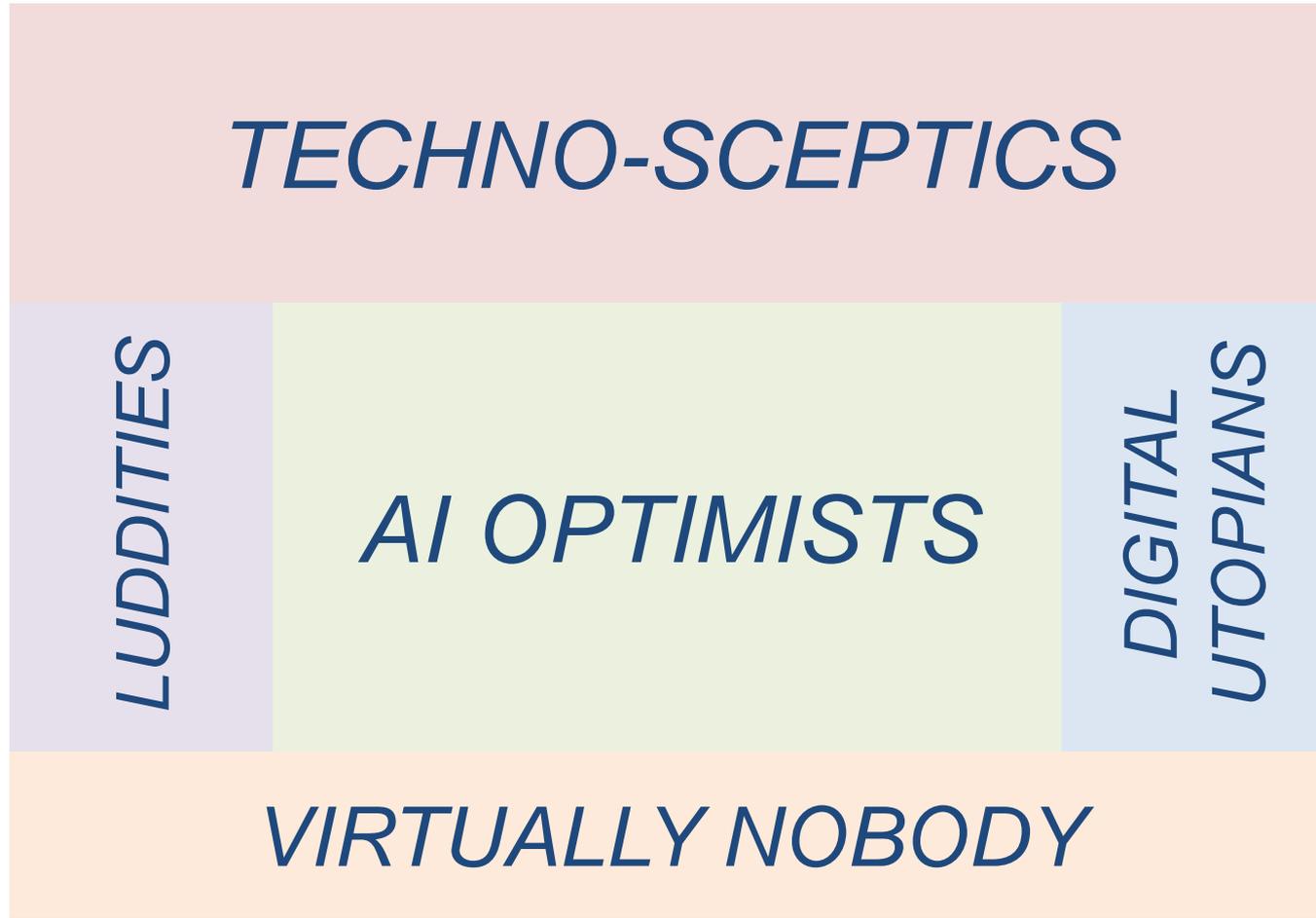
In 300 years

In 100 years

In 50 years

In few decades

In few years



Definitely bad

Probably bad

Highly uncertain

Probably good

Definitely good

If superhuman AI appears, will it be a good thing?

