Exercises in Secular Heresy

Technological Determinism, Civil Liberties, and the Taboo of Diminishing Returns

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Abstract

While phrases like **"technological evolution"** and **"technological progress"** are frequently used in both the mainstream press and scientific journals to explain or justify broad social changes, closer examination reveals serious problems with this way of thinking.

The use of evolution in reference to technology is fundamentally metaphorical, fallacious, and a threat to both democratic institutions and human ecology.

The fallacy is precisely the secular equivalent of **"intelligent design"** among religious creationists, with similarly troubling implications.

"Technological evolution" is furthermore used to frame "progress" in terms of natural processes rather than economic policies, forming the nucleus of an ideology that is profoundly influential but largely overlooked due to its effective invisibility *as* an ideology.

"Progress" must end, and ending "progress" requires a realistic appraisal of the **diminishing returns** associated with investments in technology, and, accordingly, a shift in how resources are allocated.

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graphic tracking information for a particular cell phone.

In 1979, information about phone calls apart from content could only include numbers dialed and time and duration of those …

> *"Evolution of technology may call into question legal concepts formulated in an earlier technological context."*

ments narrow the scope of information these agencies may collect.

More generally, the U.S. government has advocated an interpretation that querying a database is the threshold event that defines a search. Privacy advocates strenuously disagree, arguing that capturing data should be regarded as search. Such questions arise because computer-based searches are different from human searches, but their answers are judgments about the formulation of national policy.

LOCAL VERSUS INTERNATIONAL STORAGE OF DATA. As U.S. companies increasingly store data abroad for a variety of business reasons, how and to what extent, if any, does U.S. government access to such data require legal assent of the nations where data …

other. Few people object to the phone company's collecting metadata for billing purposes. But they may object to bulk collection of such information by government agencies.

Data that are not collected provide the maximal degree of privacy protection but are, by definition, unusable. Use-based privacy provides more flexibility in using data, but the degree of privacy protection depends on the scope of approved uses and on compliance to rules governing use. Perfect compliance with use-based protections cannot be assured, and thus, policy-makers must determine what level of noncompliance would make such protections ineffective.

SECURING VERSUS SURVEILLING. The U.S. government has sought to promote a global Internet that is safe, secure, and reliable. To this end, it undertakes many efforts, e.g., developing global standards to ensure secure communications. But it has been suggested that some parts of the U.S. government have sought to weaken standards for secure communication and to penetrate seemingly secure data communications pathways and storage facilities.

Whether or not the allegations about U.S. …

INSIGHTS

An overly tight mucus grip in cystic fibrosis *p. 730*

Getting to O_2 in photosynthesis *p. 736*

PERSPECTIVES

INFORMATION TECHNOLOGY

Technology's limited role in resolving debates over digital surveillance

Teasing apart technical issues from social and political issues

By **Herbert Lin***

Herbert Lin, "Technology's Limited Role in Debates over Digital Surveillance." ***Science***, 15 August 2014.

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Most new technology comes from industrial-scale corporations.

Corporations are chartered by law and regulated by policy.

If a commercial technological development challenges a legal framework, why does this cause us to re-examine the law, rather than reconsider the need for a new technology?

Why do corporations and think tanks get to influence the law simply by invoking "technological evolution?"

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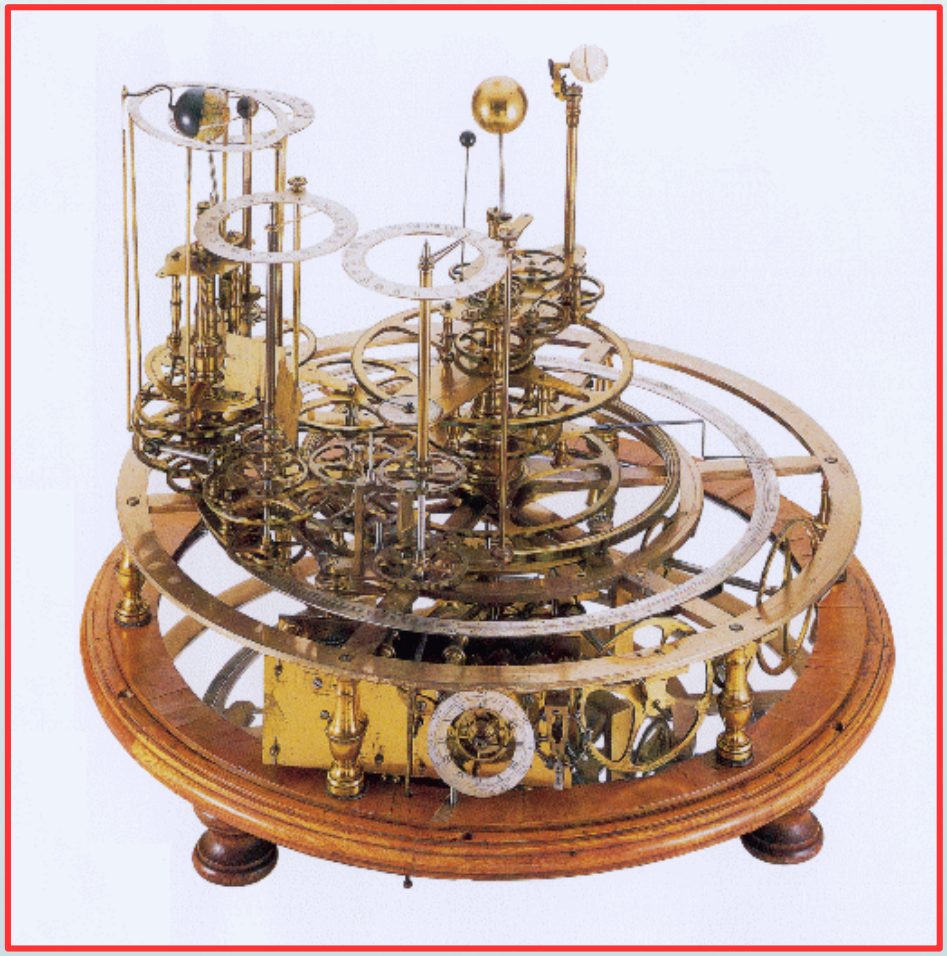

Within the Mechanical Tradition in western science, the Newtonian "clockwork universe" is used to describe natural processes in terms of **immutable laws** rather than Providence or "occult" influences.

In reference to technology, the terms "progress," "evolution," "development" and "change" are often used as synonyms.

Technology does not "evolve" because it is strategic planning, boards of directors, and market equilibrium **(oligopoly)** among major industrial firms – rather than "natural selection" – that determines how technologies develop.

Discussing technological change as "evolution" frames technology as a deterministic, logically necessary *law of nature*, rather than as the result of specific *policy decisions* by government officials in conjunction with the goals of organized industry.

