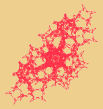


Two Percent

Nick Zivkovic

2026-06-20

Prelude

You can find an online version of this post here.

Data Salvage

I have no data, and I must count. This is, thankfully, not *completely* true. I am surrounded by data, by countables and comparables. Even if I were, hypothetically, to become blind and deaf and numb, I could still count, in silence and in darkness, the rhythmic thumping of my own heart.

The difficulty does not stem from an inability to stop counting, but from a tendency to start counting. Over the decades, I have started many lines of investigation, that I have never finished, because the starting is compulsive, but the stopping is not. And so, having accepted that most of these investigations, will forever be in various states of incompleteness — like a building with exposed scaffolding, or like a corroding пепелац[1] in the junkyard, or like a baby, born prematurely, and grotesquely malformed — I have decided to give you, precocious reader, a brief tour[2] of a small corner of that junkyard. I hope you can forgive me, as I proceed to count some things, that I found interesting.

Over the years, I have collected a number of real, physical computers, that are, as I write, continuously running. The oldest of these is a machine in my basement, that has been running a Solaris derivative since, at least, 2013 — more than a decade. This machine, in addition to itself being a relic, has quite a large trove of data within it. On this machine, there are 758 gigabytes[3] of data, and of those 758 gigabytes, there are 4509 bytes, that tell, or at least confirm, a very interesting story.

I do not remember the origin of this data, but searching for the column-names, it seems that it was derived[4] from NCES. It covers the number of degree completions, by major, from 1970 to 2011[5]. I do remember **why**, in 2011, I searched for this data, saved this data, and analyzed this data. I was drawn to this data, because of a book, a book that I would reread[6] multiple times, from the year it came out (2009, the year before I started college) to the present (2026 — 1.7 decades).

That book was *Coders at Work* by Peter Seibel[7], and it held, within its pages, interviews with programmers who — if our profession was a tribe — could only be described as shamans.

I am convinced that these individuals, each saw programming differently, compared to the median programmer[8].

The one interview that I have reread the most, is certainly the in-

[1] A contraption that, not only functions, but has surprising function — imagine if Doc Brown built a time-machine, out of a dumpster, an HP LaserJet printer, and a dozen wet shoe-boxes. See the Soviet film *Kin-Dza-Dza* by Georgiy Daneliya, free on youtube without english subtitles, unfree with english subtitles. Be warned, however, that this film *requires* an imagination, to be enjoyed.

[2] I sometimes wonder if junkyards, were they arranged differently, could be turned into ossuaries — much like those famous in Czechia, Italy, Poland, Portugal — for machines.

[3] Technically gibibytes, but I am a 90s kid.

[4] The data was converted, from HTML, into a format, suitable for awk, and then into a CSV format.

[5] Data is missing for 1970 to 2000, because the data used to be collected at only half-decade intervals, during that time-span. It is somewhat true, that I do not have data, that I would otherwise like to have counted.

[6] It is possible that the number of rereadings exceeds even the Jargon File.

[7] The same person who wrote one of the popular Common Lisp books in the 2000s.

[8] This was certainly true in 2011, and is probably even more true today.

terview with Donald Knuth, who has, beyond doubt, the most unique viewpoint about programming, of anyone in the book. Part of it may be his age — he got into all this, a short while after our profession was born, but before it became conscious of itself. He knows what the stones **used** to look like, from the time before they had runes.

Knuth says many insightful things, but one thing, that I found more *intriguing* than insightful, was that, through the decades, he would count how many people, in a large group, were programmers, and the answer was, usually, one for every fifty — or two percent.

I set out, probably in the spring or summer of 2011, to see if this ratio was reflected in the enrollment[9] data. I got my answer, but I never published it, and nobody else seems to have, either. And so, here we are, you and I, about to dust off this data, and get the answer, which is, usually «yes», sometimes «no», and *this* answer is less interesting, than other questions answered by the data.

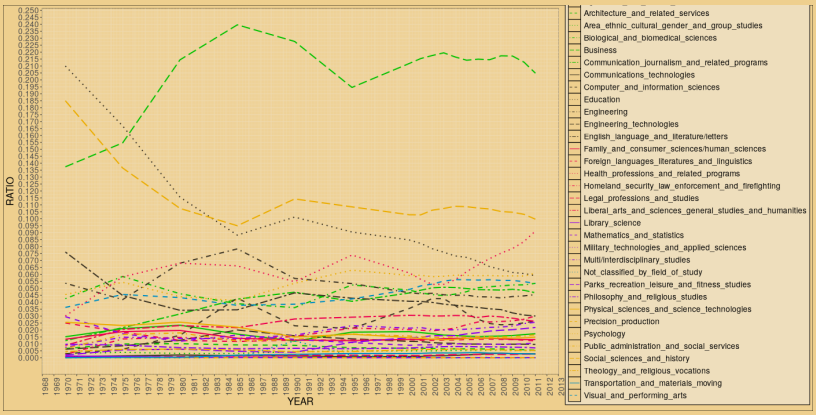
[9] Instead of enrollments, I found completions, which is even better (I was enrolled in the physics program, before switching to informatics).

Below is the whole 4509 byte data-set, plotted. You will notice that in 1975, business[10] was the 2nd most popular field, and since 1980 the most popular[11].

[10] You can find detailed break-downs, of the field-names here.

[11] Evidence that we, very possibly, live in one of the worst timelines. To any business-majors reading this, my disdain is not with you, but with the system (you and I, we are just ants in the ant-farm).

