
The End of Darwinism

How Humans are Overriding Evolution

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Overview

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3. Humanity
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Darwinism

Our definition:

- Natural Selection is biological evolution without human intervention
- Offspring overproduction with genetic variation and mutations
- The most adaptable offspring have higher statistical survival rates over multiple generations
- Similar to Schumpeter's "Creative Destruction"



Darwinism has Broken Down for Humanity

- Darwinism is based on the overproduction of offspring, with the most adaptable surviving
- In recent times, human offspring have near 100% survival rates
 - A few hundred years ago, only a minority of children survived to reproduction age
- Human adaptation is no longer biological, but instead technological and cultural



Reproduction, Life, and Evolution

	<u>Input</u> <i>reproduction activity, variation, overproduction</i>	<u>Process</u> <i>life to reproduction, competition, survival, adaptability</i>	<u>Output</u> <i>species evolution</i>
<i>Humans</i>	<ul style="list-style-type: none">- birth control- global fertility: 2.4- most developed countries below replacement fertility: 2.1	<ul style="list-style-type: none">- near 100% survival rates- high child investment- technology: medicine, sanitation, education, cumulative learning	<ul style="list-style-type: none">- inflection point with humans no longer genetically adapting- humans adapting through technology and cultural changes

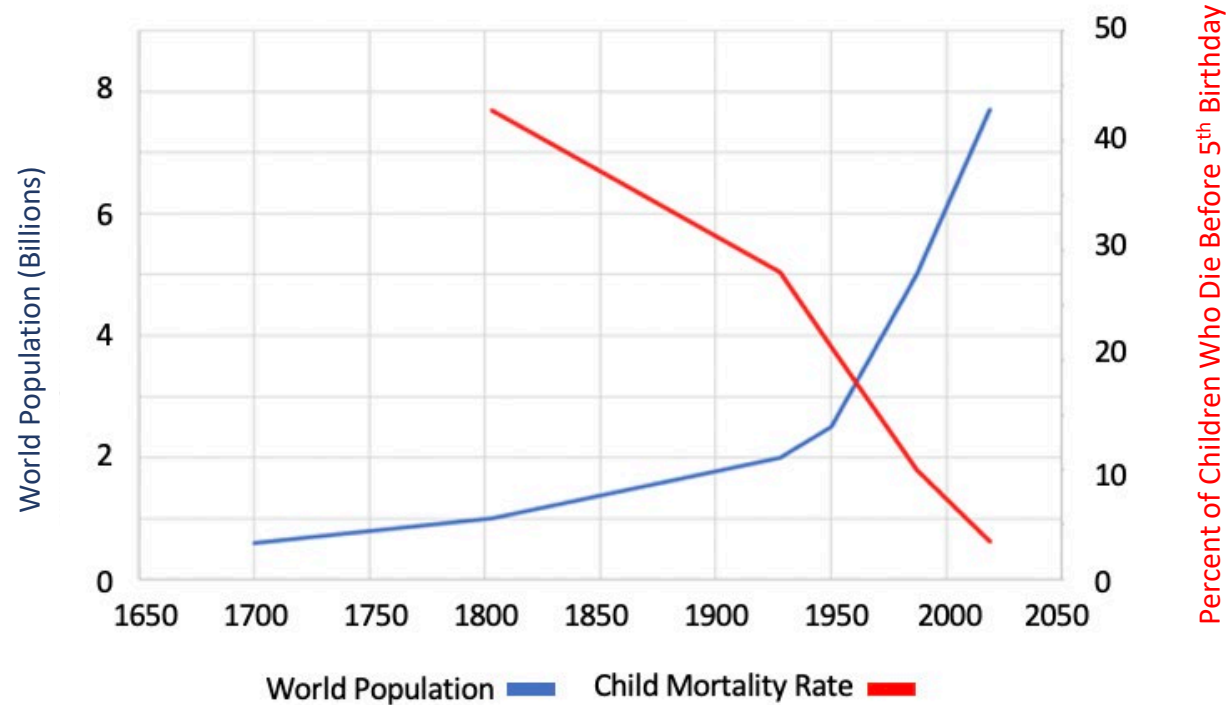


Major Innovations and Cultural Adaptations

- About 250,000 years ago: first humans, subject to Malthusian trap
- Clothes, shelter, fire, cooking, and language
- Transition from hunter-gatherer to agricultural food sufficiency
- Civilization, urbanization, warfare, religion, writing and education
- Economic development, trade, money, wealth creation
- Infrastructure, transportation, automation, computers, space exploration
- Public health, medical advances, child mortality drops, longevity
- Women's empowerment, choosing fertility, heavy investment per child



