ELECTRONOTES

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ENGINEERS

What You Do and What You Say

-by Bernie Hutchins

Many of the readers here are engineers or at the very least know friends and neighbors who are engineers. It is also usual to designate a prefixing subclass to the general term “engineer”; perhaps electrical, chemical, or software (among many others). The general take-away from the term is one of “technical competence” and a concern for actually making things work. However, the actual reason for assigning such “title” (with or without prefixing specialty) is most often unspecified. It may be a matter of educational degree, official job title at some organization, even of licensing [1] on occasion, but is often a matter of just saying what one DOES (largely what one has been doing over the last few years). As a general matter, however, the public’s association of the term “engineer” with a job to be done is often thought of as that of a qualified practitioner (even perhaps of a tradesman). Indeed there is some notion that engineers just look up formulas in handbooks and do the math correctly. At best, it may be associated with the application of the “real science” done by others.

In contrast, the term “scientist” is seldom used in the same manner as the term “engineer” is. The titles such as “chief scientist” and “visiting scientist” are rare and initially confuse. If anything, the suggestion is that the affected title ”scientist” is one of training and probably reserved for those with a PhD and an official research position. Likely it also suggests a person with a slightly higher-minded world view: finding “truth” rather than just getting something to work.

There is currently an acronym ”STEM” which stands for Science Technology Engineering Mathematics, which includes the Scientist/Engineer pairing we have been starting to discuss here and adds two other of the “nerdy” variants: Technicians and Mathematicians, all four integrated into an educational paradigm. Indeed, all four are generally (and rightfully) thought of as involving higher levels of technical achievement. Most technical undertakings are in fact a combination of at least several of the STEM practitioners. That is, the nerdy-trades overlap and evolve, and hopefully know their limitations and the corresponding need to seek adjacent expertise.

Often it is asserted that scientists do basic research and engineers apply it to make something that works and is hopefully useful. As such, the “product” of a scientist’s effort is most often a report or other disclosure (like a publication in a journal) while that of an engineer is something physical (some kind of a “gadget”). The contribution of a technician is thought to be to build working prototypes and maintain them and to facilitate production. Mathematicians are involved with assuring that correct logic (proof, verification) is used, doing statistics on observations, etc., as well as just doing the pure math they are so fond of. We applaud one species of nerd becoming involved with another; at least to the level of mutual understanding.

It would be absurd to suppose that an engineer can never do a scientist’s work, and vice-versa. Nor should anyone suppose that a particular nerdy individual is forever restricted to a diplomaed skill displayed on his/her wall. In fact, a few years after graduation, except for a general elevation of analytic thinking, the details of academic “training” may be long gone. It matters very little what one is “trained in” and matters immensely what one is currently “practicing” (and succeeding at).

From the point of view of the “man on the street” there may be considerable interchangeability of STEM denoted nerds. Hopefully, the same universality does not afflict those actually involved who almost certainly know when they do not know enough about something, and recognize that quite possibly, nobody involved (or at least nobody present) yet does. Hopefully there is enough critical mass to at least define the problem.

So it is absurd (and a logical fallacy) to attack an opponent’s view on the basis of formal credentials, either possessed, or lacking. Someone is either right or wrong objectively, with the truth sometimes emerging very soon, or perhaps deferred by general agreement (absurdly little is known when you get down to it!). Noam Chomsky stated it well in a related famous quote:

> *Generally speaking, it seems fair to say that the richer the intellectual substance of a field, the less there is a concern for credentials, and the greater is the concern for content.*

All views on scientific matters are not equal in a sense of democracy, but you really should have to have valid scientifically presented reasons to reject ANYONE'S views and promote your own.

There are plenty of perfectly valid reasons for rejecting a scientific claim. Outright rejecting a claim on the basis of lack of credentials or based on what some consider to be a phony venue are not among them. Perfectly good presentations appear on the Internet by persons unknown who perhaps don't even identify themselves. It is eminently fair to demand that the rules of science apply to anyone who makes a scientific claim. With the Internet, with its varied venues; gone is the frustration caused by delay in getting up comments, and with this we perhaps find it more difficult to evaluate the quality of the comments. However, the lengthy (often stuffy) process of "peer review" [2, 3] is fairly useless and likely will disappear in a decade or two. It is further true that much peer reviewed material is still bogus.