Note that the legend is sorted by line-color, and then by line-shape. Because I could not find a way to make the line-shape clearer, the shapes are solid, dashed, dotted, dot-dashed, long-dashed, two-dashed. If you squint a little, you will be able to make out the line.



The tumerous growth of business, since 1975, seems to coincide with the various economic challenges, that the United State was facing (e.g. an oil-crisis, an impeachment scandal[12], a currency transition, a defeat in Vietnam, and so on). Informatics, and related fields, (the dashed black line, with two peaks, near the bottom) seems to also have a positive inflection-point, in 1980, and the inflection-points seem to match the inflection-points of business.

[12] These used to be less common.

In 2010, I attended a small private lecture, held by Leon Lederman — Nobel Laureate in physics — at my alma mater (he used to be a professor there, and you might still find photographs of him, on the walls, if you visit the physics building on campus), where he discussed his book *Symmetry and the Beautiful Universe* (which I wholeheartedly recommend). He was very sharp, not for an old man, but for a man of any age. Years later, I would learn that, less than a year after that lecture, he

would start losing his memories — the universe may be beautiful, but she is also cruel. One thing I vividly remember, are his strong opinions about the American political system — something my own generation, raised by practical people, during a financial crisis, was very disinclined to discuss publicly. Many years later, I would make the connection, between the angst of Lederman, and the decisions made by the American political establishment, in the 1980s.

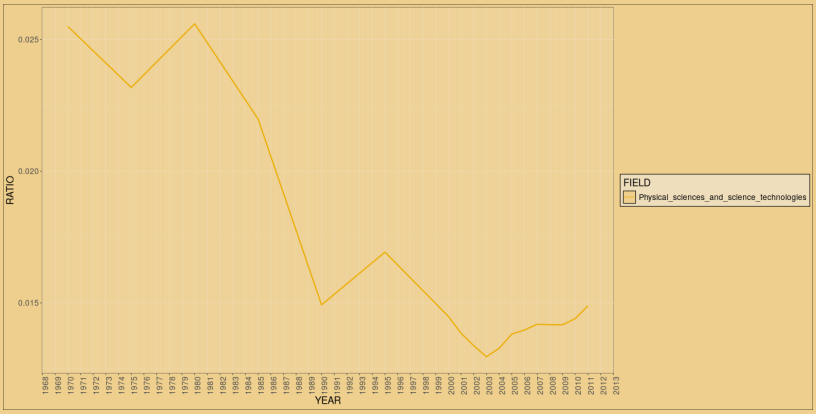
The various economic and political frictions, of the 1970s, caused the creation of the Department of Energy, which meant that the physics field, had to seek funding from congress, just like other fields. This translated into spending the 1980s, searching for champions within the government, and learning what kind of (metaphorical) kabuki dance was necessary, to open the money-faucet[13].

My own, very tentative[14], interpretation is that this budgetary tightening, would lead to a permanent crippling, of the ability of the economy of the United States, to absorb its own physics graduates. This is the reason many physicists started writing books, aimed at a popular audience, in the 1980s (partly for political influence, and partly as a hedge against future career turbulence[15]). The completion data below, **may** be a reflection of this.

[13] See, in *The God Particle* by Leon Lederman, the chapter *The God Particle At Last*, namely the section about the *true story*.

[14] I would be more confident, if I had analyzed BLS data.

[15] Lest you mistake me for a *heartless* cynic, I suspect that many were glad to (finally) have a reason to write about their interests, as well.



At exactly 1980, physical sciences, were at their apex[16], at more than 2.5 percent, and declined, by 2011, to below 1.5 percent, with a nadir at around 1.3 percent.

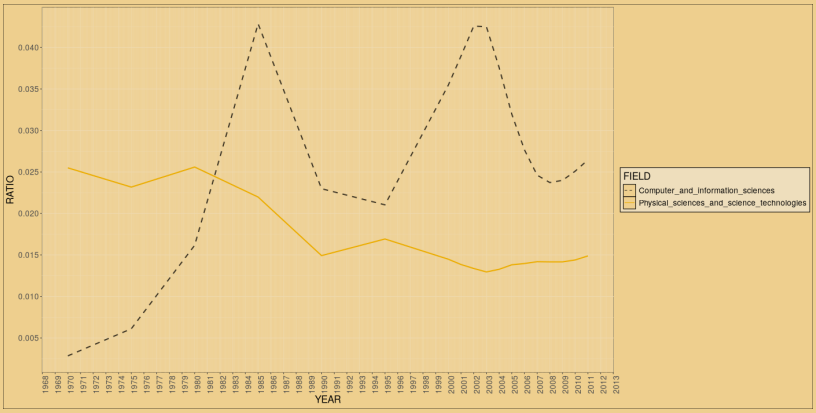
[16] Based on the data since 1970, but we lack earlier data from 1930 to 1969.

Alternatively, those lost physicists, may have — like myself in 2010 — transferred to informatics, as shown below.

There seems to be some merit to the direction of change — aside from the (shared) downward inflection in 1985, most other inflections have opposite directions. The only real discrepancy, is that the 1980 to 1985 surge, could not have gotten all three percentage-points of gain from physics, which lost less than a percent in that period.

Of immediate note, however, is that the number of informaticians, since 1980, has never been lower than two percent, supporting the claims of Knuth.

Also, there are two zeniths, the latter of which, obviously corresponds to the dot-com bubble of 2000. It is not clear what the earlier zenith corresponds to, but it was clearly a bad time for physics depart-



ments as well. I do have some theories.

