Christian Engineers and Scientists in Technology Newsletter

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From the Editor

This newsletter is intended to facilitate camaraderie and exchange of information among CEST members. Reader responses and other inputs are welcomed. Please send me **your** input for this newsletter.

My thanks to those who contributed to this issue, i.e., Dave Kramer, Paul Carr, and Dennis Feucht. BY ■

No Solution Yet - Geometry Challenge

We've not yet received a solution to the geometry problem posed in the Winter issue. So we're giving a clue, hoping someone will find a solution. The clue follows the problem statement, below.

Here's a geometry problem to challenge skills you learned in 10th grade or thereabouts. It, and the clue, were suggested by Dave Kramer.

Van Aubel's Quadrilateral Theorem states that the lines connecting the midpoints of squares constructed on opposites sides of any (arbitrary) quadrilateral are equal in length and mutually perpendicular. Prove this theorem.

Clue: *As a hint you could first prove the Triangle-Squares theorem: The lines joining the midpoints of squares constructed on two sides of a triangle to the midpoint of the third side are equal in length and mutually perpendicular. Then find a way to apply this to Van Aubel.*

Note that the approach suggested by this clue is not the only way to prove the theorem. If you can't or don't have time to develop a proof, how about passing this on to someone else to try. Maybe some high school student?

Send the proof to LWYoder@ieee.org and I will acknowledge in the next issue.

BY ■

An Engineering Challenge - Miner Lifeline

For readers who don't like math or physics problems, here is an engineering problem for you to solve.

On page 37 of the May 2012 issue of National Geographic magazine there is a note about an explosion proof transceiver that's being tested in a West Virginia coal mine. It is claimed that it will allow trapped miners to communicate to the surface above, via magnetic fields. "Voice or text can move more than 1500 feet up or down … arriving in less than a minute." I find their explanation of how this works inadequate and wonder if one of our readers could explain how it must work. Here is the explanation NG gives:

1. Voice, text, or SOS beacon gets wrapped in magnetic waves.

2. The now magnetic message moves through the earth.

3. Magnetic bubble pops when receiver recognizes source.

Can you help us understand how this scheme must work? Please send us your description of how you suppose it works.

Send description to LWYoder@ieee.org and I will acknowledge in the next issue.

BY ■

100 Miles per Gallon?

First heard on WHDH-TV Boston.

What if you were told that someday, your car could have a one-cylinder engine under its hood that has 100 horsepower, gets 100 miles per gallon (42.5 kilometers per liter), and can run on any type of fuel?

Matthew Riley, the CEO and chief research scientist at Kansas-based Grail Engine Technologies says that his company's two-stroke Grail Engine could be in consumers' cars within two to five years. In February 2012, after three years of development, the company established their first working prototype, and big car companies like Honda and Ford have already shown interest. Features include:

Two-Stroke Engine

Direct Injection

Forced Induction

Forced Semi-Homogeneous Charged Compression Ignition

You can read more at http://auto.howstuffworks.com/grail-engine.htm or at http://www.grailengine.com/ .

BY ■

Eat Your Corn

Summarized from Forbes magazine, April 23 ed.

"Dallas chemical company Celanese found a way of making ethanol from natural gas that could revolutionize how we fuel America. Too bad there's a law against it."

Celanese is building two new natural gas-to-ethanol plants—one in Texas and the other in China.

For 30 years Celanese has been making acetic acid, a chemical feedstock for plastics like vinyl acetate. Using steam and catalysts like nickel, they break apart the hydrocarbons in natural gas and reform them into acetic acid.

Acetic acid (vinegar) and ethanol are closely related. When an alcoholic beverage is left on the shelf too long air oxidizes ethanol into vinegar, removing its hydrogen atoms. In their new plants they will do the reverse. Taking the acetic acid they already make, they will use metal-based catalysts to add hydrogen to it to form high-purity ethanol. Finding the right catalysts for this was the basis of the new process.

