Reverse Engineer the Universe!

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Part I. A novel view of the theorization process with examples

Always open with a brief humorous story, they told us in speech class; so here goes. There was this local TV news item:

> The commentator relayed a story of how a small airplane crashed after the pilot lost control. It seems the pilot was doing "aerobic exercises" instead of paying attention to flying. I visualized the pilot stretched out on the deck doing push-ups. Then I realized the commentator had probably meant to say the pilot was doing *aerobatic exercises*--that is, aerial acrobatics; loops and rolls and such!

The physical theorist (not "physical therapist") when theorizing about such things as the effect of gravity on moons, planets, and small airplanes is really attempting to reverse engineer that aspect or corner of the physical Universe. "Reverse engineer" is a verb currently in use by software engineers to refer to the attempt to fathom and list the source code for a computer program. However, the term can be traced back at least to 1960 in connection with hardware when it meant an attempt to fathom and reconstruct the circuitry inside a potted electronic module.

What does it all mean?
---------- When looked at as a reverse-engineering task, perhaps some of the mistique is taken out of the process of forming a physical theory. And looking at it this way, one might think of *That Great Self-Made Engineer/ Inventor In The Sky* as having designed and constructed (created) the physical Universe by whatever process. Along with others Newton tried to fathom the design; cosmologists, the construction; Darwin, the life-shaping processes. The Church reacted by essentially saying God did not need Darwin's help.

When putting the finishing touches on a scientific theory, one may claim to have fathomed a corner of either:

Category A - The Universe; or
Category B - A somewhat equivalent universe, but not the actual one.

Ptolemy in the second century of the Christian era placed the Earth at the center of the universe and no doubt believed that to be a Cat'A solution. The Pope certainly liked it. But later, Copernicus (1473-1543) became convinced that Ptolemy had found only a Cat'B solution; Galileo (1564-1642) and Newton (1642-1727) agreed, but popes did not come around until the late 20th century when that one (John Paul II, as I recall) finally "pardoned" Galileo for having voiced views the Church did not like.

Today it is generally agreed that the Ptolemaic universe is a Category B solution, a solution having only transient value. It may be that Cat'B solutions, in general, are necessary first steps in theorization; indeed,

reverse engineering of complex devices and systems--whether manmade or natural--is perhaps never 100% successful.

Tom Young and his neuronic color sensor

At age 28 Thomas Young announced before the *Royal Society of London* the basis for a neural system to sense color--that was his *trichromatic theory*. He may have intended that his idea fit Cat'A; however, not all agreed. Helmholtz, as translated:

> *...such a work would hardly be worth the labor until the science itself was in a much maturer state than it is at present.*

Helmholtz wrote that in 1866. It was not directed overtly at Young whose idea he was well aware of, but at a "history of physiological optics" which nevertheless connects firmly to color-vision theorization. So even then, indications were that Young's idea really belongs in Cat'B. Helmholtz wrote other critical things including: "To conceive this theory objectively...would not be correct." The reference was obliquely but clearly to Young's idea. Then the Royal Society renamed Young's idea to the *Young-Helmholtz Trichromatic theory,* after which Helmholtz' energies were directed at attempts to prove Young's idea. But even his final attempt, his "line element" theory, was not able to do that.

Young stated his 1801 idea like this:

> *[Since] it is almost impossible to conceive each sensitive point on the retina to contain an infinite number of [resonant] particles...it becomes necessary to suppose the number limited, for instance, to the three principal colors...*

The "it is almost impossible" introduction might today be characterized as a "straw man" using a terribly pejorative term from 1896. At any rate we know today that it is not the only way to proceed, and Young's final supposition is not at all necessary.[1] But by that pronouncement from a highly respected scientist and its support by the highly prestigious Royal Society, Young's resonance-based principal-color paradigm became locked-in for 200 years and still counting as this is being written.

Since that time all recognized attempts to devise a detailed theory of color vision have been based on that paradigm, assuming three or four principal or "primary" colors. All have met with incomplete success in exercises reminiscent of attempts to use epicycles to fine-tune Ptolemy's theory (over a 1300-year period)! Newton historian Westfall: "Long established views are not easily surrendered."

