SZÉKELY ENGINEERING

EXPLANATIONS & EXAMPLES

From the Pyramids to Chat GPT, *or* From Roman Numbers (With a Stop Along the Way to Napier's Bones) to Computers and Artificial Intelligence.

From some of the online angst about ChatGPT, you'd think we were headed for a world-altering event with consequences as dire of those of Bronze Age Collapse and while the ramifications of A.I. may indeed be detrimental to humanity, it is:

- a.) Too early to tell, and,
- b.) If history is any guide, not bloody likely.

With regard to a.) above, it was only released five months ago and notwithstanding how much more quickly things change in our technological society than they did in medieval times, such has not suddenly nullified inertia.

With regard to b.) above, depending upon whether one considers themselves generally pessimistic or optimistic, one can find as many data points arguing world-altering change has resulted in negative consequences as positive but it's hard to argue against the explosion in human population since the aforementioned collapse unless one is so consumed with self-loathing or invested in the Gaia hypothesis as to advocate for, or believe we are already on the road to, species suicide.

So, with that cheerful preamble, what about how we got from chipped-flint hand axes to the mathematics which started the process from Pyramid building to Artificial Intelligence? Note that the fact that monuments in Göbekli Tepe, which is of the Neolithic or New *Stone* Age, are free-form in appearance which tells us that mathematics wasn't much of a thing back around 11 or 12 thousand years ago.

I mean even if they could and the ancient Egyptians didn't construct a 3-4-5 triangle via equally spaced knots in a rope, the latter were very accurate in the construction of the right angles which formed the bases of their pyramids while the former were into free-form carving of stone. Having said that, Homo Sapiens (and, who knows, perhaps even Homo Neanderthalensis) were apparently counting via tally marks as far back as 50,000 years ago.

To get on with our journey, while there are rumors of zero and the concept of place in classical numeration, in Eastern as well as Western cultures, the complete obtuseness of Roman Numerals belies their engineering achievements, with no famous Roman mathematicians remembered by History, as are those of the Greeks who came before them, such as Euclid, Pythagoras, Archimedes, and Eratosthenes, to name just a few. In fact, our process of long division may have its origins in Romans dealing with division via approximation and repeated subtraction with remainders kept in one's head or recorded separately.

The addition of zero as a placeholder allowing for positional notation was the nifty advancement which led to the concept of base as the foundation for a system of numbers, which leads to our stop for Napier's Bones, or

more accurately, to logarithms and the slide rule. Actually, as illuminated by the previous hyperlink, as this slang for a slide rule is inaccurate as Napier's device wasn't logarithmic in nature as is a slide rule, though the latter was developed in the 17th century on his work on logarithms, with the more accurate slang for a slide rule being a slipstick.

And all this is leads me to stop and think about the intervening 400 years or so and the fact that when I started in this business, such calculators which did exist were beastly desktop devices, mechanical in nature, weighed 20 pounds or so, and did no more than four-function mathematics, except for more capable specialized machines I remember when I was an engineering aide in Bechtel's Process Engineering department in the mid 1960's.

The fact is, many, if not most of the wonders of the first two-thirds of the 20th century were designed using slide rules, accurate to only 3 (though I believed if I squinted really hard, I could tease out a 4th) significant figures. Digital computers in those days were the whole-room behemoths housed in rooms which had to be environmentally controlled probably for the same reason as that requiring such for today's server farms and data centers – machine heat rejection.

It wasn't the advent of the integrated circuit that the pocketable electronic calculator came into being, but 1969's integrated-circuit Apollo Guidance Computer still managed to weigh-in at about 70 pounds. See this (1:21 long) You-tube video for its use during the descent of Apollo 11 in the first manned landing on the moon.

It's a long way though, from ones, zeroes, logic gates and computers, to Artificial Intelligence . . . isn't it? Before we get into that however, I'm of the personal opinion that the better term for it would be 'Machine Intelligence' whereas I would reserve 'artificial intelligence' as descriptive of that employed by those who proudly proclaim their intelligence while demonstrating a complete lack thereof. The link above, to a doom and gloom piece published in the *New York Times* just two days before the date of this issue, which says in more strident terms what one sees vis-à-vis limitations on Chat GPT's home page, is an example of a more pessimistic view of A.I.

I prefer a more optimistic view based on my interactions with Amazon's Alexa and Google's Assistant. Although they are really not too bright, the convenience of asking Alexa to do a mathematical calculation for me in the midst of designing while drafting, more than makes up for her "I don't know that" response to many of my queries, regardless of how carefully, precisely, and logically (as in trying to duplicate an instruction in a computer program) I formulate them.

Back in the late 60's and early 70's when I was an electrical designer working in heavy construction, I had a friend who got upset by my bussing my own place at cafeteria tables because of his belief that doing so would put

someone's job in jeopardy.

Much of today's online angst about ChatGPT seems more of the same to me, and if you believe that there is no *fundamental* difference between A.I. and human thought, i.e., that human thought is deterministic, then there is neither soul nor inspiration to say the least, and I suppose that could lead to one having fears of losing one's livelihood to A.I.

NYC Local Law 97 and CO₂, or Are You For Real, or Is It Just Hubris?

As the lion's share of my work involves buildings of less than 25,000 square feet total gross area, I had not had occasion to delve into Local Law 97 until a job I just completed where, as an adjunct to my primary task, I had to look into a set of recommendations regarding compliance with the law that was made by another entity vis-à-vis projected annual fines for not meeting de-carbonization goals, where, if I understood their report correctly, that entity's published 2050 goal for the building by 2050 was zero CO_2 output; i.e.; no fossil fuel use of any kind.

I think they may have conflated LL97's goals for reductions in buildings' CO_2 emissions with those of New York State's CLCPA net zero CO_2 goal in the generation of electricity, as the former specifies a CO_2 equivalent limit of 0.0014 tons per square foot per year which, in the case of the building I was looking at, was about 45 tons, or about 21% of its current calculated actual CO_2 output, which is still slightly below LL97's permitted output until 2029.

In fact, this entity's report had calculated the building's CO_2 emissions as slightly above LL97's permitted output by next year and specified (precipitously reduced) limits for 2030 and subsequent years though I have been as yet unable to find them as having been set by the NYCDOB Commissioner by this past January 1 as mandated by the law.

In revisiting that job in the preparation of this piece, I had thought that the reason my calculations were slightly below the 2029 limits while theirs were slightly above was because I'd not included the ascribed CO_2 output of the generated utility electricity consumed by the building to be calculated as part of its CO_2 output, but I discovered that such added 5% to the building's output, still about 11½% below the permitted limit through 2029.

The 'hubris' in the headline to this section has to do with the fact that there's up to 100 times as much water vapor in the atmosphere as the 0.04% of CO_2 where past global warming has preceded, not followed, an increase in CO_2, (plants give off CO_2 at night though they make an excess of oxygen during the day) that the climate models are just that, stating that the increase *could* raise the average global temperature by 3½ to 9 degrees F by the end of this century, and nobody has as yet been able to model the effects of water vapor as a greenhouse gas.

There exist serious reputable people arguing that pell-mell electrification is a disaster. Maybe that's why NYCDOB missed January 1.