U.S. law requires gasoline refiners to blend plant-based alcohol into gasoline, so that market is closed to Celanese in America, but not in China. In America they expect to sell their high-purity product to makers of paints, pharmaceuticals, and textiles. Celanese expects to be making 300 million gallons of their product per year by 2016.

BY ■

Compressed Air Energy Storage

Summarized from articles in Forbes magazine, Feb. 13, 2012 and at http://www.greentechmedia.com/ , Feb. 23, 2012.

To make electricity generated from solar panels and wind turbines, etc., energy storage systems are necessary. LightSail Energy, an Oakland CA company is developing a compressed air storage system. When available, electricity is used to compress air and store it in tanks at up to 3000 psi. The compressed air can then be released to generate electricity.

LightSail claims they have improved efficiency over that of other compressed air systems by spraying water into the air inside the tank during compression to absorb heat energy. The water is then separated from the air and stored. This scheme avoids the heat loss usually associated with storing hot compressed air. When it is desired to re-generate electricity, the warm water is again mixed with the air to heat and expand it.

LightSail claims that compressed air energy storage is the cheapest type of large-scale storage, with the possible exception of pumped hydro. They will build a pilot project that is expected to go online at a Texas wind farm in 2013.

BY ■

One Laptop Per Child

From various sources on the web:

One Laptop Per Child (OLPC) has unwrapped its $100 XO-3 tablet at the January 2012 Consumer Electronics Show. The device, which is designed for children in developing countries, will run Linux (Sugar) or Google's Android operating system.

The XO-3 features an 8", 1024 x 768-resolution display, Marvell Armada PXA618 processor running at 1 GHz, 4GB of internal storage, 512MB of RAM and can be charged using a removable solar panel cover or a third-party wind-up handle mechanism. A solar charger for the battery is also optional.

The device is also equipped with a USB port, Micro USB port, headphone/mic inputs and power jack.

The tablet is available with a traditional LCD screen, but will also be offered with a power-saving Pixel Qi display that absorbs ambient light to brighten the screen, reducing power consumption and extending battery life.

"[The XO-3] price will be $100 or lower. But this time there are options, so we cannot guarantee the final price," OLPC founder and chairman Nicholas Negroponte said.

The tablet provides about eight to ten hours of battery life, though some audiences may choose a smaller battery capacity to reduce the purchase price, said Ed McNierney, chief technology officer at OLPC.

The internal batteries can be charged by "just about anything that produces DC power," he said. The charging options include solar panels or hand cranks, and a study is under way to see if the battery can be detached and the tablet powered directly through a solar cell.

"Our ability to accept erratic, variable, noisy power inputs is extremely important to us, and something no other tablet has even attempted," McNierney said.

BY ■

Book Review – by Paul H Carr

Incomplete Nature: How Mind Emerged from Matter, by Terrence W. Deacon. W. W. Norton & Co ; 1st edition (November 21, 2011) 624 pages. Hardcover; $29.95. ISBN-13: 978-0393049916

For anthropologist Terrence Deacon, present day science is incomplete. It does not include human feeling, attitude, hope, value, and purpose, for which he coined the term *ententional*. His revolutionary proposal is to include the concept of absence in science, just as the inclusion of zero as a placeholder in the middle ages led to the Arabic number system that we find so useful today. Absence is pregnant with potential, as is the void within a glass container. If the glass is full, there are no more possibilities.

The concept of absence (or difference) is part of information science, to which Deacon's book devotes a chapter. In the binary number system used in modern computers, information is encoded as something (one) or nothing (zero). This is analogous to the fundamental question raised by existential philosophers, "Why is there something rather than nothing?"

Deacon rephrases this philosophical question to, "How can something not physically there (*ententionn*) be the cause of anything?" The book develops his "efficacy of absence," so that *ententions* become an integral part of science. This fundamental proposal has the promise of being as revolutionary to modern information and neuroscience as Copernicus' proposal that the sun was the center of our solar system.