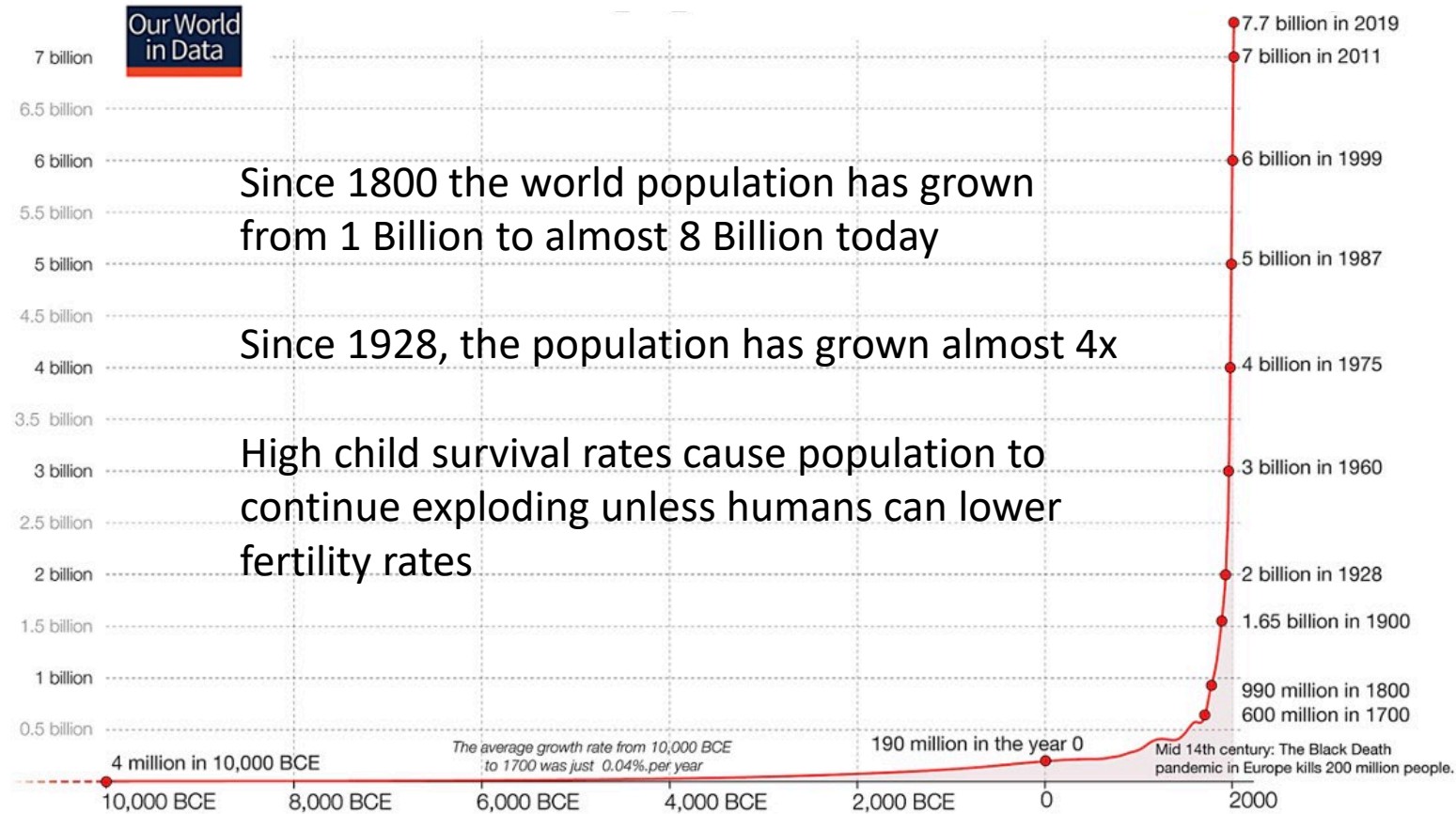
World Population vs Child Mortality



- Throughout human history, only a minority of children survived to reproduction age
- Since Malthus (1798), child mortality has dropped from 43%, down to 2.5% today



Size of the World Population over the last 12,000 years



Source: Based on estimates by the History database of the global environment (HYDE) and the United Nations. This is a visualization from OurWorldInData.org. Max Roser, Hannah Ritchie and Esteban Ortiz-Ospina (2013) - "World Population Growth". Published online at OurWorldInData.org. Retrieved from: <https://ourworldindata.org/world-population-growth> [Online Resource]