The connection to petrified knowledge

A term credited to Florentin Smarandache, "petrified knowledge" applies to the planetary theory of Ptolemy and to the trichromatic theory of Young. By thusly projecting those two theories through the same lens, I am assured of never being invited to speak before the Royal Society! (No loss, since that possibility never existed.)

But, dear reader, both Ptolemy and Young were geniuses in their respective times; and it is not my purpose to trash Young any more than it was the purpose of 15th- and 16th-century theorists to trash Ptolemy; Young did a fine job in view of the inadequacy of the times; his trichromatic theory even defines the color television cameras of today.[2] Only one robot camera that I am aware of ever did it differently.[3] Whatever the future may bring,

Young's other work will no doubt continue to stand as testimony to his genius; but if we did not question our most sacrosanct theories we would be doing a disservice to science.

All who call themselves "scientist" must continually be on the lookout for gems of petrified knowledge. If you can legitimately question the basis for a long-held view perhaps it has outlived its usefulness and the time has come for a renewed effort to reverse engineer that corner of the Universe. But tread carefully; novel claims must be firmly supported. You need more than simply a desire to see it be so.

Part II. Young Albert Einstein and his electromagnetic time machine

After the turn of the 20th century, relativity and Einstein became hot-button items in the popular press. It is said that when he was very young Einstein wondered what it would be like to ride on a beam of light. That early wonder may have colored his philosophy throughout his life.

The way it was in 1905

Relativity as presented by Einstein at age 26 had an exciting Alice-In-Wonderland quality. Not only did he build on ideas of Minkowski, Lorentz, and others with his special theory,[4] he also energized them by concluding that the speed of light, *c*, is a universal speed limit and suggesting that the ancient human desire to travel in time might truly be realized if one went fast enough. A contemporary, Jules Henri Poincaré, independently developed the same mathematical theory but did not take the same conclusions from it.

Poincaré and Einstein agreed that perceived lengths would shrink towards zero and masses increase towards infinity as the body moves faster and faster approaching *c*. But one man concluded from that that the speed of light is ultimate while the other did not spin it that way! How could the same set of mathematical, theoretical results lead to two very different conclusions? Here is one possible scenario and explanation:

1. Einstein may have been of the what-you-see-is-what-you-get school wherein if you see a fast-moving arrow shrink and become more massive, then the arrow must certainly have undergone those changes. And if you see a clock run slower when it is in motion, then that means time, itself, has *slowed* as a result of the motion.[5] That could well lead a student of that school to believe that v>c cannot happen and/or that one can travel through time.

2. Poincaré may have been of the appearances-can-be-deceiving school wherein if you see a fast-moving arrow shrink or become more massive or a moving clock run slow, one can conclude only that there is such an appearance. Ergo, there is little incentive and no need to postulate either a speed limit or time travel.

Physicists F.K.Richtmyer & E.H.Kennard (1947): "Perhaps...we have [in the relativistic effects] a sort of *kinematical perspective,* analogous in a way to the ordinary experience that an object appears to change in size as it recedes into the distance." And, I might add, if we were to observe relativistic effects on a daily basis, we might come to think of them in just that way.

At any rate, Einstein's view that the *speed* of an object is limited to the

value *c* can be legitimately questioned without endangering the mathematical integrity of relativity.[6] My friend Florentin Smarandache appears to have rejected outright Einstein's view concerning a universal speed limit, but on grounds which I do not fully understand. His views on time travel are unknown to me.

Time for a change

It seems increasingly clear that *time* is only a made-up parameter, with *change* being the real item involved. While it makes sense to ask whether a change can be reversed (some can, most cannot), it is quite meaningless to ask whether time can be reversed. This all comes under the heading, "Getting Real."

Hermann Bondi: "Time must never be thought of as pre-existing in any sense; it is a *manufactured* quantity."

John Wheeler: "Should we be prepared to see some day a new structure for the foundations of physics that does away with time? ... Yes, because 'time' is in trouble."