Absence is an integral part of Deacon's concept of emergence, which explains how the first cell came from dumb matter by natural processes. In the conventional understanding of emergence, primitive cells emerged with novel properties that are *greater* than the sum of their interacting parts. In Deacon's view, novel properties can be *less* than the sum of their parts. For him "*less is more,*" because process is more important than matter. *Absence* is a constraint driving this process. Deacon's three stages leading to the emergence of the first living cell from dumb matter are:

1.THERMODYNAMICS or CHAOS: atoms and molecules of water, methane, ammonia, carbon dioxide, etc. moving randomly from thermal fluctuations in a primordial soup.

2 MORPHODYNAMICS or FORM (I find morphodynamics to be a confusing term, as morphology, meaning structure, is generally regard as being static). This is the emergence of self-organizing form or "order for free," and the *absence* of dynamical variety. For example, diamond crystals found in the earth have carbon atoms with an orderly cubic structure. At high temperatures and pressures, diamonds emerge from the self-organization of clusters of carbon atoms in the earth. Man-made diamonds are

made by using the same high temperatures and pressures.

Similarly, the Miller (1953) and Urey experiment showed how amino acids, which are the building blocks of life-forming proteins, could have emerged. They subjected a mixture of water, hydrogen, methane, and ammonia that were present shortly after the earth was formed, to an electrical spark, which simulated lightning. After one week they identified the formation of amino acids. Primordial amino acids could also have come from interstellar dust, meteorites, and comets.

3. TELEODYNAMICS: (telos = purpose, goal) Similar to the formation of diamonds in the earth's crust, living cells emerged under the right conditions from amino acids and proteins in the primordial soup. The vital purpose (telos) of a cell is to eat and to avoid its *absence* (from being eaten).The behavior and development of cells is constrained by *absence*. To survive, a cell must move away from areas where food is *absent* to those where it is present.

Deacon develops an emergent theory of energy and work. Deacon also emphasizes the historical evolutionary emergence of human mind and consciousness from simpler organisms over the materialistic reductionism of the nerve firings of the synapses." Mind and conscious emerge from the gigantic number of nerve firings, but cannot be reduced to them. Deacon states, "The title of this book is slightly misleading. Mind does not emerge exactly from matter but from constraints on matter." I believe that an alternate title to this book could be "Incomplete Science: the Power of Absence."

Deacon's integration of emergent process with philosophical concepts reminded me of Alfred N. Whitehead's "Process and Reality," which is the foundation of Process Philosophy and Charles Hartshorne's and Philip Clayton's Process Theology. Clayton recently edited "The Re-Emergence of Emergence: The Emergentist Hypothesis from Science to Religion." Deacons' comprehensive "Incomplete Nature: How Mind Emerged from Matter" could become as foundational as Whitehead's "Process and Reality."

Paul H. Carr, March 2012■
web page: www.MirrorOfNature.org■

Paul H Carr presented a poster paper on anthropogenic global warming at the meeting of the American Association of Physics Teachers on April 27 at Thayer Academy, Braintree, MA. Here is his poster:

HUMAN INFLUENCE ON GLOBAL WARMING & WEATHER EXTREMES

- Correlation of C02 and temperature increases since 1880.
- Carbon dioxide, CO2, is from burning fossil fuels (Carbon Dating).
- Solar irradiance has not increased since 1940 (sunspot cycles).
- CO2 level of 390 ppm is 30% higher than in the last 600,000yrs. Extrapolates to 900 ppm by 2100.
- Present sea levels projected to increase 2.5 – 6 ft by 2100.
- In the next millennia, sea levels could be 100s of feet higher, as it was 51 M yrs ago, when earth was ice-free, & CO2 was 1000 ppm

NUMBER OF EVENTS WITH DAMAGE OVER $ 1 BILLION (NOAA)

- 2011: **14** - 2008: **9** - average: **3 to 4**

http://mirrorofnature.org/GlobalWarmingDebateNESAPS.pdf

Engineering in the Social Milieu

An article by Dennis Feucht

In his classic film from the 1960s, producer Saul Bass begins *Why Man Creates* with an animated section. It starts with primitive man as a hunter, the invention of the wheel, and progresses through ancient times to the Middle Ages. In an Arabic setting, a man at a desk proclaims, "Praise Allah! I've invented the zero!" Another man overhears him and asks: "What?" - to which he replies, "Oh, it's nothing, nothing." The sequence goes on, all the while building on history as a tower, a giant edifice that goes up and up as the story continues. Finally, the 19th and 20th centuries come along, and piled onto the very top of this heap of inventive human progress are airplanes, large buildings, smog (coughing), electronics, and a cloud from an atomic bomb. A wavering voice of despair cries out an agonizing "Help!"