# Myths vs facts

## MYTH

Superintelligence by 2100 is inevitable

Superintelligence by 2100 is impossible

## FACT

It may happen in decades, centuries or never

AI experts disagree & we simply **don't know**



# Myths vs facts

## MYTH

Only Luddites worry about AI



## FACT

Many top AI researchers are concerned



# Myths vs facts

## MYTHICAL WORRY

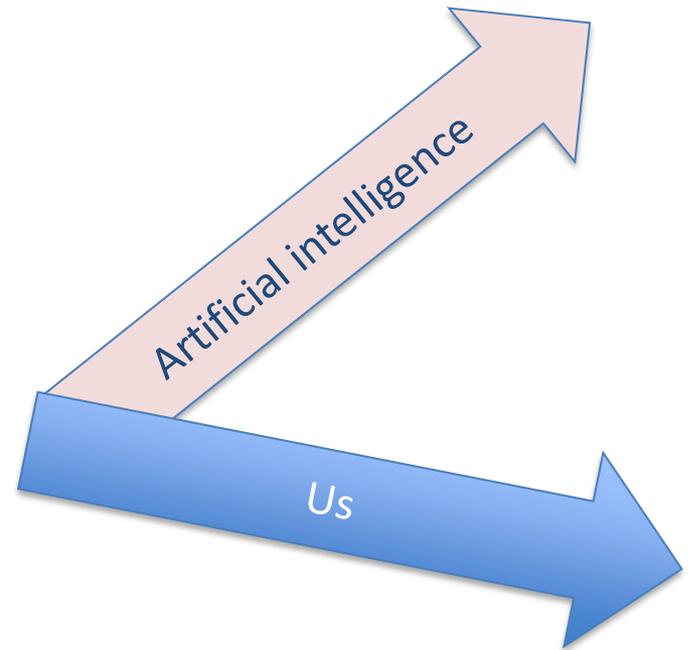
AI turns evil

AI turns conscious



## ACTUAL WORRY

AI turning competent,  
with goals misaligned with ours



# Myths vs facts

## MYTH

Robots are main concern



## FACTS

Misaligned intelligence is the main concern; **it needs no body, only an internet connection.**



# Myths vs facts

## MYTH

AI can't control humans



## FACTS

Intelligence enables control.

We control tigers by being smarter.