Doc Emmett Brown: "The future is not written. It is whatever you make it."

We may spend our energies entertaining one another with stories of time travel such as Steven Spielberg's "Back to the future," (that 3-part movie should be seen by every freshman science student) but it is hoped we would also explore actual new frontiers by seeking out the truth and not become addicted to fantasy. To paraphrase a well-known saying, "Truth is more exciting than fiction."

With the relativistic effects no longer considered real, the light barrier vanishes like a phantom. So does time travel. It was fun while it lasted and we may mourn its passing; but that would be a mourning wasted for there are jobs to be done leading to much more exciting times. (Let's have fewer mornings wasted.) Einstein may forever ride his lightbeam, but that does not mean the rest of us are similarly constrained.

[Note to Editor: Please note and preserve the two different [spellings, "mourning" and "morning"; important to the pun.

The following text highlights the old don't-confuse-me-with-facts-my-mind-is-made-up syndrome. It originally appeared in *LIGHT WORK*, Feb'95, p.3, copyright Homer B.Tilton.

Why not an infinite force?

It is often said that the mass of an object tends to become infinitely large as its speed tends towards the speed of light. Certainly that position is backed up by the behavior of subatomic particles inside particle accelerators or "atom smashers." That is a fact of measurement, predicted by the special theory of relativity. That fact is then given as a basis for proving that the speed of light cannot be exceeded under any circumstances; for you would need an infinitely large force to accelerate through the speed of light, and everyone knows that an infinite force is impossible to generate.

End of discussion? Well, not quite. Consider the following scenario from a *gedanken* technical conference:

The discussion has just reached the point, "everyone knows that an infinite force is impossible..." when, just as the audience members prepare to leave, a young upstant, Norman Nerdnick,speaks up from the rear of the conference hall.

Norman: *'Scuse me!...If you can have an infinite mass, why can't I have an infinite force?*

Conference speaker: *How do you propose to obtain your infinite force?*

Norman: *The same way you got your infinite mass; by relativistic means.*

Conference speaker: *Specifically?* (Feigning interest...)

Norman: *Consider an accelerating rocketship. It derives its thrust from material shot out of the exhaust nozzle. Now, as the rocketship goes faster and faster approaching the speed of light, its mass increases towards infinity as you pointed out; but the rocket fuel also has its mass increase towards infinity, so the thrust produced would tend towards infinity would it not? Thus we go zipping right through the light barrier like it's not there!*

Member of audience: *Can we discuss this later? Many of us have another session to attend.*

Everybody leaves...

References and notes

[1] See Homer B.Tilton, "A history of color vision and the modern Helmholtzian brightness-hue-saturation model," the journal *Atti Della Fondazione Giorgio Ronchi* (Italy), ISSN 0391-2051; in press, scheduled to appear in Vol.LVI, 2001, No.3.

[2] On the synthesis end by way of contrast, three-color displays--whether television or computer displays--have nothing to do with Young's theory but only reflect Newton's findings relative to color mixture. Four-color computer displays which include a yellow phosphor can produce more different colors and more-saturated colors than can the standard RGB three-color display.

[3] Homer B.Tilton, "Color sensing device based on a novel principle," *Optical Engineering,* July/August 1979, pp.429-431, ISSN 0036-1860

[4] The theory is "special" in that it deals only with inertial systems. Einstein's original treatment of the famous "Twins Paradox" was made before the general theory was developed. The astronaut twin's motion is not inertial; and the popularized, published results obtained using the special theory cannot be trusted because it is a problem fitting the general theory. Those results concluded that the still-young astronaut twin upon returning home after a long-distance journey at or near the speed of light, *c*, found his stay-at-home twin long dead of old age.

[5] *Slowed relative to what?* is a question not generally addressed. The appearance of a second kind of time is required; is it Einstein's "proper time"? Unclear.

[6] *Speed relative to what?* is again a question ordinarily ignored. The speed of a photon at *c* may be a universal constant needing no reference; but a rocketship is not a photon. It may be that Einstein confused going at lightspeed with being a lightbeam, which could explain much concerning his conclusions.