Despite the social critique of the animated introduction, the film portrays invention by bringing out what it is that both motivates and encourages inventors. In one scene, a late-night tinkerer has built a Rube Goldberg-like contraption and calls his wife, in her nightgown, out of bed to see it. She is not as impressed by it as he. I first saw the film as a lunchtime movie in the Technical Center auditorium at Tektronix in the late 1960s, itself a hotbed of engineering creativity. Each section of the film is introduced by turning off background music and zooming in, with camera and microphone, to a sharp-tipped wooden pencil writing the title of the next section on a green cross-hatched engineering pad. The effect had a realistic feel of engineering to it, with the amplified scratching of the pencil and the anticipation of making out what is being written as the printed letters appeared. (The film is available for about $30 US on CD.)

In the late 1800s and first-half of the 1900s, inventors were part of the social consciousness. During this "gilded age" in America, inventive inspiration for young minds came from a publishing empire of literature for youth, the Ed Stratemeyer syndicate. Stratemeyer published Hardy Boys and Nancy Drew, but also Tom Swift, the perpetual 18-year-old inventive genius who accomplished more in one book than a team of Nobel Prize winners could in a decade. This unrealistic view of the ease of creative accomplishment drew most of the popular criticism of the Tom Swift Sr. series, though by the 1950s, Grossett & Dunlap issued the books I first read, the Tom Swift Jr. books. By then, the senior Swift was a guiding background influence, and 18-year-old Tom junior, with boundless energy (and fueled with prodigious amounts of food by the colorful Swift Enterprises former Texas chuckwagon cook, Chow Winkler) did not bother with the smaller magnitude of inventions of his upstate New York father - motorcycles, airplanes, airships, RVs - but was instead building flying laboratories, rockets, outposts in space, aquatomic trackers, and ultrasonic cycloplanes. Some Tom Swift historians believe the senior Swift character was based on Glenn Curtis of Hammondsport, NY. Swift Enterprises is situated in New York state on the fictional Lake Carlopa while Hammondsport is at the southern

end of Lake Keuka, one of the NY fingerlakes. Curtis was an exemplary inventor of the gilded age, and the museum dedicated to him in Hammondsport includes motorcycles and airplanes of his design.

By the way, the fictional author of the Tom Swift series, Victor Appleton, happens to be the name of a British physicist who won a Nobel prize for atmospheric research and who became renowned in science while still in his teens. My proposal to the "Swiftologists" that perhaps the pen name was based on the actual physicist was not received with much enthusiasm because they did not believe that Stratemeyer, late in the first decade of the 1900s, would have heard of Appleton. Yet it was possible.

In retrospect, this concealment of the difficulties of inventing from youthful, zealous minds was not so bad. One has to begin with a dream. Complications can be addressed when one has the requisite skills and the habits of stamina to face them. *Inventors* are now called *research engineers*, though the function is essentially the same, that of pushing the state of the art into unknown territory at the frontiers of technical know-how. For those who have developed strong engineering skills, and who now have the confidence and indefatigable drive to achieve identified technical goals, the early difficulties of becoming a competent engineer are largely forgotten. It is all downhill from here, right?