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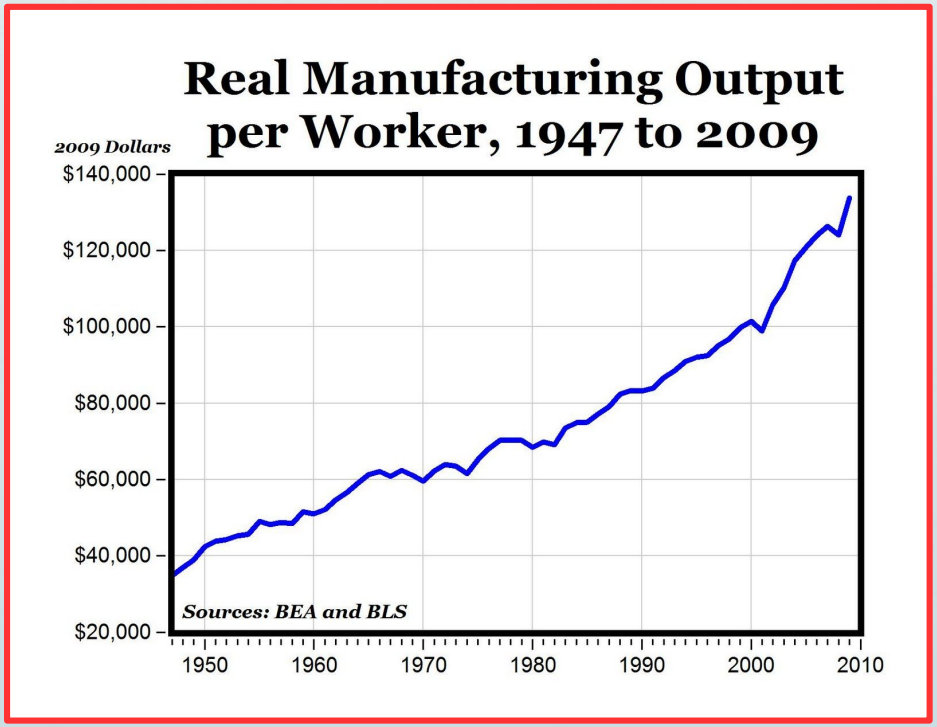
By invoking popular notions about the *amoral* objectivity of science, the doctrine of "technological evolution" *creates a moral problem for society's relationship to organized industry* by obscuring the role of *human intentionality (and, thus, of moral responsibility)* with respect to the social consequences of commercial technology products.



Left, data from the US Bureaux of Economic Analysis and Labor Statistics show gains in worker productivity resulting from automation.
Right, *Modern Times* (1936), The Tramp strapped into a workplace feeding machine to dramatize the human impact of technology on labor.

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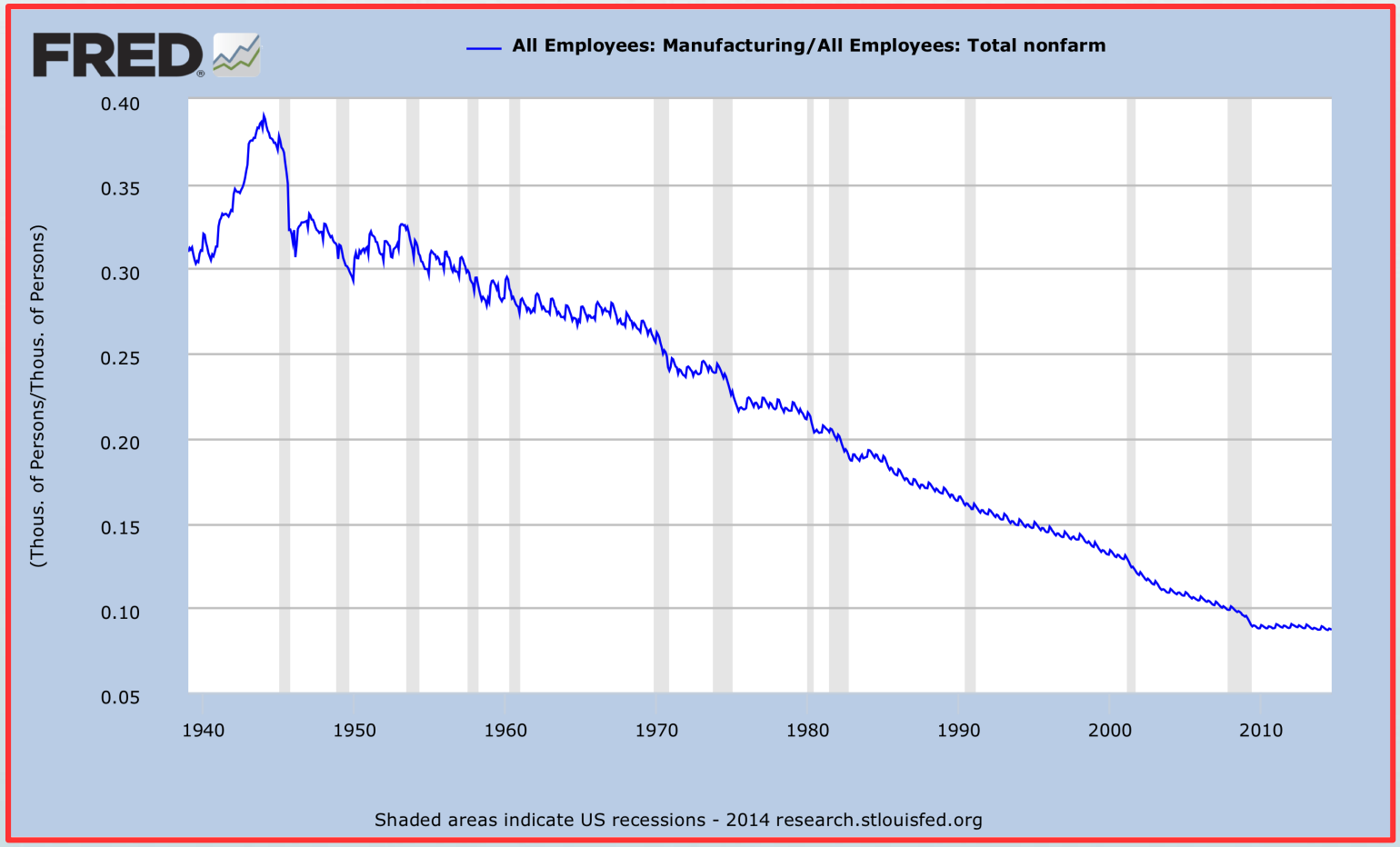

WHO IS RESPONSIBLE FOR THE LOSS OF MANUFACTURING JOBS, WAGES, BENEFITS, AND TAX REVENUE CAUSED BY WORKPLACE AUTOMATION?

Exercises in Secular Heresy

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The use of evolution in reference to technology is fundamentally metaphorical, fallacious, and a threat to both democratic institutions and human ecology.

DO WORKERS DESERVE A SHARE OF THEIR INCREASED PRODUCTIVITY? * DO THOSE WHO PROFIT FROM THE ELIMINATION OF JOBS HAVE A SOCIAL OBLIGATION TO THOSE HARMED BY LOST JOB OPPORTUNITIES?

David R. Witzling (drw@frametheweb.com)

The fallacy is precisely the secular equivalent of "intelligent design" among religious creationists, with similarly troubling implications.

Religious fundamentalists who advocate the “intelligent design” of nature commit a fallacy, since nature is **not** *teleological*, or, designed with intent to satisfy a specific purpose.

Scientistic ideologues who promote “technological evolution” commit a fallacy, since technology **is** *teleological*, or, designed with intent to satisfy one or another specific purpose.

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The fallacy is precisely the secular equivalent of "intelligent design" among religious creationists, with similarly troubling implications.