# Myths vs facts

## MYTH

Machines can't have goals



## FACT

A heat-seeking missile has a goal



# Myths vs facts

## MYTHICAL WORRY

Superintelligence is just years away

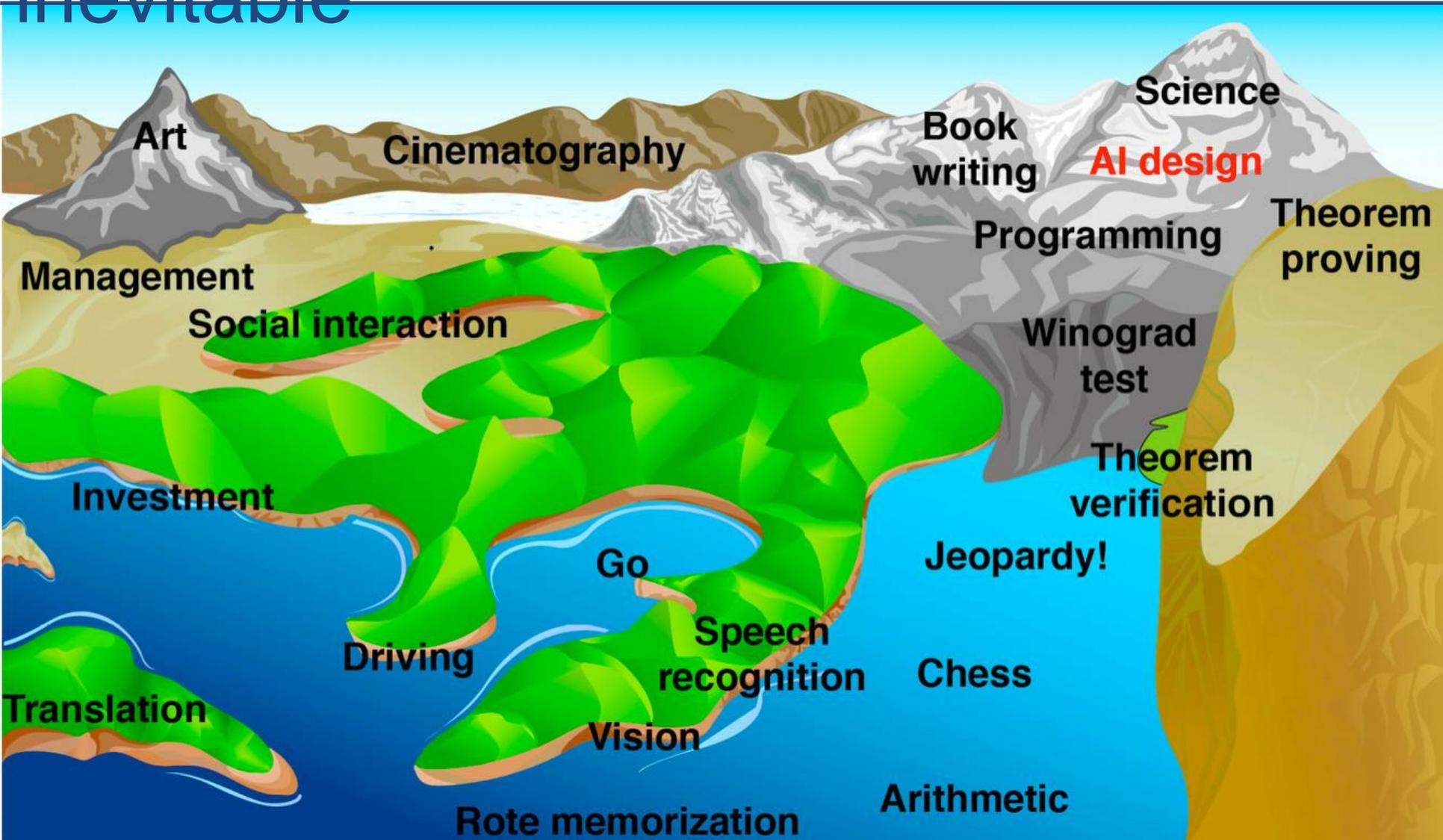


## ACTUAL WORRY

It's at least decades away, but it may take that long to make it safe



# The Flood is coming ... and is inevitable



*Hans Moravec's "landscape of human competences"*

Tell to your kids ... to choose the peaks

---



What will certainly happen to you?

WHAT WILL HAPPEN TO  
US WHEN WE DIE? 😊



EARTH TO EARTH,  
ASHES TO ASHES, DUST  
TO DUST; IN SURE AND  
CERTAIN HOPE OF THE  
RESURRECTION INTO  
ETERNAL LIFE

- Book Of Common Prayer

# Genesis 3:19

By the sweat of your face You will eat bread, **till you return to the ground**, because **from it** you were taken; for you are dust, and **to dust you shall return.**



**More air than dust ...**

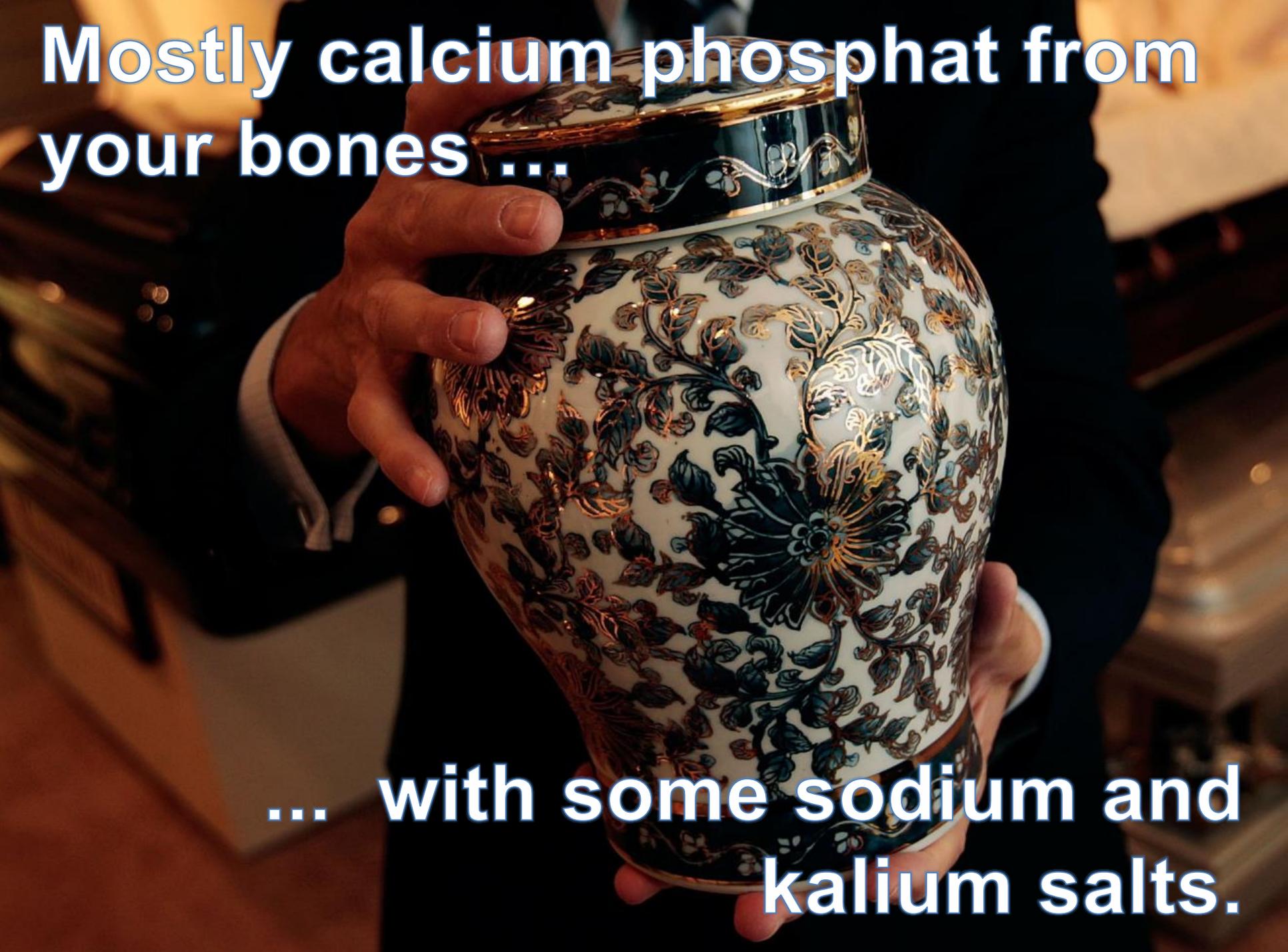
**... invisible “spirit” composed  
of CO<sub>2</sub> and vapour.**