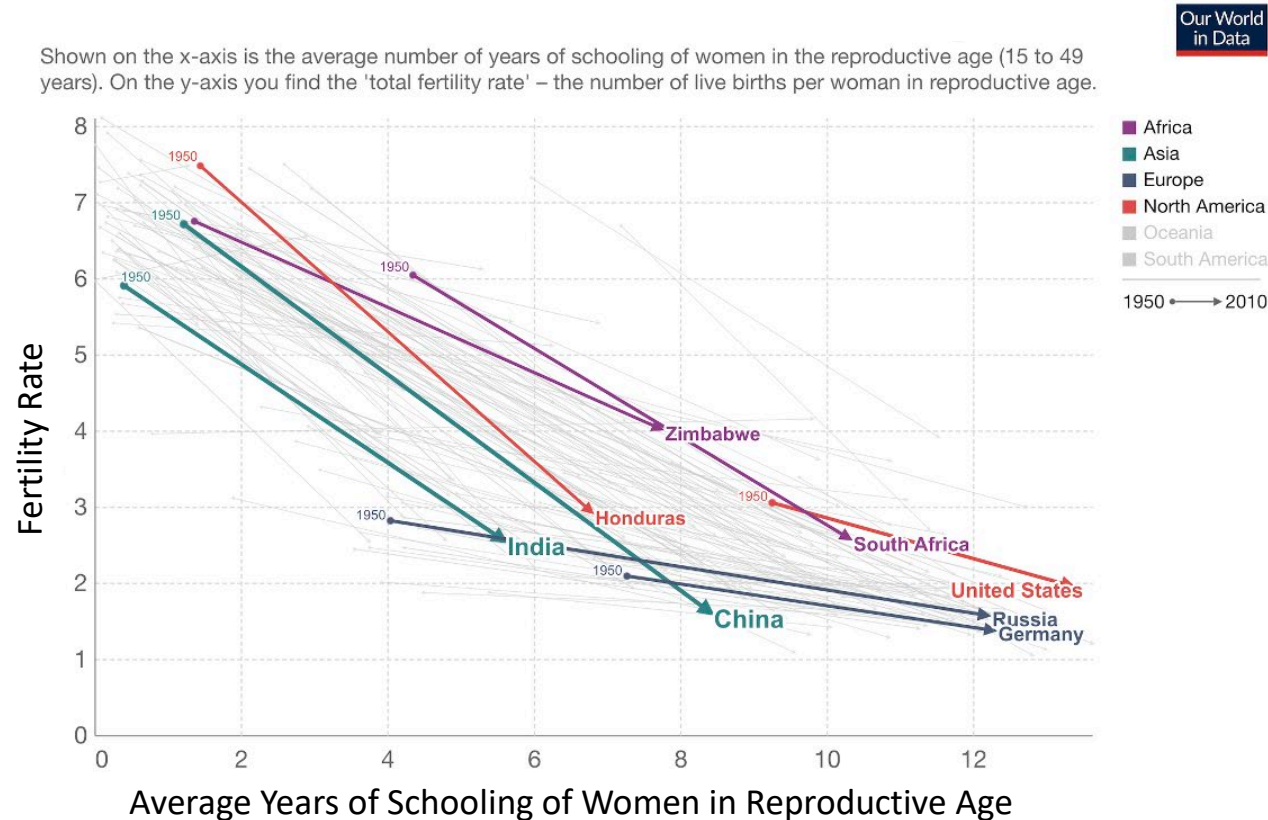
Long Term Growth Rates in GDP per Capita

	<i>China</i>	<i>UK</i>	<i>World</i>
<i>Start Year</i>	1000	1000	1820
<i>Start Year GDP per Capita</i>	\$1,225	\$1,151	\$1,102
<i>End Year</i>	2020	2020	2020
<i>End Year GDP per Capita</i>	\$13,370	\$41,250	\$15,678
<i>Ratio</i>	10.9	35.8	14.2
<i>Annual Growth Rate</i>	0.23%	0.35%	1.34%

- Since 1820, world real GDP growth (2.38%) far exceeds population growth (1.03%)
- Humans are economically adapting: per capita GDP continues to increase



Women's Educational Attainment vs Fertility Rate



- Women's empowerment lowers fertility rates, acting to curb explosive population growth
- Since 1970, world fertility rates per woman have fallen from 4.8 to 2.4