The use of "technological evolution" to *explain* technological change as an amoral, objective process (like the laws of nature) leads to problematic inferences about the social consequences of technology policy:

"Technology is neither good nor bad, but can be used for good or bad." *

"Nerve gas is neither good nor bad, but can be used for good or bad."

"Thermonuclear weapons are neither good nor bad, but can be used for good or bad."

"Cold War nuclear stockpiles were neither good nor bad, but could be used* for good or bad."

"The decision to develop thermonuclear weapons was neither good nor bad, but could be used for good or bad."

"The decision to deploy * thermonuclear weapons in WWII was neither good nor bad, but could be used for good or bad." *

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"One would encounter less dispute, on the whole, by questioning the *sanctity* of the family or religion than the *absolute merit* of technical progress."

"No other social goal is more strongly avowed than economic growth. No other test of social success has such nearly unanimous acceptance as the annual increase in the **Gross National Product**. And this is true of all countries developed or undeveloped; communist, socialist, or capitalist."

"The Communist countries have been greater or less rivals of the non-Communist states in accordance with their greater or less increase in **output**."

"There are differences of opinion between Communist and non-Communist scholars on the validity of the statistics and concepts which are employed in the two worlds to *measure* economic growth. *But there is no disagreement on the validity of the goal itself.*"

– John Kenneth Galbraith, *The New Industrial State* (1967)

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Eli Kintisch, "Fund climate intervention research, study says." *Science*, 23 February 2015.

CLIMATE SCIENCE

Fund climate intervention research, study says

U.S. needs more science to understand sun-blocking, carbon-removal technologies

The U.S. government should fund research in the contentious field of climate engineering, the National Research Council (NRC) declared this week. One tome of the hefty, two-volume report examines so-called albedo modification—concepts for cooling the planet by shading it, for example by spreading particles in the stratosphere or by making clouds more reflective. The other scrutinizes carbon dioxide removal techniques, which directly reduce the amount of greenhouse gas in the atmosphere, by using giant carbon-sucking machines, for instance.

Neither "intervention" is "a replacement for reducing carbon emissions" in combating climate change, the authors stressed in a statement. But they concluded that albedo modification—the more controversial of the options—requires a "increasingly likely" that carbon removal and storage technologies will be needed "to avoid the worst impacts of climate change." But any move to deploy them "should be informed by a far more substantive body of sci-

A Canadian firm envisions carbon-sucking fans (artist's

"might translate into gove... says climate scientist Dav... vard University. "It might ...sion' that [federal] progra... they need to move ahead."

Previous funding initia... tered. In 2001, a draft ... Energy (DOE) plan calle... $64 million research effort ... squelched that proposal, ... ficial Aristides Patrinos s... cause it didn't match ag... DOE also feared "adverse p... less of the merits of the re... noted. In Congress, says ...

...urvey and now editor-in-chief of *Science*, ...ight translate into government action," ...ys climate scientist David Keith of Har... ...rd University. "It might be the 'permis... ...on' that [federal] program managers feel ...ey need to move ahead."

...Previous funding initiatives have fal... ...ered. In 2001, a draft Department of ...nergy (DOE) plan called for creating a ...64 million research effort. But the agency ...quelched that proposal, former DOE of... ...cial Aristides Patrinos said in 2009, be... ...use it didn't match agency priorities. ...OE also feared "adverse publicity, regard... ...ss of the merits of the research," Patrinos ...oted. In Congress, says former Repre...

The report offers few specific guidelines for new funding. But it emphasizes that albedo modification potentially poses greater risks than carbon removal, because it involves large-scale changes to the atmosphere. The panel concludes that major experiments should not advance until the government establishes a "deliberative process" for weighing environmental risks. Both research areas should be managed by the cross-agency U.S. Global Change Research Program, it suggests, embedding such studies within mainstream climate science. Yet the authors warn that mixing albedo modification studies with basic atmospheric research could "have a chilling effect" on funding such basic studies. Some scientists think a dedicated research program would be less likely to "contaminate" climate science.

Researchers are eager to see how the government responds. Keith leads a team that wants funding to release half a kilogram of sulfuric acid particles into the stratosphere to see how sulfate haze—a possible sunshade—would affect ozone (*Science*, 18 October 2013, p. 307). "The agencies say they're waiting for guidance from OSTP [the White House Office of Science and Technology Policy], but OSTP says the agencies can do what they want," he says. (OSTP declined to address Keith's comment.)

Some hope the report will end such gridlock—and help the United States avoid the controversies that have crippled climate engineering research elsewhere. In the United Kingdom, the Royal Society in 2009 recommended a decadelong, £100 million research program. Six years later, it has funded just three projects, and the first—which involved using a balloon to release water vapor 1000 meters up—died after controversy over patents and opposition from environmental groups. The lesson, says physicist Tim Kruger of the University of Oxford in the United Kingdom, is that "for any proposed technique to be deployable, it needs both to work technically and socially." ■

...ns carbon-sucking fans (artist's concept) that could help cool the planet.

...ntative Bart Gordon (D–TN), who once ...d the House of Representatives science ...anel, the idea faced skeptics from both ...ght and left—from conservative lawmak... ...rs who felt it addressed a nonexistent ...hreat and from environmentalists worried ...hat geoengineering would sap support for ...missions cuts.

The field continued to get the cold shoul... ...er under President Barack Obama. In 2009, ...fter news reports suggested that White ...ouse science adviser John Holdren had put ...ch studies in play, Holdren felt compelled ... shoot down the idea. Among policymak... ...rs, the message was clear: The topic was ...boo. It's telling that the new report was ...riginally requested by the CIA, although ...veral research agencies, including DOE ...nd NASA, ultimately helped pay for it.

Corrected 12 February 2015; see full text.