- 800 – 1000 °C
- In few minutes all water molecules will evaporate to the atmosphere
- Then the carbon, with oxygen, will fly away to the atmosphere as  $\text{CO}_2$
- Similar thing will happen to hydrogen, sulfur or nitrogen atoms

**Mostly calcium phosphat from  
your bones ...**

**... with some sodium and  
kalium salts.**





“DEATH IS NOT THE END”

TRUE-BLOOD.NET RADIO  
EPISODE 225







# You want a physicist to speak at your funeral

---

- ▶ You want the physicist to talk to your grieving family about the conservation of energy, so they will understand that your energy has not died. You want the physicist to remind your sobbing mother about the first law of thermodynamics; that no energy gets created in the universe, and none is destroyed. You want your mother to know that all your energy, every vibration, every Joule of heat, every wave of every particle that was her beloved child remains with her in this world. You want the physicist to tell your weeping father that amid energies of the cosmos, you gave as good as you got.

*Aaron Freeman*

---

# You want a physicist to speak at your funeral

---

- ▶ And you'll want the physicist to explain to those who loved you that they need not have faith; indeed, they should not have faith. Let them know that they can measure, that scientists have measured precisely the conservation of energy and found it accurate, verifiable and consistent across space and time. You can hope your family will examine the evidence and satisfy themselves that the science is sound and that they'll be comforted to know your energy's still around. According to the law of the conservation of energy, not a bit of you is gone; you're just less orderly. Amen.

*Aaron Freeman*

---

- Where do we come from? Who we are?
- Where are we going?
- Does universe has a purpose or a sense?
- Is universe created or has appeared from nothing?
- Why there is something, rather than nothing?
- Up to now we thought these are the questions for  
PHILOSOPHY OR RELIGION
- But, these are the questions about **nature** and they are  
in domain of

**SCIENCE**



*By Lawrence Krauss*

From **observers of nature** we became



**CREATORS OF NATURE**

A photograph of a classroom with a green chalkboard. Several students' hands are raised in the air, indicating an active discussion or a Q&A session. The focus is on the hands, with the students' faces blurred in the background.

**DISCUSSION IN  
WHICH WE SHOULD  
ALL GET INVOLVED**

# The right question

---

~~What will be the future?~~

What is the future we want?

---

# I am an optimist ...

---

... because I believe in you.

... in those that will inherit you.

... or even better “in those you will create”



What is certain ...

---

**The future will be  
hyper-super-ultra  
interesting!**

---

**NOT ONLY PARTICIPATE**

**CREATE IT!**