Not so, for the edifice in Saul Bass's film continues to be built, but with different materials. In the mid-1900s, electronics and atomics (now called nuclear engineering) were on center stage. A full-page advertisement in *Time*, 17FEB58 by Atomics, International, a division of North American Aviation, about the "peaceful atom" exudes hope in technology; the people of Atomics viewed themselves as "Pioneers in the creative use of the atom." The Tom Swift-like exuberance of the *Time* ad reminds us that as we mature, we become more capable of weighing the relative merits of technology. With Chernobyl and Fukushima, we see the sometimes inherent danger of technical building-blocks. We know nothing is quite as ideal as the hope that motivates our enterprise. The wider public by the 21st century no longer can be said to share this earlier kind of youthful enthusiasm for science or technology, yet affluence continues to endear the general public to technical gadgetry, ready to seek a new iFix.

The earlier kind of inventors like Curtis and the iconic inventor archetype, Thomas A. Edison, continued with electronics inventor Philo Farnsworth (lesser known than he should be), Vladimir Zworykin, who invented at RCA the critical element of television, the iconoscope, Bill Lear in the mid-1900s - inventor of the car radio (and Motorola), 8-track tape, and the Learjet - and even Steve Wozniak and Steve Jobs. The public knows something of Jobs and software hacker Bill Gates, yet the character of technical icons to the public has decidedly changed. Wozniak designed the Apple I and II computers. The II has clever design features that can take an experienced engineer some time to figure out. (That is, it took me a while!) The contribution of Jobs to computing has not so much been technical; he is known for innovative product marketing features. Former software hacker Bill Gates similarly has not contributed much to technology as such, and both are better known as entrepreneurs and financial high-rollers. Jobs retained (to his deathbed) a fascination with new ideas for technology, and Gates has become a money-man, participating with the Money Power on how to remake the world. Yet in the public mind, these are prominent technical people, the "inventors" of our time.

Another symptom of the separation of the public from the engineering aspect of technology is the lack of popular technology magazines on the grocery-store racks. Some magazines are about the *use* of existing commercialized technology. *BYTE*, the once-prominent popular computer magazine, originally had technician and sometimes engineering-level detail, with articles having circuit diagrams and software code listings. Readers could build computers and enhance their code from its articles. In the early '90s, *BYTE* turned to product review instead; the computers were too complicated to build. To get the same kind of content as in the earlier *BYTE*, one had to subscribe to *BYTE* spin-off, *Circuit Cellar* magazine, which is not found in grocery stores. All the popular electronics magazines (*Popular Electronics*, *Electronics Now*, *Radio-Electronics*) are gone, as are the three electronics publishing icons of the 20th century: Howard W. Sams, Hugo Gernsbach, and John F. Ryder. They have not been replaced. (In Mexico, the popular magazine racks have *Electronica* and *Saber Electronica* which are essentially like the defunct *Popular Electronics* but in Spanish.) *Popular Mechanics* similarly has become a showcase for mechanical technology and a mouthpiece for Establishment propaganda and counterintelligence - no more blueprints.

Returning to the weighing of technological merits and the new materials comprising the technological edifice, bioengineering is now chasing electronics from center stage. If nuclear is scary, the public will have nightmares over the possibilities of opening Pandora's Box with genetic modification. A major controversy here in Belize, a geopolitically quiet corner of the world, is over the introduction of GM corn to the belizean environment. So far, it has been kept out, though some large-scale farmers are promoting it. The concern is that the native and naturally optimized genomes of corn will be polluted by corn that has in its genome the capability of producing the *Bacillus thuringiensis* (Bt) toxin. This poison tears up the gut of insects like the corn borer but is claimed to not have any ill effects on mammals like us humans. The protein that does the damage is well-characterized and studies of its interaction with stomach tissue have been investigated. Thus, companies like Monsanto tell us that all is okay; there are no health problems in using it. Actually, it is the management and marketing people who are saying this. Scientists in the laboratory are more cautious as they continue their work. (Recently it has been found that ill effects of the Bt toxin occur in the intestine.)

Another major concern is not about the technology itself but about the legal consequences of using it. The Monsanto contract with farmers places the liability upon them for keeping Monsanto's "intellectual property" to themselves. Of course, the wind knows nothing of field boundaries and if a neighbor's corn is polluted, Monsanto can sue both farmers, the first for breaking the contract and the second for patent infringement. While patents require novelty, food labeling avoids mention of genetically-modified organisms (GMOs) by the claim of "essential similarity" - that is, nothing is new here of any significance that requires making a labeling distinction. You cannot

logically have it both ways - unless you have political power.