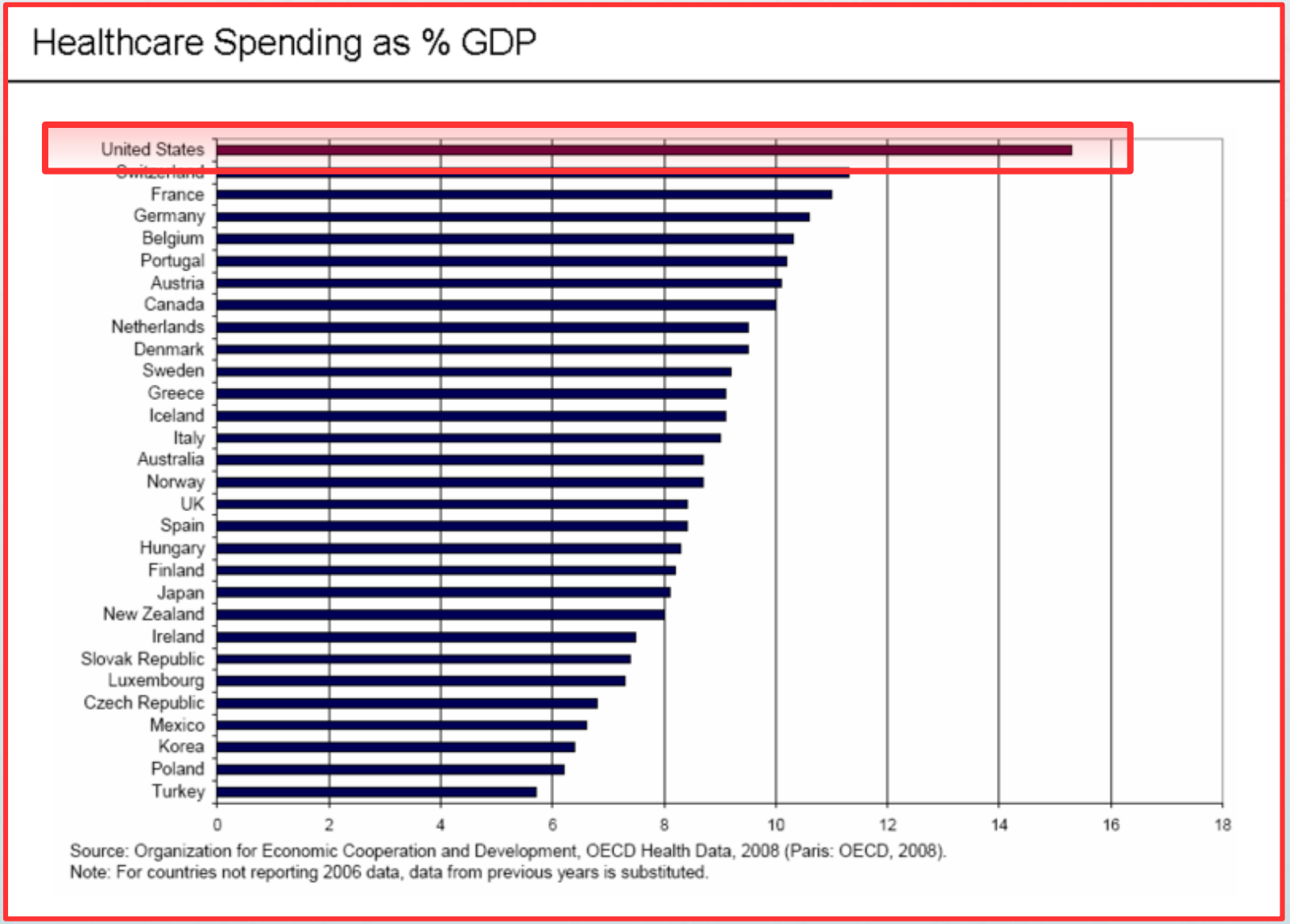
Published by AAAS

Is it *rational as a policy position* to expect technical solutions to the problems caused by technology itself?

Rather than develop new technologies to mitigate the harmful consequences of current technologies, a straightforward policy solution to CO2 emissions, for example, is to reduce energy use by increasing its cost (though this may impact growth & "progress). *

Reducing use avoids the problem of diminishing returns.

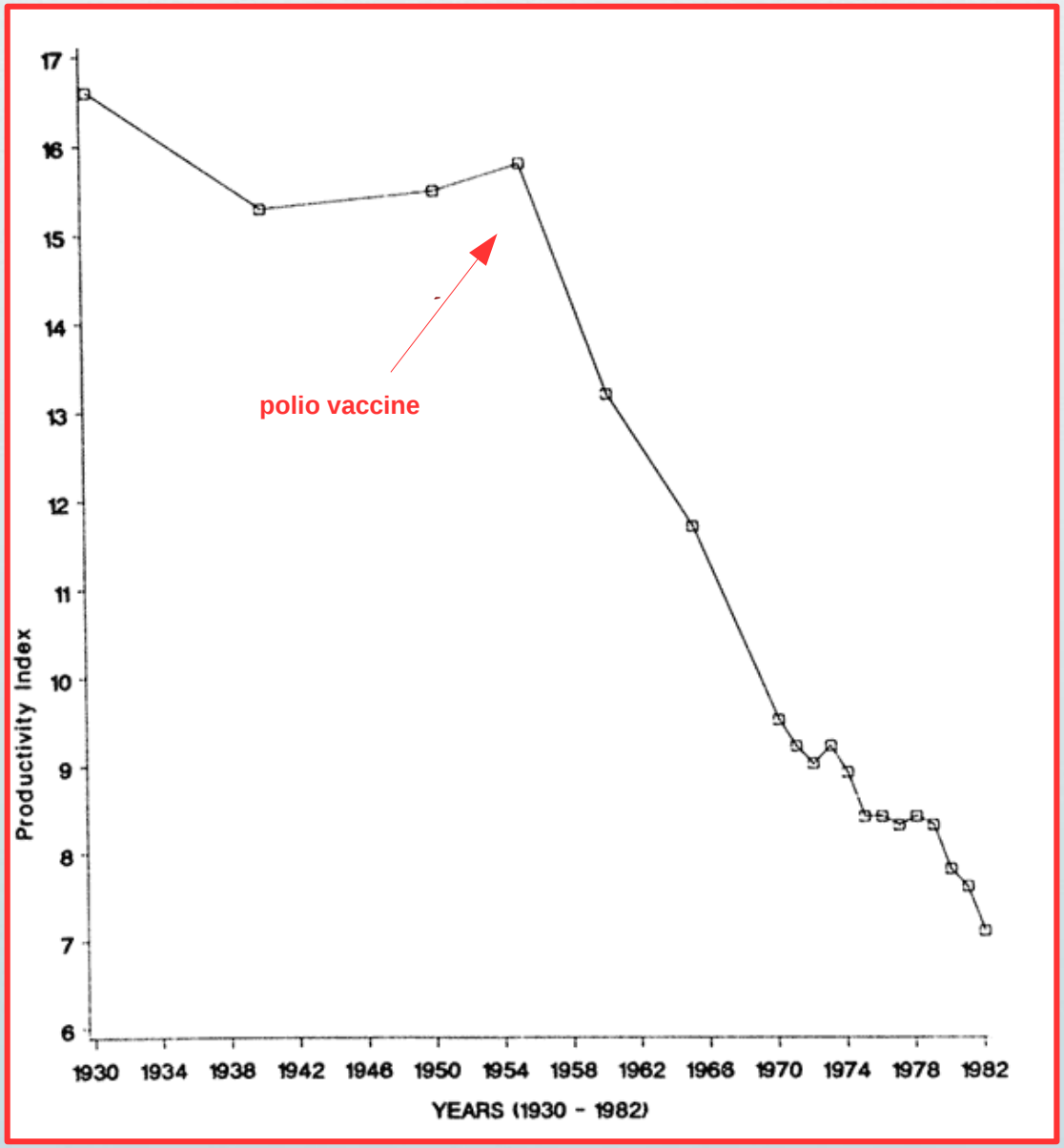
EXERCISE 1 – "PROGRESS" IN MODERN MEDICINE



Americans do not live 25% longer than the Swiss, French, or Germans. *Like any other business, societal investments modern medicine are subject to the economic law of diminishing returns. As a **law**, diminishing returns is not an explanation but a **description**: Newton's **laws** of gravity say nothing about what this invisible force is, while Einstein's **theory** of relativity **explains** gravity in terms of a curved space-time continuum.*

EXERCISE 1 – "PROGRESS" IN MODERN MEDICINE

"Advancement of Medical Science" *or* "Diminishing Returns"



Productivity of the US health care system, 1930-82.