Source: United Nations, Department of Economic and Social Affairs, Population Division (2019). World Population Prospects: The 2019 Revision, DVD Edition. <https://population.un.org/wpp2019/Download/Standard/Interpolated/>
Barro and Lee, census data <http://www.barrolee.com/data/wholepop.htm>



Domesticated Animals and Plants

Reproduction, Life, and Evolution

	<u>Input</u> <i>reproduction activity, variation, overproduction</i>	<u>Process</u> <i>life to reproduction, competition, survival, adaptability</i>	<u>Output</u> <i>species evolution</i>
<i>Domesticated Animals</i>	<ul style="list-style-type: none">- birth control- artificial insemination- selective breeding	<ul style="list-style-type: none">- humans choose the survival rate for domesticated animals	<ul style="list-style-type: none">- species evolve to meet human needs and preferences
<i>Domesticated Plants</i>	<ul style="list-style-type: none">- GMO seeds- human determined location and proximity- Homogeneity	<ul style="list-style-type: none">- crops survive- weeds impacted	<ul style="list-style-type: none">- industrialized agriculture produces an abundance of inexpensive food- agriculture is less than 2% of the US economy

Descriptions under Input, Process, and Output are authors' interpretations



Domesticated Animals and Plants

World Land Area

	Land Type	Percent of Earth's Land
DOMESTICATED (35%)	Grazing Pastures	27
	Cropland	7
	Towns, Cities, Infrastructure	1
WILD (65%)	Temperate Forest	20
	Deserts and Barren Land	19
	Glaciers	10
	Savanna, Grassland, Shrubland	8
	Tropical Forest	6
	Freshwater	1
TOTAL:		100%

- The land useful to humans is mostly domesticated
- Grazing pastures are majority of the domesticated land
- Meat substitutes may reduce the need for grazing pastures



Reproduction, Life, and Evolution

	<u>Input</u> <i>reproduction activity, variation, overproduction</i>	<u>Process</u> <i>life to reproduction, competition, survival, adaptability</i>	<u>Output</u> <i>species evolution</i>
<i>Wild Animals</i>	<ul style="list-style-type: none">- Variety and proximity of mates may be limited	<ul style="list-style-type: none">- pesticides, hunting- Pollution, plastics, habitat destruction- geographic isolation	<ul style="list-style-type: none">- evolution cannot keep up with human induced environmental change- endangered species
<i>Wild Plants</i>	<ul style="list-style-type: none">- habitat destruction	<ul style="list-style-type: none">- Herbicides, degraded soil- Invasive species- Climate change	<ul style="list-style-type: none">- Relative proportions of species altered



Ability to Adapt

<i>Organism</i>	<i>Time to Sexual Maturity</i>	<i>Number of Offspring</i>	<i>Lifespan</i>
Oak Tree	20 years	Up to 10,000 acorns per year	150-300 years
Fruit fly	24-48 hours	20 eggs, up to 500 eggs lifetime	40-50 days
Robin	1 year	4-6 per season	5-6 years
Housecat	7-9 months	4 per litter, 5 times per year	13-17 years
Atlantic Bluefin Tuna	4-5 years	5 million – 25 million per year	20 years
Elephant	8-13 years	1, up to 12 throughout lifetime	50-70 years
Human	12-16 years	1 every 1+ years for 20 years	72 years

Ability to adapt is:

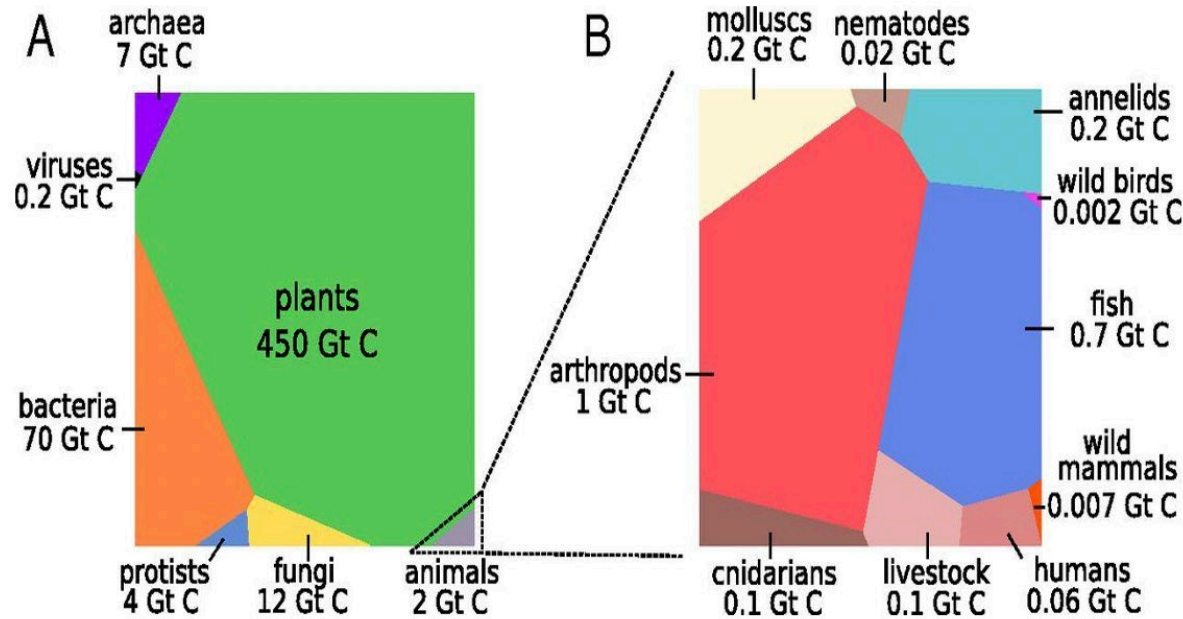
- positively related to the number of offspring
- inversely related to time to sexual maturity, e.g. elephants
- dependent on migration ability, plasticity, diversification



Wild Animals and Plants

Biomass by Category of Species

i: Graphical Representation of Biomass Proportions



Drawn only to approximate scale

	<i>Terrestrial</i>	<i>Ocean</i>	<i>Subsurface</i>	<i>% of Total Biomass</i>
<i>% of Total Biomass</i>	86.20%	1.21%	12.59%	100%
<i>Plants</i>	95.60	13.60	0	82.57
<i>Bacteria</i>	1.34	21.15	90.82	12.84
<i>Fungi</i>	2.50	3.63	0	2.20
<i>Archaea</i>	0.08	4.23	9.18	1.28
<i>Protists</i>	0.37	33.83	0	0.73
<i>Animals</i>	0.09	23.56	0	0.37 (0.01 humans)
	100%	100%	100%	100%

- Animals make up a small part (0.37%) of biomass with humans only .01%
- 96% of mammal biomass is domesticated
- Most of the planet's biomass is not heavily affected by humans



Human Impact on Selected Categories

Selected Categories	Description	Human Impact
Animals:		
Mammals	96% domesticated; humans, cattle, pigs, etc.	Very High
Birds	Mostly domesticated; chickens, turkeys, etc.	Very High
Fish	Overfishing, pollution, global warming, farming	Medium-High
Mollusks	Pollution harms mussels, octopi, snails, etc.	Medium
Arthropods	Pesticides & pollution impact insects, crustaceans	Medium
Annelids	Industrial agriculture impacts worms, etc.	Low
Plants:		
Domesticated	Agriculture (grains, corn), grass, gardens etc.	Very High
Wild	Global warming & herbicides impact wild plants	Medium-Low
Other:		
Bacteria	Single-celled microorganisms found throughout nature	Low
Fungi	Primarily terrestrial; mushrooms, mold, etc.	Low
Archaea	Primarily subsurface single-celled microorganisms	Low
Protists	Oceanic & terrestrial single-celled protozoa, algae, etc.	Low



Benefits and Costs

- Humans **benefit** from overriding Darwinism
 - Food, shelter, high investment per child, wealth
 - Low child mortality, longevity, choosing fertility
- **Mixed** impacts on domesticated animals and plants
 - Industrial agriculture creates uneven conditions for animals
 - Advocate to create more hospitable environments for animals
 - Plants and animals would benefit from more diversity
- **Negative** impacts on wild animals and plants
 - Environmental damage = human population x per capita damage
 - Developed countries have the big environmental footprint
 - Eating less meat, ecological-agricultural efficiency, polluting less
 - Poor countries have high fertility rates



Conclusions

- Darwinism
 - Overproduction of offspring with genetic variation
 - Higher statistical survival rates over multiple generations for the most adaptable
- Humans
 - Near 100% survival rates -> explosive population
 - Resolved by technological and cultural adaptation, e.g. lower fertility rates with high child investment
- Domesticated and Wild Species
 - Domesticated: humans override natural evolution
 - Wild: many have trouble adapting to the fast-changing environment, especially higher order species
- Darwin Fights Back
 - Humans have not yet impacted most of the planet's biomass
- Overriding Darwinism
 - Overriding Darwinism benefits humans, is mixed for domesticated species, and harms wild species