Realizing Growth

While the numbers themselves are convincing, it may help to actually recount some of the events, in the field of informatics, to get a tangible intuition of how *fundamental* those years were. It is no exaggeration, to label that span of time, as our «Big Bang».

The growth of informatics, from 1970 to 1985, is, most apparently, reflected in the proliferation of protocols and operating systems. The first email was sent in 1971, the same year that the first files were transferred, via ftp **and** via floppy disk. And two years before that, in 1969, unix started development, Xerox PARC was founded, the first RFCs were published. In 1968, Philip K. Dick published *Do Androids Dream of Electric Sheep*, and *The Whole Earth Catalog* (predecessor to The WELL) began publication, before discontinuing operations in 1971. John Conway, also in 1968, started research of cellular automata, and published his results, about *the game of life*, in 1970. Data General (the company featured in *The Soul of A New Machine*, written by Tracey Kidder), was **also** founded in 1968, and a year later would release their first machine, the Nova.

In 1972, Xerox PARC had prototyped the Alto[17], and had, internally, prototyped Ethernet. In 1975[18], fellow hackers started writing my beloved Jargon File, *Byte Magazine* began publication, USENIX was founded, Fred Brooks published *The Mythical Man Month*, and Chaos Theory, which was untractable before computers, was about to see a wave of publications, that would formalize and publicize fifteen years of research. A year before that, in 1974, the government started an anti-trust case against AT&T, Ted Nelson published *Computer Lib/Dream Machine*, and Data General released the Eclipse. A year after that, in 1976, commodore was founded, both EMACS[19] and vi saw their first releases. In 1977 — the same year as the creation of the Department of Energy — the first home-computers were launched (e.g. Apple II, TRS 80, Commodore PET), and the film industry started using CGI. In 1979, Data General released the Eclipse MV/8000, the titular «New Machine», and Bricklin and Frankston released VisiCalc, the

[17] The first graphical desktop workstation.

[18] Knuth himself has said that, in 1965, zero percent of universities had informatics departments, and by 1975, one hundred percent did.

[19] Yes, the original spelling was majuscule.

first spreadsheet.

Ethernet was first sold in 1980, coinciding with numerous Lisp Machine projects completed (or almost completed) at Symbolics, Lisp Machines Inc, BBN, and Xerox. In 1981, IBM launched the IBM PC, Tracey Kidder published his book. In 1982, Madelbrot published *A Fractal Geometry of Nature*, Sun Microsystems[20] was founded. In 1983, the film *Wargames* was released, and VisiCalc loses **all** of its customers, to Lotus 1-2-3[21]. In 1984, AT&T was broken up (and Bell Labs would begin its slow, yet inevitable, decline into a pale shadow of itself). That same year, the term «AI Winter» was coined by Minsky and Schank, *Neuromancer* was published, the first issue of *2600* was published, Steven Levy would publish *Hackers*, the Santa Fe Institute was founded, and Data General released the DG-1 (this was the prototype for all laptops ever-after[22]). In 1985, *Phrack* and *The WELL* published their first issues[23], *Byte* (the magazine) would diversify into bulletin board systems (by launching BIX), the Amiga was launched, and *The RISKS Digest* became an active mailing list, on USENET. A year later, in 1986, Stephen Wolfram would begin work on Mathematica, the best mathematics program ever made[24], and Sun Microsystems (along with, fatefully[25] Oracle) would IPO. A year after that, in 1987, the Lisp Machine market collapsed, partially a consequence of DARPA cutting funds, into AI[26] research, and partially a consequence of the successes of Sun, Apple, Amiga, and so on. Interestingly, in that same year, Solow published *The Productivity Paradox of IT*.

[20] Progenitors of SunOS which later became Solaris.

[21] An example of the less known second mover advantage.

[22] It was even featured in a 1985 issue of Byte, alongside the (very fitting) moto «A Generation Ahead».

[23] The New York Times wrote, a year earlier, that there was a glut of computer *magazines*, so it makes sense that the 1980s were, simultaneously, a period of proliferation *and* decline (i.e. many new — and ultimately doomed — magazines were founded, while many old magazines, like *Byte*, saw their margins decline (sometimes to negative values)).

[24] I use this program heavily, for various tasks, but rest assured, suspicious reader, I am not being payed by Wolfram.

[25] These two companies had a relationship similar to that between Stalin and Trotsky, with the Oracle playing the role of the former.

[26] DARPA dismissed the predominant form of AI (expert systems) as «clever programming».

Hypothesizing Decline

It is certainly plausible that the dismemberment of AT&T, caused economic turbulence, similar to the disintegration of large states, which in turn, caused a decline in *relative* demand for scientific researchers and programmers. Alternatively, the cuts to DARPA funding for AI-related projects — and the AI Winter that resulted — could have contributed in a similar way. In both cases, the actions of the government technocracy, altered the economy to such an extent, that the very demographics of graduates changed as a result. The biggest whale[27], in any industry is, effectively, the US government.

Please do not interpret this as an expression of free-market fundamentalism — it is well known that the free-market would not have, on its own, created the internet, nor nuclear energy, nor transistors, nor satellites, and so on. It *does* seem to excel at packaging those innovations, for convenient use by the populace. I promise you, this is going to be relevant, in a latter section.