Productivity index = (Life Expectancy) / (National Health expenditures as a percent of GNP)

Modern medicine is largely successful due to a small number of innovations:

1) Sanitation and hygiene (1847)
2) Anesthetics and Analgesics
3) Antibiotics (developed for ~ $20,000)
4) Preventative medicine (vaccine)

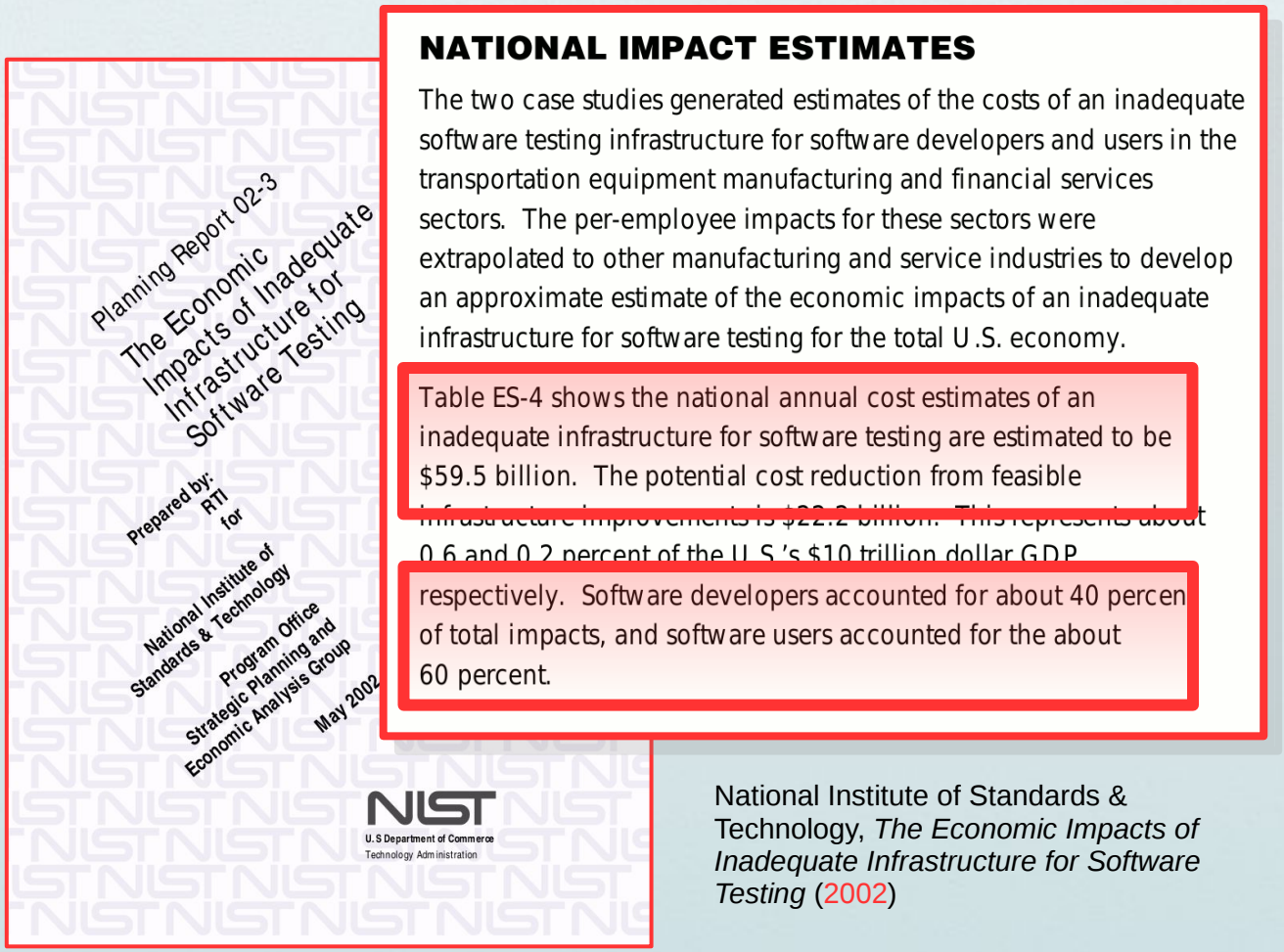
Modern medicine today is increasingly concerned with mitigating the negative consequences of industrial civilization itself on ***diet, lifestyle, and habitat****.*

Medical discoveries today solve increasingly esoteric problems -- at increasing costs -- for fewer patients.

From Joseph Tainter, *The Collapse of Complex Societies* (Cambridge University Press, 1988).

EXERCISE 2 – PROGRESS IN COMPUTING TECHNOLOGY

"Newer is Better" *or* "Diminishing Marginal Utility"



National Institute of Standards & Technology, *The Economic Impacts of Inadequate Infrastructure for Software Testing* (2002)

Adjusted for inflation, $59.5 billion equals $78.9 billion in 2015 dollars.

End users subsidize technological growth through indirect costs associated with software upgrades, such as lost productivity due to bugs or interface changes, updated system requirements, incompatibilities, and overhead (IT departments).

"For better or poorer, the only two products not covered by product liability today are religion and software, and software should not escape for much longer."

– Dan Geer, *Cybersecurity as Realpolitic* (Blackhat Keynote, 2014)

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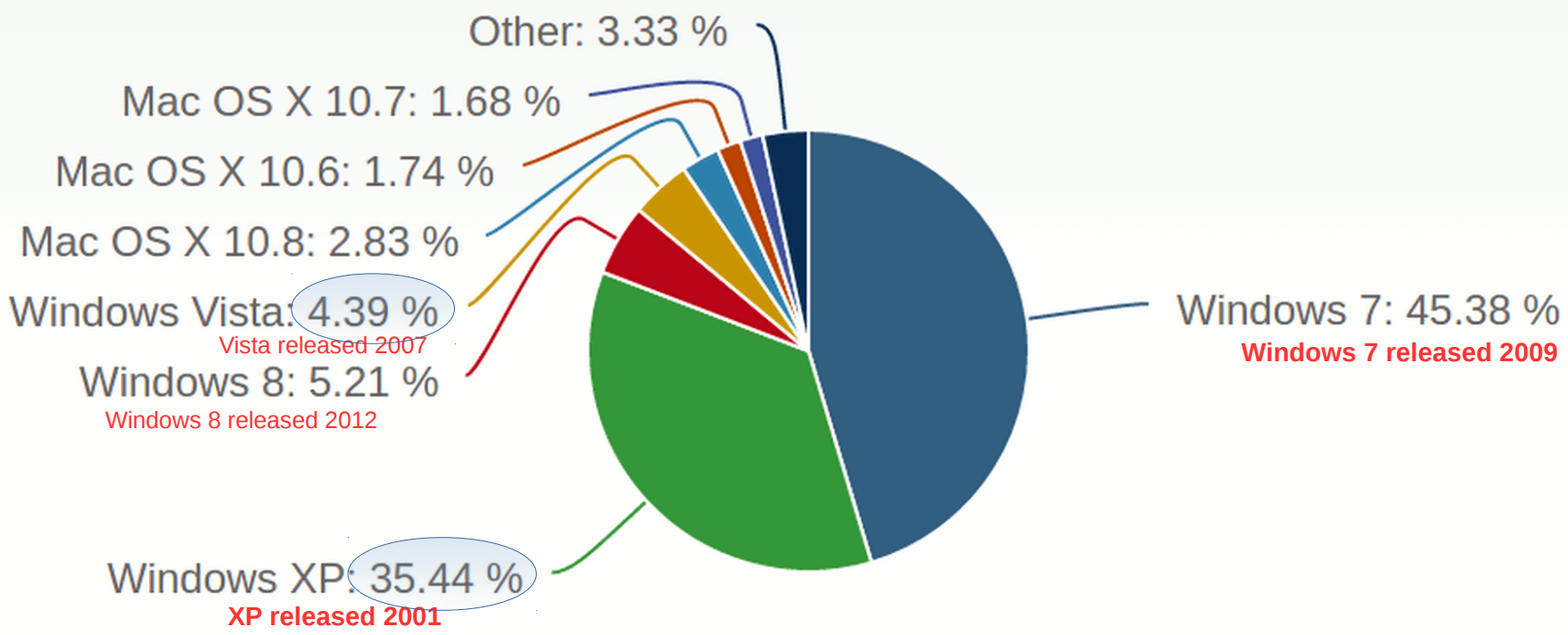