Claims based on (or shaped by) politics (like "Global Warning") or religion (like anti-evolution) hold zero value. These should be, but too often are not, accepted or rejected on the merits of the arguments. Rather whether or not someone favors a conclusion determines the reaction.

SMART METER RF ?

An engineer or scientist (indeed perhaps anyone who is a relative expert in ANY field of study) is going to find himself or herself in a position of knowing "too much" relative to the general public.

About a year ago, we got a letter saying that our water meter was going to be replaced with a "smart meter" which would report usage automatically, electronically, by microwaves. Somewhere they addressed the matter of whether or not there were health issues associated with the RF. More recently, there is an opportunity to participate in an electric/gas smart meter program. Again, they got around to the health issues. Both assure the homeowner that there is no risk associated with the RF, citing a supposed consensus of scientific evidence. Likely they are right. This would all be more comforting if there were not such a strong propaganda flavor to these proposals: All scientists agree. There are no reports of problems.

Prominent in these sales pitches are the comparative aspects of smart-meter RF exposures relative to other RF sources. Fair enough – if apples-to-apples. One soon notices that there is a bottom "party-line": smart meters are inconsequential as compared to cell phones. In fact, it is likely that the actual frequencies and power output of the two transmitters (smart vs. cell) are the same within a factor of about two

or three (that is, both are about a watt). If you have a mind to influence, you can easily hide this fact by measuring the phone a few inches from the head, held there for perhaps an hour per day, to a smart meter that is 10 feet away and transmits a total of 1 minute per day. By adjusting distances and duty-cycles, it is no challenge to achieve any desired conclusion. The relative power densities are (transmitters assumed equal power) proportional to the ratio of the duty cycles then multiplied by the ratio of inverse squared distances. High-school physics. Then forget about the distance and duty-cycle downgrade and just state watts/meter^2. In fact, make a pretty bar chart.

Inherent here is the assumption that most people will not be knowledgeable enough to ask any questions at all. Further, people are already predisposed to insisting that cell phones are not harmful (what if they were – I'm not going to stop). Public relations! And there are apologists (with PhD advisors), hired "white coats", who are in the propaganda business.

The problem comes up when you do come across someone (perhaps you may be that someone!) who knows what to ask. Such a person is not likely to get an answer from the person who wrote the cheerful upbeat letter announcing the change – the pamphlet writers don't even know. They will just say that experts have looked at it. **Trust us!**

Should an engineer (physicist, ham radio operator) storm into a public meeting (chip on shoulder) and demands answers? Probably not. But a "feet to fire" attitude seems appropriate. Both the water company and the electric company (those persons who deal with the public) made the same mistake of quoting, in writing, data on power density (mW/cm^2) as being frequencies. Frankly, you may be one of only two or so people in the room to catch this. Here is an approximate exchange between myself and a power company guy (who did actually have a technical background) who was holding up a bar chart.

Power Guy: …so we see that the smart meter has the lowest power frequency of any common device on the chart….

Me: (hand up) – "You said 'power frequencies'. Is that the right term?"

Power Guy: (after thinking a few seconds) "No."

Me: - (immediately, feeling I had made the point) "Thank you."

The power guy went on to mutter that the presentation was not intended for a technical audience, as though it would have been unclear if he used the right terms. If he had said power density instead of power frequency, no general attendee would have been either more or less in the dark – the engineers would not have been left to suppose that the pamphlet writers did not understand and probably did not care.

Another number (talking point) tossed around was that in order to get the same exposure as you get from using a cell phone 15 minutes a day for one year you would need 375 years exposure to a smart meter (2 minutes/day). Nice touch - adding that 375 years. Who is going to stay near a smart meter for 375 years. And that cell phone is so much worse – but we don't want to even hear about that anyway. Let's NOT discuss cell phones! But 375 does seem like too many significant figures. More to the point, where did 375 even come from?