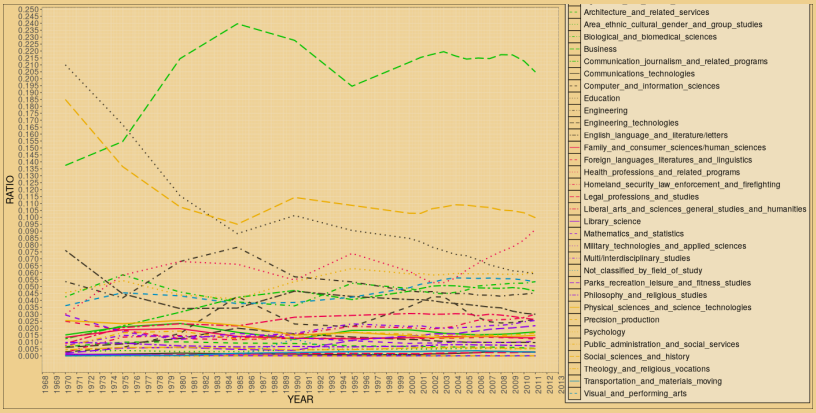
[27] Jargon, meaning the small number of titanic customers, that provide most of the revenue to a company (e.g. I once worked at a cloud provider who owed its existence to its two largest customers, Walmart and Samsung, despite having at least *thousands* of customers).

Whence and Whither the Geeks and Nerds?

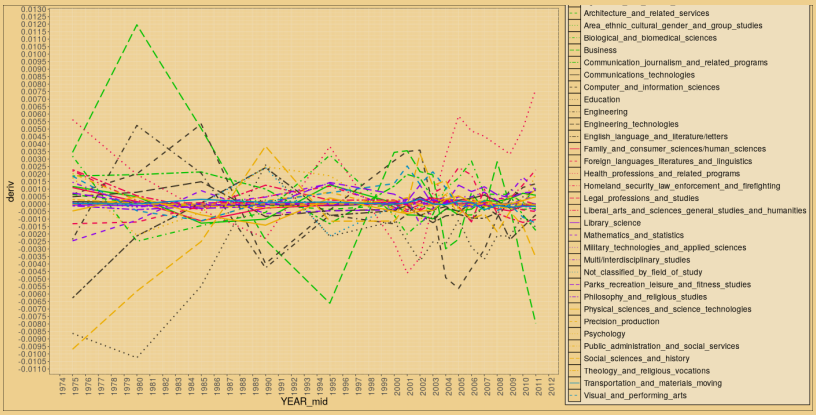
The *sensitivity* of these degree-completion curves, in response to economic and systemic changes, is striking. It is also striking that, since 1985, the proportion of computer nerds and computer geeks, never descends below two percent, and never ascends above 4.5 percent.

Because these are proportions, we are left wondering if the «surplus geeks», are more likely to come from specific fields, or if their arrival is evenly random.

Below is the overview plot (the first one from this paper) placed here for convenience.



Looking at it, it does seem that, since 1980, the informatics fields are inversely correlated to the healthcare fields (the dotted pinkish line that, when compared to the black dashed line, has an opposite shape). Below is a plot, that represents the first derivative of these curves (i.e. the y-axis represents, instead of percent-loss or percent-gain, the loss and gain of percentage *points*).

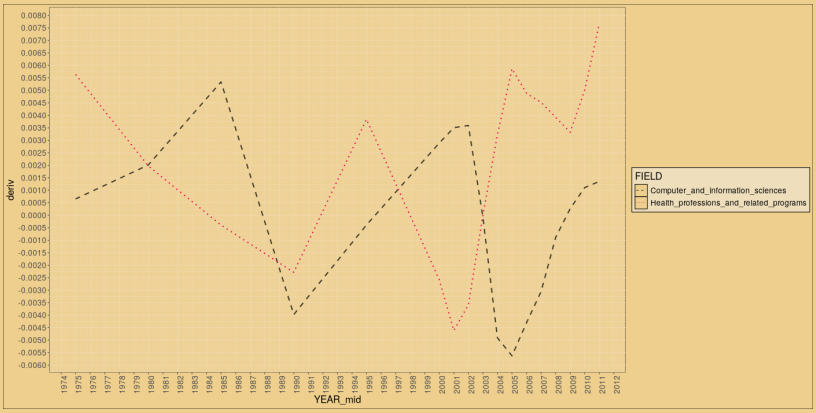


The inversion, between healthcare and informatics, is most apparent since the early 2000s, and is broadly present since 1995, (i.e. they mirror each other perfectly, from 2000 to 2007). This is quite surprising. Below is a version of the previous image, with only healthcare and informatics.

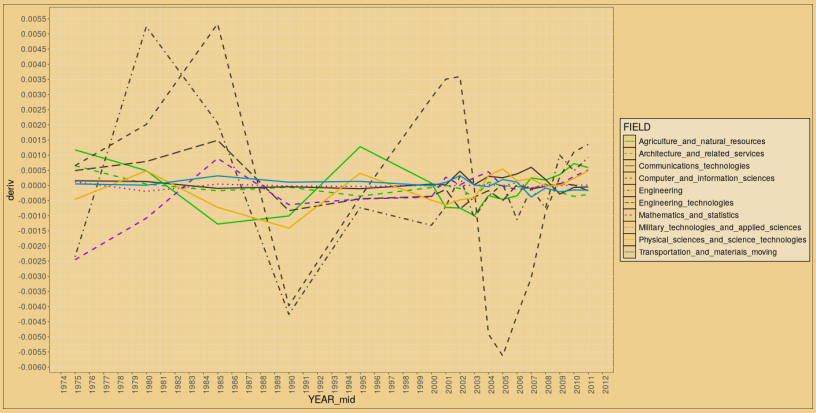
It **does** look like informatics starts to decelerate, whenever healthcare starts to accelerate. In fact the zenith and nadir, of 2005, are almost exactly 0.55 percentage points, above and below zero, respectively. I invite you to do the comparison yourself.