Monsanto upper management is part of the power cabal who desire to rule the world. If the essentials of life can be controlled, including the food supply, then the world becomes dependent on those who supply them. Most of the indigent farmers in Belize do not have the means to challenge large transnational corporations in court - and for the Monsanto contract that would be a court in U.S. jurisdiction. Consequently, Monsanto ends up owning the land of the farmers and they end up working for Monsanto, growing GM corn but not benefiting from whatever profits they would have enjoyed as independent farmers. Of itself, this is not a technical issue, not something engineers can address as engineers, yet it would not occur were novel technology not involved.

The lively discussion in Belize about GMOs led me to suggest to the pro-GMO farmers that the topic be given a ten-year rest – a decade moratorium like Peru just imposed. For some of us, the commercialization of this new technology is premature and more should be learned about it and about life and genetics. Some indications are that it could be a Pandora's Box. The states of Europe (except Spain), as seen in the European Food Safety Authority, are being cautious about its introduction. Whether a technology is ready for commercialization - whether there are inordinate risks - is an engineering consideration. As engineers, we must be knowledgeable of the tradeoffs between rewards and risks. A few decades ago, atomics looked appealing and companies like Atomics Int'l could run ads in popular magazines about their technology, expecting public support. Now that more experience with the technology has accrued, the public (albeit a different kind of public) is generally anti-nuclear. As nuclear engineering refines the technology, reduces risks, and recycles spent nuclear fuel, the intervening nuclear disasters alarm the global public, placing the weighing of risks and rewards into the hands of politicians who usually reflect public sentiment. That sentiment is too often alarmist and immoderate, failing to weigh the relative merits thoughtfully and knowledgeably. As a consequence, decisions that might best be made by engineers pass beyond engineering.

On the other hand, there are the opposite situations where decisions should not be left solely in the hands of technical experts because they have larger consequences that affect people who should be making decisions themselves on matters affecting them. The harmony of engineers and non-engineers deciding about technical issues was better when the general public was more informed technologically, and the ordinary Joe Sixpack was closer to wires and wrenches than many are today.

The scriptures speak very little to this issue directly because it is couched in the social and technical circumstances of our time. Yet the wisdom literature is full of general principles that should underlay such decision-making. Thoughtful engineers have sometimes had to retreat from such interaction with non-technical people because "If a wise man has an argument with a fool, the fool only rages and laughs, and there is no quiet." (Proverbs 29:9) Some people rage against nuclear power, for instance, despite the reasonableness of arguments for it (apart from whether those argument are valid or not). I have been unable to extract from my discussions with Amish buggy-part makers in Ohio coherent criteria for their selection and rejection of technologies. Consequently, we can only profitably enter dialog with the remnant of thoughtful, mature non-technical people who have an interest in wider engineering issues.

One possible group is fellow Christians who are not engineers. Perhaps we should start where we are and offer some talks to our respective churches on technology and its wider considerations, for these are often not of themselves technical but are social and spiritual. Technology only sets in motion the manifestation of the spiritual state of those affected by or involved with it. Sermons not uncommonly are indirectly about technology - about the detrimental effects of television programming, for instance - and among the Amish, about telephones in homes. More could be said from those more familiar with technology. As engineers, we are familiar with technology but often not as much with its social effects. Some church talks might be mutually educational.

Dennis L. Feucht, DEC 2011■

ASA/CEST Newsletter Distribution

The primary distribution of this newsletter is via email to ASA/CEST members as indicated in the ASA's online directory. Members are expected to keep their email address up to date there. No paper copies are mailed. Recent past issues are located at ***http://www.asa3.org/ASA/cest*** *All issues are archived at the YahooGroup* asa_cest@yahoogroups.com *web site, where they are accessible to group members. To join the group, go to:* groups.yahoo.com/group/asa_cest/join *and follow the instructions.*

Bill Yoder, ed. ■

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