Well it apparently came from a PhD "expert" and it came through something called the Smart Grid Consumer Collaborative. This expert is apparently (Google) known for also attesting to the safety of tobacco and asbestos! If you request the papers [4,5], you come up with (as provided to me by SGCC's Nathan Shannon in May 2017):

$$[\ 900 \text{ sec} \ \times \ 0.5(\text{SRA})] \ / \ [120 \text{ sec} \ \times \ 0.01(\text{MPE})\ ] = 375$$

Absolutely correct, and would be disserving of ONE significant figure - <u>if the dimensions were allowed</u>. <u>They aren't</u>. It does seem that the numbers 0.5 and 0.01 are fractions of some agreed-upon reference (maximum?) value, but fractions are not necessarily dimensionless numbers. 50% or an apple divided by 1% of an apple is indeed 50 - dimensionless. But 50% of an orange divided by 1% of a potato is not 50. SRA is in watts/kg while MPE is watts/cm^2. (A two-dimensional area has no mass!) So you can't divide them. The ratio is cm^2/kg which is not even a physically valid quantity. What a sloppy job. As long as the general public, and particularly the people who are <u>paying the white coat</u>, don't catch on, I guess you can get away with it. The Internet of course notices when the <u>same</u> expert vouches for smart meters, tobacco, and asbestos, as <u>all</u> being harmless! [My local power company took the propaganda down – to their credit.]

In such a case, or course speak up. Don't list credentials – people will either recognize that you likely know what you are talking about, or all is lost always.

THE YELLOW LIGHT TIMING:

Speaking of getting paid for false testimony (above), or worse – <u>being fined for true statements</u>, we have all heard of "red-light cameras." I have never encountered one of these – likely some readers here have. The idea is that a camera records cars going through an intersection and reports those (by license number, with an image of the face of the driver) who then gets a fine in the mail. There is a Constitutional issue here of course, and the obvious lack of full context in the snapshot images. It gets worse when you learn that the proceeds of the traffic fine are divided between the municipality and the private company who provides the camera!

On her excellent website, Lucia has posted:

http://rankexploits.com/musings/2017/are-yellow-lights-badly-timed-engineering-law/

Are Yellow Lights Badly Timed? Engineering & Law

24 May, 2017 (14:11) | politics Written by: lucia

Which begins:

"Have any of you heard of the electronics engineer who is being fined $500 for criticizing the timing of yellow lights? Yes. It's true. The Oregon State Board of Examiners for Engineering and Land Surveying has punished Mats Järlström for presenting his analysis of the timing of yellow lights while calling himself an engineer."

(The comment stream wonders about half way through.) In total, Lucia has discussed several issues with these lights – particularly with regard to the timing of the yellow light, AND (**THE MAJOR POINT HERE**) who is allowed to comment on the timing. Let's first consider how one might determine how long the light should remain yellow.

Who would do these calculations? Well, a traffic engineer should be able to handle this. And certainly a physicist could do this – perhaps you have forgotten (I did) but this trivia is called "kinematics". Most everyone reading this could do a credible initial job.

Consider a person approaching a green light. If you noticed when it turned green, this would influence your actions. If you saw it just turned green, you might maintain speed. If it was green when you first saw the light, a judicious person probably slows down or at least is prepared to brake. At some point of decision, if the light is still green you probably stomp on the gas (go for it) and resume legal speed with full confidence (belief at least) that even if the light instantaneously turns yellow, you can still clear the intersection before it turns red. Knowing the legal speed and the length of the intersection and cars, you could compute a minimum yellow light time, and likely add 50% to 100% more. Would you not do it this way? Refining the analysis, you could allow for the responsible person who decelerated out of caution, or who is making a turn. You could do it.