Instead of doing 33 pair-wise comparisons, which would consume too much time and space, we are going to compare informatics to three clusters, named[28] STEM, HEAL, and SHAPE.

[28] Taken from wikipedia, with overlaps removed.

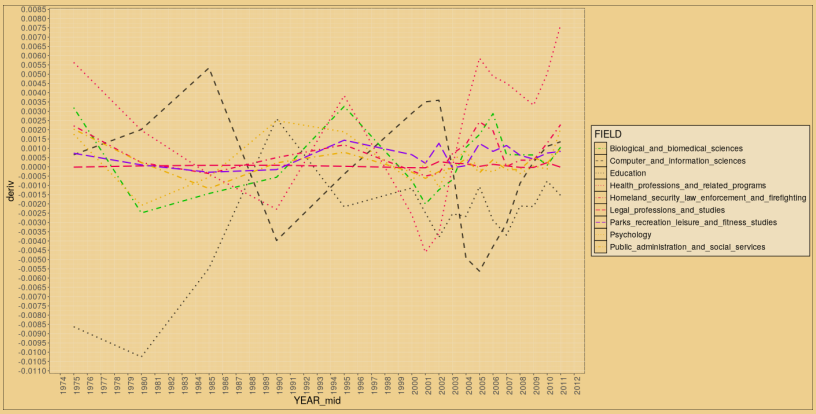


Below is the first cluster, STEM, short for «science technology engineering math». As you can see, the STEM fields tend to follow similar trends, with rare deviations. Physics, mathematics, engineering technologies, and agriculture, seem to follow each other, more than the other fields. While informatics and engineering (weakly) do the same, until 1995, before resynchronizing in 2005.

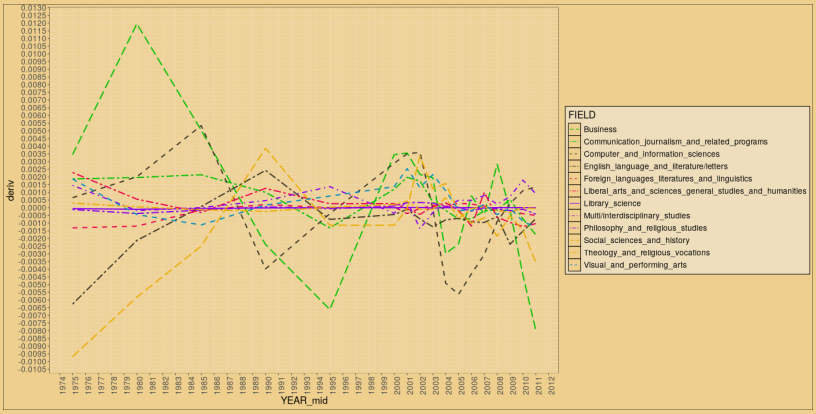


Next is the HEAL cluster, short for «health education administration literacy». We see that biological and biomedical sciences (the green dot-dashed line) tends to follow the healthcare line closely, causing them to share the same relationship. Surprisingly, education and law enforcement are soft[29] inverses of informatics.

[29] Their rates have the same sign, but the direction of change is different. Phrased differently, the education curve (since 2001) looks like the healthcare curve, but with the opposite sign.



Next is the SHAPE cluster, short for «social-sciences humanites arts for people and economies». It shows us that, much to my chagrin[30], business and informatics tend to grow and shrink together. In particular, informatics (and perhaps business as well), seems to grow at the expense[31] of foreign languages, belles-lettres, social sciences, and liberal arts. This used to be true for visual-arts as well, which was synchronized to liberal arts, until 1990, when it synchronized to business[32].



Initially, I was not sure what it was about the HEAL cluster, that makes it so contradictory to engineering, and why, out of the SHAPE cluster, only the business-element follows engineering. Now, however, I do have a pretty solid hypthesis. But first, we will have to read an excerpt from an old essay[33].

The Ritual and The Trade

Below this paragraph is an excerpt from an (incomplete) essay, about consciousness, I wrote nearly a year ago, and published at the beginning of this year. I have also commented about it here, where I briefly explained what was planned for the full essay. In the course of writing **this essay** (the one you are reading now), I realized that there was a connection between this excerpt, and my aforementioned hypothesis, as well as the *specific* ratio of two percent. The citations have been removed (but you can find them behind the above links) and the sidenotes have been retained (so references to «this essay» are **not** references to *this essay*). In that essay, I used «computer programmer» to mean «informatician».

Let us begin.

My own eyes spent countless nights observing, with curiosity and wonder and delight, the responses of a computer, as I commanded it with code, like a sorcerer casting spells. I could not have known, that this obedient machine, this silicon golem, was also, slowly and imperceptibly, enchanting *me*, and changing how my eyes would see.

At the time[34], I was a mere fifteen years old, young enough, so that the gravity of life was weak enough, and the mind nimble enough, to allow me to explore without any material justification.

[30] One silver lining is, business-types do not seem to overlap with geeks and nerds — otherwise their curves would have inverse correlations.

[31] And this does make *some* sense to me, considering that these are all things, that I, personally, enjoy studying in my spare time. On the other hand, these fields have limited application beyond education (which is a soft inverse of informatics).

[32] Is this why nerds, with precious few exceptions, cannot draw anymore?

[33] My apologies, for not writing new text *specifically* for this piece, but it does fit thematically, if not prosaically.