Operating System Market Share (2013). Source: Net Applications

At the end of 2013, over 30% of computers on the planet were running Windows XP, a 12-year-old, "functionally obsolete" operating system (which, over time, proved *good enough for a great many users*). Windows 95 was a commercial success because it was far superior to DOS. Windows Vista, a notorious flop, was not comparably superior to its predecessors (like XP).

EXERCISE 3 – EVOLUTION AND MARKETS NEVER ERR

"Humans are Tool Making Animals" *or* "**Why Nukes Are a Survival Advantage**"

Progress in Perspective (scale: 1 million years = 1,000 pixels)

The average longevity of a mammal species is 1,000,000 years

As an organizing principle of social order in the West, the ideology of progress is only about 200 years old. Although Antiquity acknowledged a "primitive" past, humankind was considered in a degraded state compared to a remote Golden Age. In Christendom, Eden was a lost paradise. The Renaissance venerated Antiquity. The idea that knowledge, society, and technology can be made to constantly improve dates to the Enlightenment, and has threatened ecological catastrophe in the geological blink of an eye. **There is little empirical evidence that our big brains are a distinct survival advantage.**

Neanderthals endured for about 350,000 years.

Behaviorally modern humans first appeared 50,000 ago

As an ideology and social mythology, progress is only about 200 years old

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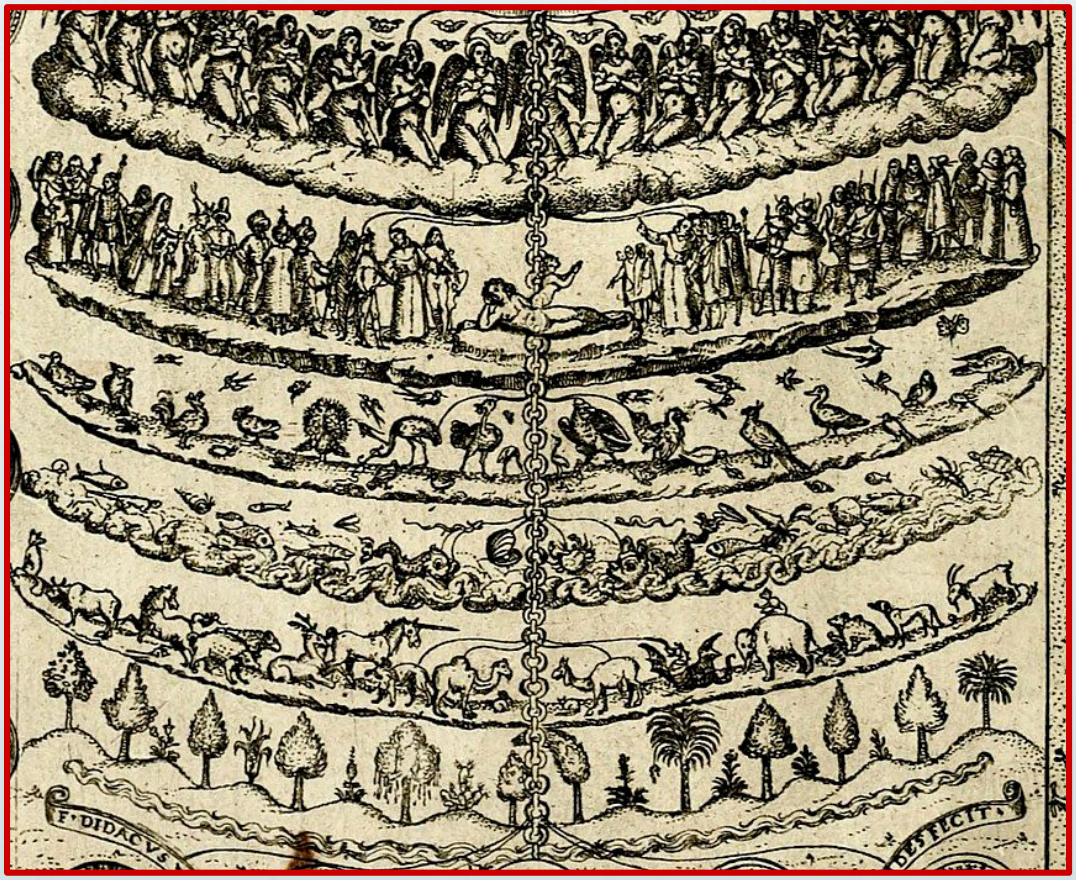
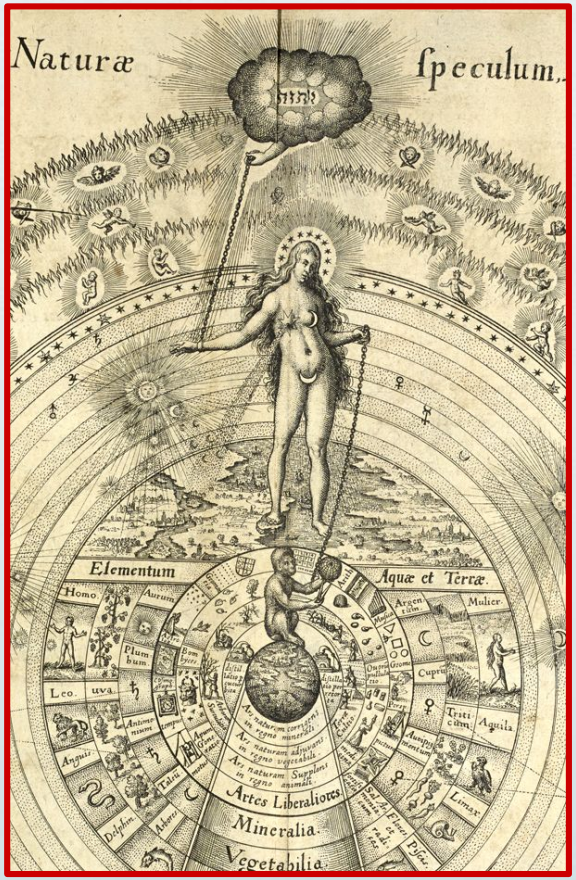
"Humans are Tool Making Animals" *or* "**Are Nukes a Survival Advantage?**"





Our ideas about progress derive from medieval conceptions of the scala naturae, or "great chain of being," which continues to influence perceptions of our role on the planet today: since "god is dead" we talk about humanity at "the top of the food chain" or "the most evolved" species on the planet. We apply this same thinking when we assume new technologies always improve the quality of our lives when, in many cases, this is only true when qualified as "convenience" or "distraction."