Okay you suspicious person – what if the time were minimal or a bit short. You might "accidentally" catch some cars in the red intersection. This would even be more likely if you were going slow, slowing down to turn (or to turn into a store just beyond the intersection), if you are being cut off by other drivers, or for myriad similar reasons. We've all been trapped in such situations, and generally been given the right-of-way by drivers who recognize what is occurring. Likewise, we have granted forgiveness to other unfortunates. At worse, we have opted out of rushing to cause an intentional crash and just blown a horn, less the unfortunate person not realize he has inconvenienced an important person such as yourself! The red-light camera just snaps a picture. ($$$$$!)

Of course, who would set the time so short as to be unfair? Make the yellow time long enough and most problems will be avoided. However, it is in the interest of both the municipality and the camera provider to catch some extra cash. So while they can't get away with, say, a one-second yellow time, they could well choose a guideline formula that kept yellow time minimal even if it made no allowances for untypical but not uncommon circumstances which a human police officer would allow to be legal. What if you challenge this? What if you are an engineer?

Well – what was Mats Järlström's sin (or sins)? Was it just being an engineer or was it calling himself one? Was it being a whistleblower? Or was it just being annoying (to government officials and bureaucrats) for being able to actually think? In as much as his calculations were available and easy to understand (and criticize if any errors are found), it appears he just spoke the truth to powers who did not want to have a favored cash-cow questioned. The claim that he called himself an engineer without official government permission, (not having an official license - none required - like most engineers), was a convenient excuse. Had it not been that, perhaps chewing gum might have been the next choice.

BE ON GUARD

Government officials are not, I assume, universally corrupt! In certain locations however, they really should begin with the assumption that they are probably not the smartest person in the room. In a town with major universities, no one likely should make this sort of "ranking expert" assumption.

In this regard, the power company in my smart meter example recently had a public meeting where they announced by email that they would have experts who could answer technical questions. They had a panel of four experts – three of whom seemed to be power company employees and one who was an out-of-town paid expert (thankfully, not the SGCC expert). He was, supposedly, the expert on RF exposure. During his 5 minutes, he spent the first 2.5 stating his credentials, and the remaining 2.5, assuring us that there were many papers indicating that the meters were harmless (scientific consensus).

During the question period that followed, it was clear that the panel was unprepared for the depth and scope of what a room of 40 plus intelligent people might ask. Lots of **crickets**. In fairness, the panel might have asked that very specific questions be submitted before the meeting, as well as allowing for impromptu questions.

It is common for people asking questions to automatically preface their inquiries with brief matters of background and perspective. For example, perhaps they tell you they

have elderly parents without a computer, or that they had experience with microwave equipment, or that they were physicians, or engineers. It helps the panelist know where to start. But from Lucia's blog, we find that some may regard saying you are an engineer (based on college degree and/or job title), even while never suggesting you are a licensed engineer, as "practicing engineering without a license". Ridiculous.

At a previous meeting, I had in fact stated that I was an electrical engineer. I quickly backtracked to say that actually I was retired from teaching engineering, which was not the same as actually doing it. This I did mainly because I thought it would get a few chuckles (and it did).

What Järlström did was proper, above board, and courageous, and should have been appreciated in the spirit of all wanting to achieve improvement. Instead it was met by **censorship**, **arrogance**, and **bullying**. **SHAME**.

REFERENCES

[1] "Engineering 'License' ", Electronotes Webnote 36 4/7/2016
http://electronotes.netfirms.com/ENWN36.pdf

[2] "(1) Peer Review Intractability: Often A Brickwall Is Hit; (2) 'Not-Peer-Reviewed' - As A Hammer", Electronotes Webnote 11 2/22/2013
http://electronotes.netfirms.com/ENWN11.pdf

[3] "Peer-Review – Less Than You Suppose; A Reasonable View Of 'Peer Review' " Electronotes Webnote 48 4/17/2017
http://electronotes.netfirms.com/ENWN48.pdf

[4] http://ccst.us/publications/2011/2011smart-final.pdf

[5] http://3593f84chf852yw5d4c5emoe.wpengine.netdna-cdn.com/wp-content/uploads/2012/06/Valberg-Testimony_4-5-2012.pdf