[34] 2005 to 2006.

The computer was the believed and I was the believer.

A consequence of becoming obsessed[35] with computer programming, is that one starts to see new metaphors, algorithmic metaphors, everywhere one looks. This new metaphorical lense, belongs entirely to the third eye.

Without this lense, I would look at a traffic jam, and see a traffic jam. With the lense, I would look at a traffic jam, and wonder if, and to what extent, the latency-throughput trade-off[36] was true for highways. Without the lense, I would read about social theory, and simply see the words. With the lense, I would ask if society was, a tree[37], a graph[38], a tree of graphs, or a graph of trees[39].

To generalize, the computer programmer looks at something, and asks, *is this thing an algorithm, and if so, what kind*? The entire *trade* of computer programming, it revolves around this question, around the discovery of metaphors that fit[40].

It is thus little surprise, when a computer programmer asks if (or sometimes asserts that) a certain kind of algorithm[41] is intelligence[42], consciousness, or both.

The entire *ritual* of computer programming, is similar to the trade, in that it involves discovering metaphors, not as a means to an end, but as their own end. This ritual is difficult to explain to someone who has never practiced it. Imagine, instead of trying to find metaphors that bridge the real to the algorithmic, one tries to find metaphors that bridge the algorithmic to itself. It is very similar to what mathematicians do, but it requires writing programs in a very principled and abstract way[43].

This ritual, unlike the ritual of writing, and unlike the ritual of mathematics, has a dominant material component (the computer) which can make your code, in addition to an *imaginary* experience, a *material* experience[44]. This makes the computer a medium — an artificial oracle or artificial hallucinogen — that can safely imagine the unimaginable. And like the oracle, the computer exists to provide insight[45].

Without the ritual of programming, there would be no field of chaos theory, nor complex systems (very important for economics and environmental sciences), and *certainly* no elaborate fractals. Pure mathematics could only scratch the surface, because the mathematical ideas, of the mid 20th century, that our imaginations could access, were insufficient for exploring these systems. Computers allow us, not unlike microscopes and telescopes, to magnify the informational dimension of nature.

Computers, and the arcane programming languages that make them obey, are magic machines, that created a new interaction between, two elements of the human psychic triad, the immaterial and material.

What is this triad, and what is its third element? The concept of the triad appears so frequently, in recorded human thought, and in the structure of language, that it is either some kind of adaptive ideal[46], or a consequence of language itself[47], if not both. Pythagoras called *three* perfection itself. Plato divided the world into three parts. And,

[35] Obsession meant the action of an evil spirit. Plato would have said that, he was driven by a splinter in the mind.

[36] On any internet connection, you can sacrifice latency for throughput, and vice-versa.

[37] Like a hierarchy.

[38] Like a network.

[39] The algorithmic idea of a fractal, as opposed to the mathematical idea, comes naturally to the programmer.

[40] We often call these metaphors programming languages, models, applications, application programming interfaces, user interfaces, database schemas, simulations, algorithms, functions, macros, domain specific languages, routines, endpoints, notations, and many other names.

[41] Such as large language models, chess-engines, theorem provers, expert systems, neural networks, markov chains, or even lookup tables.

[42] Another one of the dream-words, that has many overlapping definitions.

[43] For the curious and similarly enchanted, this is the kind of exploration that seeks *endogenous* truths, like whether a mechanism is turning-complete, and whether bloom filters are, conceptually, purpose-built markov chains, and whether system dynamics models are basically boltzmann machines, with arbitrary weights (a causal variant of a correlative model).

[44] Writing and mathematics both have non-dominant material components.

[45] Richard W. Hamming said that the purpose of computing is insight, not numbers.

[46] Maybe we get the most mileage out of traids, from an evolutionary point of view.

[47] The sentence structure of this very essay, for the most part, is a consequence of the triadic structure of language. We know that humans can hold seven (plus-or-minus two) elements in mind at a time. Most of the sub-sentences (anything between punctuation marks) of this essay have seven words, and no more than nine. If verbs (and conjuctions and so on) can turn a dyad of words into a triad, then they can also turn a dyad of triads into higher-order triad, making three plus three plus one into seven (metaphor is to triad as analogy is to heptad). Beyond seven to nine words, we need to use punctuation to turn a sequence into a tree.

even today, our modern shamans and sages, use triads to discuss the universe.

Roger Penrose has a traid consisting of physical, platonic, and mind. Lacan has a triad consisting of real, symbolic, and imaginary. Plato has a triad of good, truth, and beauty. Of the three, Lacan's naming is the most self-explanatory.

In this essay, the *material* is the *real*, and the *immaterial* is the other two.

The *trade* of programming is driven by the real, while the *ritual* of programming is driven by the imaginary. A trade is pursued because of real, material concerns (such as covering the cost of living), while a ritual is pursued because of imaginary concerns — concerns that can, more precisely, be called *aesthetic*.

HEAL, SHAPE, Informatics, Business, Healthcare

The ritual and the trade, for now, have a symbiotic relationship, even if it is an uneasy one. Similar to those romantic couples, that cannot stay together, and cannot stay apart, locked in mutual orbit, destined to periodically eclipse one another[48].

In informatics, we have two categories of correctness: safety and liveness[49]. Safety is a correctness constraint, that guarantees that something bad **never** happens. Liveness is a correctness constraint, that guarantees that something good **eventually** happens.

Software systems that can be described as *infrastructure*, tend to be built by people with a strong bias towards safety. Software systems that are described as anything else, tend to be built by people with a strong bias towards liveness. The latter **depend** on the former (e.g. the browser and internet have be *safe*, before one can start — like myself — inflicting oddly constructed ideas onto society).