CONCLUSION – THE MODERN HERESY

"More Technology is Always Better"

Average Annual Rates of Labor Productivity and Capital Productivity Growth

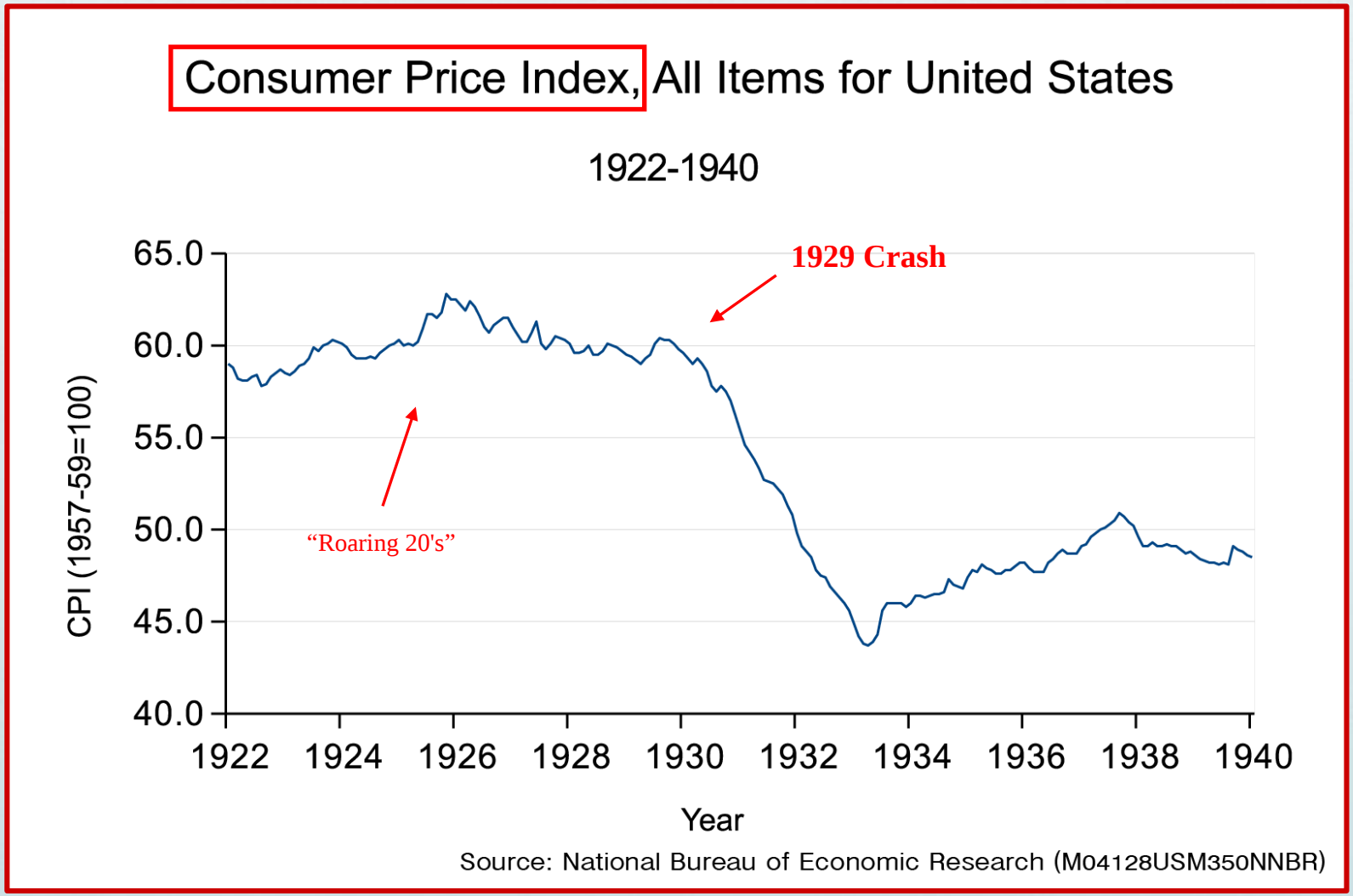
Period	Average Annual Labor Productivity Growth	Average Annual Capital Productivity Growth
1899-1909	1.30%	-1.62%
1909-1919	1.14%	-1.95%
1919-1929	5.44%	4.21%
1929-1937	1.95%	2.38%

Source: Devine, Warren Jr. (1983), Table 2 "From Shafts to Wires: Historical Perspectives on Electrification." *The Journal of Economic History* vol. 43

During World War I, American agricultural output increased dramatically to supply grain to Europe. The years leading up to the Great Depression were, accordingly, some of the most productive on record. After the war, American agriculture underwent heavy industrialization, which increased **supply** further, while European **demand** began to decline...

CONCLUSION – THE MODERN HERESY

"More Technology is Always Better"



In the postwar years, as mechanization and automation caused supply to far outstrip demand, prices collapsed.

CONCLUSION – THE MODERN HERESY

"More Technology is Always Better"

The most hungry years of the Great Depression were some of the most productive on record.

This social and economic disaster was compounded, paradoxically, by abundance: policy makers failed to organize an adequate system to regulate technological output in light of its social consequences.

Source: USDA *Agricultural Statistics* (1939)

TABLE 1.—*Wheat: Acreage, production, value, and foreign trade, United States, 1866–1938*—Continued

Year	Acreage harvested	Average yield per acre	Production	Season average price per bushel received by farmers [1]	Farm value	Price per bushel at— Chicago, year beginning July [2]	Price per bushel at— Minneapolis, year beginning July [3]	Foreign trade, including flour, year beginning July [4] Domestic exports [5]	Imports [6]	Net exports [7] Total	Net exports [7] Percentage of production
	1,000 acres	*Bushels*	*1,000 bushels*	*Cents*	*1,000 dollars*	*Cents*	*Cents*	*1,000 bushels*	*1,000 bushels*	*1,000 bushels*	*Percent*
1916	53,510	11.9	634,572	143.4	910,052	157	176	205,962	24,960	181,067	28.5
1917	46,787	13.2	619,790	204.7	1,268,898	228	220	132,579	31,215	102,775	16.6
1918	61,068	14.8	904,130	205.0	1,853,063	224	236	287,402	11,289	276,615	30.6
1919	*73,099*	*12.9*	*945,499*								
1919	73,700	12.9	952,097	216.3	2,059,421	227	300	222,030	5,511	216,671	22.8
1920	62,358	13.5	843,277	182.6	1,539,584	216	201	369,313	57,682	312,625	37.1
1921	64,566	12.7	818,964	103.0	843,458	128	148	282,566	17,375	265,590	32.4
1922	61,397	13.8	846,649	96.6	817,929	113	126	224,900	20,031	205,079	24.2
1923	56,920	13.3	759,482	92.6	703,283	106	124	159,880	28,079	131,892	17.4
1924	*50,862*	*15.7*	*800,877*								
1924	52,463	16.0	841,617	124.7	1,049,534	139	158	260,803	6,201	254,695	30.3
1925	52,443	12.8	668,700	143.7	961,131	161	165	108,035	15,679	92,669	13.8
1926	56,616	14.7	832,213	121.7	1,012,831	140	151	219,160	13,264	205,994	24.8
1927	59,628	14.7	875,059	119.0	1,041,512	138	141	206,259	15,734	190,578	21.8
1928	59,226	15.4	914,373	99.8	912,496	117	126	163,687	21,442	142,301	15.6
1929	*62,000*	*12.9*	*800,649*								
1929	63,332	13.0	823,217	103.6	852,928	130	130	153,245	12,956	140,361	17.0
1930	62,614	14.2	886,470	67.1	594,892	84	82	131,475	19,059	112,435	12.7
1931	57,681	16.3	941,674	39.0	367,636	53	71	135,797	12,886	123,774	13.1
1932	57,839	13.1	756,927	38.2	289,156	53	61	41,211	9,382	32,284	4.3
1933	49,438	11.2	551,683	74.4	410,291	94	91	37,002	11,494	25,508	4.6
1934	*41,948*	*12.2*	*513,218*								
1934	43,400	12.1	526,393	84.8	446,367	102	116	21,532	25,134	[8] 3,602	
1935	51,229	12.2	626,344	83.2	521,315	104	126	15,929	46,638	[8] 30,709	
1936	48,863	12.8	626,766	102.6	643,183	117	147	21,584	47,924	[8] 26,340	
1937	64,422	13.6	875,676	96.3	842,874	118	128	107,194	3,561	103,633	11.8
1938 [9]	70,221	13.3	930,801	[10] 55.2	514,231						