This dyad does overlap (imperfectly) with the following dyads: platonists and materialists, rationalists and empiricists, endogeny and exogeny, neats and scruffies[50], fluffies and technoids[51], hedgehogs and foxes[52], synthesis and analysis[53], r strategies and K strategies[54], liberals and conservatives[55], halal and haram[56].

The computer and software companies, of the 1970s and 1980s, grew because of software like VisiCalc, the so called «killer apps», that had, what I do not hesitate to describe as, *seductive* business-oriented demonstrations[57]. Most of the tech giants of today, that were founded before Web 2.0, gained their treasure and influence by promising, but only sometimes[58] delivering, some kind of cost reduction.

When the economy is expanding, it may be the case, that some particularly intelligent philologists, anthropologists, philosophers, and writers, feel more confident about applying their substantial metaphor-oriented cognition, to something that pays better than their obsession. A sacrifice of passion in exchange for money, and a chance at eventual retirement.

The entertainment industry (e.g. music and film and literature) is, for the most part, dominated by liveness constraints (i.e. only one

[48] Best exemplified by the «two Steves» (Wozniak and Jobs) and the «two Johns» (Carmack and Romero) — it is counterintuitive, to me, how technical excellence was less essential for «serious» microcomputer software, and how critical it was for video games (as evidenced by which half of that dyad defined, culturally, their respective companies, for decades).

[49] You can find more context for this, in the early chapters of the Herlihy book, about parallel programming.

[50] Piece of jargon, from the AI field.

[51] Coined by Ted Nelson, in *Literary Machines*, to emphasize the difference between the cognitive biases, of those with a technical background, and those with a humanistic background.

[52] Coined by Isaiah Berlin in his book of the same name, to distinguish people who interpret the world through one lense, or more.

[53] Which itself is very similar to the distinction between integration and differentiation, and set intersections and symmetrical set differences. In fact, this chained analogy is an intersection of sets.

[54] Jargon from biology, describes whether species prefer many offspring or fewer offspring.

[55] Not in the popular sense, but in the sense that Steve Yegge meant it.

[56] Itself broadly corresponds to, inclusion and exclusion, nourishment and poison, «yum» and «yuck». I chose this dyad, because, firstly, it is alliterative, and, secondly, it is not English (but still means something in a foreign language), and so — like yin and yang — acts more as a pair of variables or sets.

[57] Ted Nelson mentioned this in his book, *Computer Lib/Dream Machine*.

[58] See the aforementioned *Productivity Paradox*.

project needs to succeed to pay back the cost of failures, and to finance future projects).

The software industry, has more in common with the entertainment industry, than the healthcare industry. I am not suggesting that nerds — or, for that matter, software (aside from video games) — are entertaining. I am suggesting that only **one** software company needs to succeed, to justify massive investments, in thousands of others.

For as long as I have been programming, many engineers got their start in the industry, by working at a startup — putting them in (or at least near) business-shaped situations[59]. Many researchers, work at research labs like Microsoft Research and Xerox PARC. In other words, since the days of Bell Labs, informatics research was not (directly) financed by the government.

[59] In fact, my entire career has involved working for startups (or borderline startups).

Which brings us to the HEAL cluster, which depends, to a large degree, on government subsidies to function. Curing the sick, especially the very sick, is not a very profitable venture (nor should it be — before 1978, it was *illegal* for hospitals to make a profit). In any case, much of the basic research in this field, is subsidized by the government, and the field as a whole has many more regulations (because many aspects of their core operations (e.g. surgical interventions), cannot be virtualized). In business, data corruption can be an expensive problem, but in medicine, it can be a *fatal* problem.

Healthcare and biomedical science are dominated by safety constraints, because they depend on a huge amount of non-metaphorical infrastructure. Even though liveness is a very explicit constraint (e.g. a cure for cancer, a vaccine for coronavirus) there is an enormous safety constraint, that cannot be magicked away.

While I am unsure if this is a good thing or not, I am *more* sure that this puts subsidy dependent fields (e.g. education and biomedical research and healthcare), at odds with those that depend on venture and monopoly funding (e.g. business and engineering and informatics). In particular, even though all demand, when followed to its root, comes from the government — it does print the money and spend the taxes, after all — the *contradictions* arise from what *government policies* stakeholders prefer.

It is very interesting, however, that, at a time when healthcare was having the **most** positive, of all positive pivots, Leon Lederman had to sell his Nobel Prize, to pay for care and treatment.

One in Fifty

While researching this essay (e.g. reading various sources, creating plots, trying to find 6 colors that look good on various line-types, and do not clash with the colors of this document) I stumbled upon a lecture, about aesthetics, given by a neuroscientist, named Ramachandran.

While taking notes (I always take notes) I was wondering if the computer geeks, were computer geeks, because of some kind of formative imprinting (e.g. I had access to a computer from an early age

— a rarity for children in the 1990s — and started programming in my teens), or because of some kind of neurological quirk (not a possibility that I would, typically, entertain, but various neurodivergences were the subject of the lecture).

The lecture about aesthetics focused, primarily, on synesthesia, which is the ability to see color, in colorless shapes (go watch the lecture). Two intriguing facts were mentioned by Ramachandran: firstly, synesthesia was nine times more frequent, among artists, poets, and novelists, and secondly, synesthesia occurs, across the general population, at a rate of *one in fifty* or **two percent**.

In other words, the humanistic arts are like a sirensong, to these *other* two-percenters. The numbers imply, all other rates being equal, that eighteen percent of artists (and writers) have synesthesia. This may be an instance of the Pareto[60] principle (more popularly known as «the 80-20 rule»).

In the data, belles-lettres has three percent of completions, at **lowest**, and 7.5 percent, at **highest**. In both informatics and literature, the rate of completions more than doubles, between zenith and nadir.

So what to make of all this?

Most fields seem to have a low floor[61], at around a few percent, and experience surges in cycles (e.g. healthcare has a floor of five percent, and zenith at nine percent). The floor *probably* represents people who would have chosen their field of study, without regard for the economic situation (the obsessed, the fixated, the infected, the enchanted).

The surges *probably* represent people[62] who, by and large, for good reasons and bad, choose their field of study based on economic prospects, above all else (job seekers, aimless young people). This may explain why so many informaticians — at least in my personal experience — complain of *imposter syndrome*.

After flirting with the idea of career-driven cognitive cross-polination, I have to reject it, because it does not explain the perfect inversion between healthcare and informatics. That said, I *have* met bellettrists and philosophers and philologists — during my own education — who I thought would enjoy informatics, if they did not think informatics was for cylons.

[60] I did not know, when I started writing this, that Pareto would make another appearance, in one of my essays.

[61] A horizontal line that touches the most nadirs, over the longest period of time.

[62] Throughout the data, international students are consistently below eight percent of informaticians (and engineers) — and even less of business-majors. No clue what the ratio is post-2011.

Anti-Intellectualism

There **is** a material contradiction between safety and liveness fields, that stems from government policy. Safety and liveness do have overlapping concerns, respectively, with the ritual and the trade. However, interpreting the increase in completion-rates as a measurable improvement (of something), for *either* the liveness-leaning or safety-leaning fields, is mistaken.

An increase in completion-rates is a measurable improvement for the departments themselves (more tuition dollars can justify larger budgets), but a detriment for a certain kind of student. Namely, students who are more closely aligned with the ritual, than with the

trade. By implication, a decrease in completion-rates, is a benefit to those students.

As with the synesthesia connection above, I have — while still trying figure out how to close this essay — found an obscure reference, that aligns with what we have explored so far. There was a paper, published in 1991, by Rigney, called *The Three Kinds of Anti-Intellectualism*. The paper defines three kinds of anti-intellectualism, one of which is named *unreflective instrumentalism*. Rigney defines it in the excerpt below.

> A third type of anti-intellectualism implied in Hofstadter's analysis may be termed unreflective instrumentalism, defined here as the devaluation of forms of thought that do not promise relatively immediate practical payoffs. In its narrow conception of practicality, instrumentalism suppresses questions about the ends toward which practical and efficient means are directed. Hofstadter locates this form of anti-intellectualism primarily in the economic institutions of American capitalism.

Rigney explains the hostility of the unreflective instrumentalists as follows.

> The hostility of an instrumentalist business culture toward intellect expresses not only an impatience with ideas that are deemed impractical or utopian but also a disdain for purely theoretical inquiry as a valuable activity in its own right. Theoretical scientists, for example, are called upon to demon-strate practical applications of their work, and esoteric research is held up to public ridicule with the award of the Golden Fleece. Scientists are sometimes provoked to argue for the value of their research on the grounds that it may eventually yield useful outcomes that are not immediately apparent, producing in their own behalf testimonial examples from the history of science. That such defenses are necessary in the competitive struggle for research dollars is indicative of the power of instrumental criteria to define the direction in which scientific and other kinds of knowledge will be allowed to grow.

According to Rigney, this hostility was present as early as the nineteenth century.

> In the nineteenth century, the conflict between intellectuals and capitalists was largely a conflict between a class of cultivated gentlemen of inherited wealth and an emerging business class still in the process of primary capital accumulation.

You can find a longer, more detailed excerpt here, contextualized by recent events.

It is entirely possible, that the fluctuations we see in the completion rates — and the steady decline of fields like education and social-sciences, along with continued dominance of business — is due to the struggle between intellectuals and anti-intellectuals (which corresponds, approximately, to the ritual-trade distinction[63]).

That said, there is also an overlap with the technoid-fluffy distinction, coined by Ted Nelson, in 1981. Below, Nelson caricatures the attitudes, of the humanists and technologists, towards technology and authority.

> This in a way characterizes the technoid mentality. If the government solicits bids on a Deterrent Weapons System, that will selectively barbecue only the small children of an Aggressor Nation, the technoid will

[63] When I first expressed this distinction, I did not anticipate that it was anything more than an expression of a certain kind of consciousness, in two different modes.

> probably say «yes sir», «can do», «what color do you want the corpses», while the fluffy who has read Sophocles and/or Tocqueville may be slightly more likely to say, «wait a minute...».

It is, to use a scientific term, very cool to see this caricaturized misalignment — published in 1981, but probably experienced by Nelson years earlier — reflected in the data, and for three entire *decades* since publication.

It is always exciting to see stories, and intuitions, and even philosophies, supported by data.

Postlude

This essay was *supposed* to be much shorter — yet it is the longest one since 2022. One question lead to another, and I wanted to share the insights with you. The *original* plan was to demonstrate that the number of informatics-completions doubled during tech-bubbles (a result I remembered from more than a decade ago) and to then publish a follow-up, investigating if the trend held decades later. I wish I had more time to polish and to compress, if not to read more sources.

Over the coming months, you can expect shorter (and more focused) posts. Some of them will not even be analytical or «serious», just a scribbler having fun.