CONCLUSION – THE MODERN HERESY

"More Technology is Always Better"

TABLE 627.—*Farm equipment and related products manufactured and sold: Value by classes, United States, 1920–37*

Year	Total manufactured	Total sold for export	Sold in United States: Total	Plows and listers	Harrows, rollers, and pulverizers	Planting machinery	Cultivators and weeders	Harvesting machinery	Haying machinery	Machines for preparing crops for market or use	Tractor and traction engines	Horse-drawn vehicles	Barn and barnyard equipment	Miscellaneous	Power group [1]
	1,000 dollars	*1,000 dollars*	*1,000 dollars*	*1,000 dollars*	*1,000 dollars*	*1,000 dollars*	*1,000 dollars*	*1,000 dollars*	*1,000 dollars*	*1,000 dollars*	*1,000 dollars*	*1,000 dollars*	*1,000 dollars*	*1,000 dollars*	*1,000 dollars*
1920	536,945	66,626	471,442	37,699	20,636	21,612	17,296	30,626	19,667	34,749	165,799	40,929	(2)	82,429	242,174
1921	328,041	(2)	(2)	9,071	7,488	5,870	6,545	8,977	6,776	15,032	(2)	(2)	[3] 437	(2)	----------
1922	209,640	21,663	222,908	11,215	5,472	5,241	5,571	11,242	8,831	19,873	53,861	13,410	4,306	83,886	81,406
1923	364,854	49,349	311,976	20,086	[4] 10,340	9,250	[4] 13,179	17,032	14,017	22,918	77,418	23,156	9,635	[4] 94,938	108,914
1924	[4] 323,367	[4] 51,988	[4] 277,925	17,651	[4] 8,596	[4] 12,966	[4] 13,432	14,849	12,158	[4] 19,987	[4] 74,063	15,408	6,369	[4] 82,446	102,964
1925	[4] 391,812	[4] 65,324	340,271	20,002	[4] 10,174	[4] 19,121	17,234	23,468	12,247	[4] 27,617	[4] 92,507	17,457	8,889	[4] 91,555	133,870
1926	461,399	78,993	364,751	23,737	13,546	24,490	17,041	29,161	12,858	25,445	105,002	11,965	8,563	92,942	149,872
1927	460,881	71,946	391,869	22,676	12,327	22,882	13,086	38,823	14,850	28,948	131,667	8,961	9,158	88,491	183,351
1928	[4] 524,255	[4] 95,158	[4] 402,872	26,436	12,870	24,387	16,534	48,641	13,760	25,149	122,281	9,406	8,950	[4] 94,458	183,862
1929	[4] 606,622	112,870	[4] 458,091	30,450	13,400	24,811	20,536	53,655	17,311	24,825	155,406	8,194	10,020	[4] 99,482	223,208
1930	[4] 507,002	98,257	[4] 382,191	28,483	11,538	21,040	[4] 18,729	42,030	14,060	18,862	133,055	4,754	8,381	81,259	187,099
1931	214,391	[5] 248,979		(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	----------
1932 [6]	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------
1933 [6]	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------
1934 [6]	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------
1935	[4] 334,210	[4] 24,185	[4] 302,259	17,127	8,221	14,663	11,396	25,461	14,708	14,630	123,433	[7] 5,778	(8)	[9] 56,899	157,392
1936	487,273	37,045	409,090	22,523	11,598	20,692	16,731	29,605	15,928	19,088	171,851	[7] 7,755	(8)	[9] 79,285	228,231
1937	580,048	64,095	507,147	28,760	14,507	25,482	20,256	50,537	17,028	21,179	214,192	[7] 8,288	(8)	[9] 89,080	293,257

[1] Data include power equipment as follows: Tractors, tractor plows, combines, grain threshers, corn huskers and shredders, power hay presses, power feed grinders, farm engines, and power spraying pumps complete. Data for tractors in 1924 and 1925 based on revised figures.

[7] Farm wagons and horse-drawn trucks only.
[8] Included in miscellaneous.
[9] Value of engines shown separately as follows: 1935, $9,942,451; 1936, $14,033,704; 1937, $17,838,272.

Source: USDA *Agricultural Statistics* (1939)

" ... the present state of acute economic emergency being in part the consequence of a severe and increasing disparity between the prices of agricultural and other commodities, which ... has largely destroyed the purchasing power of farmers for industrial products .. and has seriously impaired the agricultural assets supporting the national credit structure ..."

-- Agricultural Adjustment Act of 1933

CONCLUSION – THE MODERN HERESY

“You Can't Reason with Nature, but You Can Tax a Corporation”

Why allow commerce to occupy such a central position in society if its causing the erosion of civil society and leading us to ecological catastrophe?

Why afford technological “progress” carte blanch to reorganize human societies on the basis of a metaphorical use of the word “evolution?”

Technological “evolution” is not a benign metaphor, but treats certain types of organized commerce as necessary.

The word “**heresy**” derives from the Greek “**to choose**.”

We have a choice about how we wish to expend our resources: technology can be controlled by policy, and limits imposed in light of ecological concerns and economic limitations; or, we can have faith that a technical solution to the problems created by technology will appear miraculously, and save us from ourselves.

Additional Notes

Estimate of mammal species longevity: PBS Evolution Library, “The Current Mass Extinction” (http://www.pbs.org/wgbh/evolution/library/03/2/l_032_04.html)

Although 50,000 years ago is the conventional figure for behavioral modernity, good evidence of modern cognitive abilities can be found about 80,000 years ago in Christopher Henshilwood, et al. (2002): "Emergence of Modern Human Behavior: Middle Stone Age Engravings from South Africa," *Science* 295 (5558): 1278–1280. doi:10.1126/science.1067575

Neanderthal dates: Smithsonian Institution, National Museum of Natural History, “Homo neanderthalis” (http://humanorigins.si.edu/evidence/human-fossils/species/homo-neanderthalensis)